Chris Minnear.

REFERENCE	DATE	PAGE
62 S 2 402	Jul 2001	1 of 13

TSI
Technology Services International

OUR REFERENCE

MT358

62 S 2 402

CONTRACT/ ORDER NO.
TBA
G2465

TECHNOLOGY SERVICES INTERNATIONAL (TSI)

MATERIALS TECHNOLOGY

CORROSION PROTECTION SPECIFICATION

TUTUKA POWER STATION – REPAINTING OF ASH CONVEYOR STRUCTURAL STEELWORK

PAGE 1 OF 13

JUL 2001

COMPILED BY:	APPROVED BY:	COMPILED BY:
D T JANSE VAN RENSBURG	K NORTHCOTT	SENIOR CORROSION OFFICER
	LEVEL II QC INSPECTOR	

CONTENTS

1. SCOPE AND CONDITIONS OF USE

This document details the application, quality and safety procedures to be followed for the Repainting of Ash Conveyor Structural Steelwork at Tutuka Power Station and shall not be sub-divided or modified in any way.

The specification is project specific and compiled based on information provided by Mr E Janse van Rensburg. TSI extricates itself from this specification should it be used for other applications.

IMPORTANT NOTE: PLAGIARISM IS UNETHICAL

Lower Germiston Road Private Bag 40125 Cleveland 2022 Gauteng South Africa

Telephone: +27 11 629 5111 Facsimile: +27 11 629 5777 Web-Address: www.TSI-SA.com

REFERENCE	DATE	PAGE
62 S 2 402	Jul 2001	3 of 13

2. NORMATIVE REFERENCES

The following specifications shall be read in conjunction with this document. The latest revision available at the time of contract award shall be applicable and shall remain applicable for the duration of the contract unless the *Employer* and the *Contractor* mutually accept new revisions. In case of conflict the provisions of this Quality Document shall take precedence.

SABS Test Method, 141, *Dry film thickness of paint coatings by means of electro-magnetic flux or eddy-current type gauges.*

SABS 1217, *The production of painted and powder-coated steel pipes.*

ISO 8501-1, *Pictorial surface preparation standard for painted steel surfaces.*

SIS 055900, *Pictorial surface preparation standard for painted steel surfaces.*

SABS Test Method No. 769, *Cleanliness of blast-cleaned steel surfaces for painting.*

SABS Test Method No. 772, *Profile of blast-cleaned steel surfaces for painting (determined by micrometer profile gauge).*

3. DETAILED COATING SPECIFICATIONS

ITEM	Present corrosion protection system	Specifications	Additional Requirements /Notes
Ash Conveyor Structural Steelwork	Unknown	402.1 or 402.2	1 to 5

Additional Requirements / Notes

1. The performances of these materials will depend on the quality of application.
2. It is recommended that a qualified paint inspector (SAQCC qualified) be appointed to oversee the quality of application of the coating.
3. Ventilation should be adequate to allow good visibility and proper curing of the coating and to avoid/ minimise health and safety risks.
4. Sufficient time should be allowed for the proper curing of the coatings prior to service (at least 7 days).
5. The detailed specifications make provision for protection of the epoxy coatings against UV light degradation. Hence, the third coat (i.e. polyurethane coat), in the case of both detailed specifications would be optional for areas not exposed to UV light.

90% km = 900 m.w ×16

REFERENCE	DATE	PAGE
62 S 2 402	Jul 2001	4 of 13

SPECIFICATION 402.1

SURFACE PREPARATION:	All surfaces shall be high-pressure water wash to remove ash and other loose contaminants. Abrasive blast clean to Grade Sa 2,5 or Hand clean by means of scrapers, wire brushes and abrasive paper to remove all loose paint, corrosion product or other surface deposits. Rinse with copious quantities of potable water. Allow to Dry.
PRIMER COAT:	Apply by brush, roller or spray, one coat Twin Pack, High Build (≥ 85% volume solids content), Aluminium or Micaceous Iron Oxide Pigmented Surface Tolerant Epoxy. **Work coating into all irregularities.** Dry film thickness to 80 to 100 micrometers.
SECOND COAT:	Allowing sufficient time for the first coat to cure, the manufacturer's recommendations shall be adhered to in this regard, apply a coat of Twin Pack, High Build (≥ 50% volume solids content) Epoxy. (No **Aluminium filled coatings shall be allowed with the second coat).** Dry film thickness 70 to 80 micrometres.
TOPCOAT:	Allowing sufficient time for the second coat to cure, the manufacturer's recommendations shall be adhered to in this regard, apply one coat Twin Pack Recoatable Polyurethane Enamel. Dry film thickness 30 to 40 micrometres.
SAFETY NOTE:	The manufacturer's recommendations regarding the safe handling and use of these materials must be adhered to.
APPROVED SUPPLIERS	Dulux, International Protective Coatings, Jotun, Ameron and Sloncor

REFERENCE	DATE	PAGE
62 S 2 402	Jul 2001	5 of 13

SPECIFICATION 402.2

SURFACE PREPARATION:	All surfaces shall be high-pressure water wash to remove ash and other loose contaminants. Abrasive blast clean to Grade Sa 2,5.
PRIMER COAT:	Apply by brush, roller or airless spray one coat Twin Pack, Epoxy Primer. Dry film thickness 70 to 80 micrometres.
SECOND COAT:	Allowing sufficient time for the first coat to cure, the manufacturer's recommendations shall be adhered to in this regard, apply a coat of Twin Pack, High Build (≥ 50% volume solids content) Epoxy. **(No Aluminium filled coatings shall be allowed with the second coat).** Dry film thickness 70 to 80 micrometres.
TOPCOAT:	Allowing sufficient time for the second coat to cure, the manufacturer's recommendations shall be adhered to in this regard, apply one coat Twin Pack Recoatable Polyurethane Enamel. Dry film thickness 30 to 40 micrometres.
 **SAFETY NOTE:**	The manufacturer's recommendations regarding the safe handling and use of these materials must be adhered to.
APPROVED SUPPLIERS	Dulux, International Protective Coatings, Jotun, Ameron and Stoncor

4. CORROSION PROTECTION QUALITY REQUIREMENTS

4.1 Materials

4.1.1 Selection of coating system

The detailed specification to be used for corrosion protection shall be:

As defined in Section 3 of this specification for the items of equipment being protected.

or

Alternative coating systems or methods of corrosion protection which are better known to the *Contractor*. Such alternatives shall be supported by detailed technical evidence that the proposed alternatives will meet the *Employer's* performance requirements.

Before alternatives may be used, approval shall be obtained.

4.1.2 Selection of coating materials manufacturers

Approved coating materials manufacturers are indicated per each detailed coating specification. Where alternative coating manufacturers are preferred, the *Employer*'s prior approval shall be obtained.

4.1.3 Composition of coating systems

The manufacturer's data sheet for each system shall be supplied with the tender. It shall contain at least the information listed in Table 1.

The coating materials shall be homogeneous and designed for the proposed application method. If the *Contractor* considers that the proposed application method is not suitable for the materials specified, he shall notify the *Employer* in writing. His proposed alternative method may only be used after approval has been obtained.

All coats in a given system shall come from the same manufacturer.

During application, solvents may only be used:

a) when they are compatible with the base material, and

b) when the percentage added does not exceed the limits given by the paint manufacturer in Table 1.

4.1.4 Packaging

Coating materials shall be supplied in sealed, robust containers of a size large enough to allow mixing in the containers and labelled with all the information necessary to ensure coating storage, application and traceability.

4.1.5 Forwarding and storage

The containers shall be kept in approved stores which are dry, enclosed, covered and kept at a temperature compatible with good preservation of their contents. The same applies to the abrasive media that is being utilised.

If any container shows traces of leakage before use on site, the contents of that container shall not be used.

4.2 Surface Preparation of the Substrate

Prior to blastcleaning, all welds shall be free of slag, slag inclusions and pinholes. Adjacent areas shall be free of weld spatter, which shall be removed by grinding or scraping.

Abrasive blastcleaning shall be carried out using equipment suitably designed for this purpose.

If required, the *Contractor* shall submit, for approval, two samples of grade of blastcleaning specified. The samples shall be overcoated with a clear lacquer to prevent deterioration of the surface. Following approval, the samples shall be used as the reference standard of blastcleaning to be obtained by the *Contractor*.

Blastcleaning shall be carried out on dry surfaces using dry air, free from impurities (in particular grease or oils), in an atmosphere where relative humidity is less than 85 %, and the ambient temperature above +5 °C. The *Employer* may require the *Contractor* to demonstrate that the air is clean and dry.

Blastcleaning on site shall be carried out only in areas approved by the *Employer*.

All surfaces that are blastcleaned shall be coated with a primer coat within 4 hours. Alternatively, provided the surface cleanliness requirements of ISO 8501-1 or SIS 055900 are maintained, the primer coat may be applied within the same working shift. Under no circumstances shall blastcleaned surfaces be left uncoated overnight.

Care shall be taken to ensure adequate protection of machined parts or any other part not requiring blastcleaning and coating. Every precaution shall be taken to avoid deformation of the substrate and damage to welds.

Blastcleaning may be carried out using grit and platinum slag. Irrespective of the material used for blastcleaning, it shall in all cases be free of foreign matter such as clay, humus, chlorides and bitumen. The use of re-cycled blasting media is also strictly prohibited.

The grit or slag shall comply with the following quality requirements:

- The abrasive blasting media shall not have a pH below 6,20.
- The conductivity of the water-soluble salts of the abrasive shall not exceed 150 µS/cm.
- The conductivity shall be less than 100 µS/cm.
- The moisture content for the material when delivered in bags or in bulk shall not exceed 0,5%.
- The abrasive shall not be polluted with oil and grease.
- The abrasive shall have a minimum hardness of 6 on MOH's scale.

- The Specific Gravity shall be a minimum of 2,5.
- The maximum free silica content of the abrasive shall be 1 % by weight.
- The materials shall have no adverse effects on the health of personnel when Occupational Safety and Health Administration Guidelines are observed.

In all cases, after blastcleaning, all traces of blasting media and dust shall be removed from the surface by vacuum cleaning. Cleaned surfaces shall not be contaminated with oil, grease, rust or other deposits before coating. Unnecessary traffic prior to painting shall be avoided.

4.3 Application of Coatings

Unless otherwise specified, coating systems shall only be applied to dry surfaces. During application, the relative humidity shall not exceed 85 % and ambient temperatures shall be between 5 °C and 30 °C. In the case of special coatings, the conditions specified in the appropriate technical note, a blank example of which is shown in Table 1, for each system shall be adhered to.

The maximum/minimum substrate temperature at the time of coating application shall be in accordance with the technical note.

Care shall be taken to ensure adequate coating of all bolt holes, edges and other areas normally prone to corrosion attack. Where appropriate, these areas shall be stripe coated.

The colour of each coat shall be different from the colour of the previous coat. However, two finishing coats of the same colour may be applied to achieve complete colour uniformity. All finishing colours shall be to the *Employer's* approval. However, in the case of a two-coat system each coat shall be a different colour. In the case where aesthetic requirements are secondary, repairs after final testing should be carried out using a different colour.

Damaged paint areas shall be cleaned. Rust spots and any other deleterious matter shall be removed. Spot repairs shall be carried out such that the patch painting extends at least 25 mm beyond the damaged areas. Spot repairs shall reinstate each of the previous coats and shall commence directly after surface preparation.

Care shall be taken to ensure that all machined parts are adequately protected against contamination and corrosion during paint application, transport/shipping and pre-commissioning storage.

4.4 General Conditions of Workmanship

All work shall be carried out under the supervision of an experienced supervisor. Testing and inspection of coatings, shall be carried out by a SAQCC qualified Coating Inspector. Final release of the painted component shall be by a SAQCC level II Coating Inspector.

All coatings shall be evenly applied to form a smooth, continuous, unbroken coating free from sags, runs and other defects. Film thicknesses shall be as specified and each coat shall provide complete coverage.

No cleaning or coating applications shall take place when site conditions are likely to adversely affect these operations. The *Contractor* shall be responsible for providing all protective equipment necessary to prevent contamination of the coatings and to minimize delays due to such site conditions.

Equipment name plates and identification plates shall be protected from coatings. No coatings shall be applied over any surfaces where these will adversely affect the performance of the item or component.

4.5 Quality Requirements

4.5.1 Control of coatings

Manufacturers' factory testing
Coatings shall be regularly tested in the coatings manufacturers' factories. The *Contractor* shall satisfy himself that regular quality control tests are carried out to ensure that good quality of the coatings is maintained.

Identification by the *Contractor*
A record of the details (batch number, date of manufacture, etc.) of each type of system used, shall be retained by the *Contractor*. He shall also ensure that the coatings manufacturer retains a sample of each batch for at least the guarantee period. Where shelf life is a parameter, the expiry date of the retained sample shall be recorded.

4.5.2 Quality control of surface preparation

During blastcleaning, the relative humidity shall not exceed 85 % and the ambient temperature shall be above 5 °C.

The standard of finish for blastcleaned surfaces shall be in accordance with ISO 8501-1 or SIS 055900

Where surfaces are blastcleaned, the peak of valley profile shall be measured in accordance with SABS test method number 772 and shall be as specified in Table 2.

Table 2 — Peak of valley profiles

Coating Thickness (Total)	Minimum profile	Maximum profile
90 to 180 µm	30 micrometres	60 micrometres
120 to 225µm	40 micrometres	75 micrometres
150 to 300µm	50 micrometres	100 micrometres
300 to 500µm	75 micrometres	100 micrometres
>500µm	75 micrometres	125 micrometres

Immediately before coating, blastcleaned steel shall not exhibit more than 0,3 % dust and debris when tested in accordance with SABS test method number 769.

4.5.3 Quality control of coating application

During application, the relative humidity shall not exceed 85 % and the ambient temperature shall be between 5 °C and 30 °C. In the case of special coatings, the conditions specified in Table 1 for each system shall be adhered to.

The method of application shall be as specified in Table 1.

Drying and overcoating times shall be as specified in Table 1.

All coating thicknesses on metal substrates shall be measured in accordance with SABS Test Method 141. These measurements shall be made on surfaces free of all contaminants. Approved electronic instruments shall be used for determination of film thicknesses. In cases of dispute, both the *Employer's* and the *Contractor's* dry film thickness machines shall be re-calibrated and the percentage variation between the two machines shall be applied as being the standard deviation for each reading.

Thicknesses on non-metallic substrates shall be checked by verification of the quantity of coating consumed.

The thicknesses of each coat shall be as defined in the detailed specification. 90 % of random readings shall be equal to or greater than the specified thickness. No individual reading shall be less than 90 % of the specified thickness. No individual reading shall be greater than 120% of the specified thickness. In the areas where stripe coating is carried out the maximum total specified dry film thickness range shall allow for the additional coat.

All deficient film thicknesses shall be rectified to the *Employer's* approval at the *Contractor's* expense.

Where excessive film thicknesses can be detrimental to the integrity of the coating, the manufacturer's recommended maximum shall apply. In this situation the *Contractor* continues to assume complete responsibility for the application and performance of the coating system.

4.6 Defects During the Guarantee Period

Paintwork will be considered defective if, during the guarantee period, latent defects appear which could lead to a general breakdown of the coating system.

4.7 Systems Containing Liquids of Gases

For the internals of circuits or systems containing liquids or gases, the conditions of the coated surfaces should not be detrimental to the full and correct functioning of the circuit or system as envisaged in the applicable design criteria of that circuit or system.

4.8 Records

In all cases the *Contractor* shall be responsible for meeting the quality control requirements and shall keep records of all his inspections and tests.

The *Employer* may witness the final inspection and may also elect to have witness and hold points other than the final inspection. Prior to the commencement of work, the *Contractor* shall confirm with the *Employer* in writing, the date of the commencement of work and the *Employer's* inspection requirements.

1.9 Tests

The *Employer* may require destructive tests to be carried out. Before these tests are performed the *Contractor* shall be notified in writing of the nature and extent of the

testing to be done.

4.10 Table 1

Basic format of Technical Information Sheet.

TABLE 1

BASIC FORMAT OF TECHNICAL INFORMATION SHEET			
ITEM NAME:		MANUFACTURER:	
SUBSTRATE:		PREPARATION OF SUBSTRATE:	
		Degree of Blasting	
PAINT SYSTEM USED:	PRIMER:	INTERMEDIATE COAT:	TOPCOAT:
Trade Name			
MATERIALS:			
CHARACTERISTICS			
General Type			
Spec. Gravity			
Flash Point			
Toxicity			
Colour			
Gloss			
Mixing Ratio			
Usable mixed life at 25°C			
Shelflife at 25°C			
Viscosity at 25°C			
Pigment Type			
Pigment % by weight			
Vehicle Type			
Vehicle % by weight			
Solids:			
% by volume			
% by weight			
FILM THICKNESS			
Minimum			
Maximum			
Theor. Spreading Rate			
Pract. Spreading Rate			
WORKMANSHIP			
Application conditions			
Dryness of Surface			
pH of Surface			
Min. Surface Temp.			
Max. Surface Temp.			
Min R.H. %			
Max. R.H. %			

Min. Ambient Temp.			
Max. Ambient. Temp.			
Application Methods			
Method od application			
Max. % of Solvent			
Addition permitted			
Drying and Curing			
Dust Dry at 25°C			
Through Dry at 25°C			
Max. Hardness at 25°C			
Min. Overcoating Time at 25°C			
Max. Overcoating Time at 25°C without Special surface preparation			

.....
SIGNATURE OF COATING SUPPLIER

5. GENERAL HANDLING PRECAUTIONS WHEN WORKING WITH COATINGS

Care needs to be taken when working with organic coating materials. Compliance with health and safety regulations is especially important when working with heavy-duty industrial coatings. Many of these materials are hazardous in one way or another and regular exposure of workers to toxic elements may cause long-term health problems.

5.1 Special Precautions

In general the following rules should always be followed: (even when the paint is relatively harmless):

- Prevent all skin and eye contact
- Avoid breathing vapours
- Immediately cover wounds or cuts
- Re-seal partly used containers
- Ensure that all containers are properly labelled to prevent accidental ingestion
- Wash with soap and water before eating, drinking, smoking or using toilet facilities
- Launder clothing before use

1.2 Storage Precautions

- Store containers in cool well-ventilated areas away from the sun, heat, sparks, and open flames. The ideal storage temperature is between 10 to 30°C
- Close all containers after each use
- Store containers away from oxidising agents and other incompatible substances
- Some products are static accumulators. Transfer equipment should be grounded or bonded

- Consult other national and local requirement for additional storage requirements

5.3 Spillage (actions to take for spills/leaks)

- Remove all sources of ignition
- Avoid contact with material
- Persons not wearing appropriate protective clothing/equipment should be excluded from the area of the spill until clean-up is complete
- Contain spread with a dyke
- Prevent liquid from entering sewers and watercourses
- Pump liquid to salvage tank
- Remaining liquid may be taken up on clay, diatomaceous earth or other absorbent, and should be placed into disposal containers

5.4 Waste Disposal

- Paint should be disposed of in accordance with State and local regulations
- Rags, spray booth filters, paint suits, empty cans, etc. contaminated with product may be hazardous waste
- Determine whether contaminated items are hazardous and dispose of appropriately

5. 5 Safety Aspects Associated with Certain Generic Types of Coatings

The safety aspects associated with coatings will depend on their chemical formulations. The following table summarises the typical solvent types, flash points and volume solids content of common decorative, industrial and heavy-duty coatings. Note that the Material Safety Data Sheet for each paint will be different as well as between different coloured paints.

Table 3: Flash Points and Solvent Contents of Various Generic Types of Organic Coating Systems

Binder Type	Typical Solvent Type	Typical Flash Point Min. (°C)	Typical Volume Solids Content (%)
Latex emulsions	Water	Non-flammable	29 to 56
Solvent-based acrylic	Hydrocarbons	26	46
Vinyls	Aromatic hydrocarbons/ esters/ketones	20 to 21	25 to 36
Vinyl Butyrals	Aromatic hydrocarbons/alcohols / ketones	4 to 14	7.7 to 12
Chlorinated rubber	Aliphatic and aromatic hydrocarbons	0 to 23	37 to 43
Bitumen	White spirits or turps substitute	30 to 38	46 to 50
QD Alkyds	Aliphatic and Aromatic hydrocarbons	5	
Alkyds	Hydrocarbons	21 to 38	44.3 to 67
Alkyd phenolics	Aliphatic & Aromatic hydrocarbons & alcohol	4 to 38	35 to 47.8
Alkyd/amino resins (baking enamels)	Hydrocarbons	4	37
Polyurethane/alkyd resin	Hydrocarbons	30 to 38	45 to 48
Oleoresins	White spirit	24 to 40	32 to 57
Alkali resistant synthetic resin	Hydrocarbons	38	20
Silicone/alkyd	Aromatic hydrocarbons	40	39

Amide cured epoxies	Aromatic hydrocarbons, alcohols, ketones, esters and glycol ethers	-7 to 22	29 to 90
Amine cured epoxies	Aromatic hydrocarbons, alcohols, ketones, esters and glycol ether	4 to 22	37 to 40
Solvent-free amine cured epoxies	Solvent-free	Non-flammable	100
Solvent-free Polyamide cure epoxies	Solvent-free	Non-flammable	100
Epoxy esters	Aromatic & aliphatic hydrocarbons, ketones and alcohols	-4 to 28	21.4 to 46
Water-based epoxies	Water	Non-flammable	44 to 66
Polyamine cured coal tar epoxies	Aromatic hydrocarbons/ketones & alcohols	4 to 23	54 to 65
Polyamide cured coal tar epoxies	Aromatic & Aliphatic hydrocarbons, ketones, esters	-5	68
Solvent-free amine cured epoxy tar	Solvent-free	120	100
Inorganic Zincs (alkali silicate)	Water	Non-flammable	73
Inorganic Zincs (ethyl silicate)	Aromatic hydrocarbons, glycol ethers, alcohols and water	17 to 25	74,4 to 80% by mass
Nitrocellulose	Hydrocarbons, esters, ketones, alcohols and glycol ethers	-6	26
Powders	Solvent-free	Non-flammable	100
Silicones	Alcohols and aromatic hydrocarbons	4 to 38	14 to 47.4
Silicone Acrylics	Aromatic hydrocarbons	21 to 29	35
Urethanes	Aromatic hydrocarbons, ketones, glycol ethers, ethyl glycol acetate, esters	-17 to 21	36.4 to 50
Moisture cured urethanes			100
Polyester	Solvent-free	34 ± 2	96 ± 2
Vinyl ester	Solvent-free	34 ± 2	96 ± 2
Elastomeric urethanes	Solvent-free	> 110	100

Considering Table 3 it is clear that certain coatings pose a much greater risk with respect to fire and explosion. In the case of coatings with low flash points, i.e. vinyl butyrals, QD alkyds, baking enamels, polyamide cured coal tar epoxies, nitrocellulose coatings and urethanes, extra precautions need to be taken to prevent ignition. In the case of these products vapour may be ignited by flame, pilot lights, smoking, sparks, heaters, electrical equipment, static discharges, or other ignition sources close to or distant from point of handling. Since material will accumulate static charges, good grounding should be ensured.

Most coatings however, have flash points close to room temperature. In the case of these materials, good ventilation is generally sufficient precaution to avoid fire or explosion risks. The degree of flammability depends on the volatility of the solvent employed. Consequently, the paint with the strongest smell is likely to be the most flammable. In order of flammability, the least dangerous are household paints based on mineral turpentine, followed by industrial spraying enamels based on aromatic hydrocarbons, followed by certain high performance paints such as solvent-based epoxies and polyurethanes, and the most flammable are cellulose lacquers.

Those coatings that are considered least hazardous are the water-based and solvent-free materials. It should however be noted that most coatings give off vapour of some kind, even in the case of the water-based and solvent-free materials. In the case of emulsion paints it may be ammonia. In the case of solvent-based paints solvent vapour escape as soon as the tin is opened and evaporate during the drying process. Even solvent-free paints often contain materials that are volatile and give off vapours. These

REFERENCE	DATE	PAGE
62 S 2 402	Jul 2001	15 of 13

vapours of fumes may be toxic. It is important, therefore, to avoid breathing in fumes of paint.