DEPARTMENT OF WATER AND SANITATION

STANDARD SPECIFICATION

DWS 9900

SECTION C1

CORROSION PROTECTION OF STEEL PIPES AND SPECIALS FOR PIPELINES

This document shall be read in conjunction with:
DWS 2020: Quality Assurance and Procedures

Annexures
Requirements to be specified

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1. SCOPE

This specification covers the corrosion protection of steel pipes and specials to be used for the conveyance of raw and potable water at ambient temperature, which may be buried or subjected to environments with variable corrosive tendencies.

2. INTERPRETATIONS

2.1 PROJECT SPECIFICATION

Steel pipes and specials shall be manufactured and corrosion protected in accordance with the requirements specified in the Project Specification. No deviation from specification will be allowed without the written consent of the Project Engineer. In the case of there being conflict between specifications or between specifications and product data sheets, the discrepancy shall be referred to the project engineer for resolution

2.2 APPLICATION

This specification contains clauses that are generally applicable to the corrosion protection of steel pipes and specials.

2.3 DEFINITIONS

LINING

Refers to the internal coating of pipes and specials.

COATING

Refers to the external coating of pipes and specials.

DIS-BONDED AREA

An area of lining or coating that initially did adhere to the steel substrate after application, but which subsequently became loose from the substrate as a result of mechanical, chemical or other action.

UN-BONDED AREA

An area of lining or coating which at no stage adhered to the steel substrate.

3. APPROVAL PROCEDURE

3.1 APPROVALS BEFORE AWARD OF CONTRACT

The Corrosion Protection System specified in the Project Specification, shall be agreed upon between the Corrosion Engineer, Cathodic Protection Engineer and Project Engineers.

(a) Approval by the Corrosion Engineer of the corrosion protection system, procedures and specific materials offered in the Tender. Manufacturers' data sheets or legible copies thereof shall be submitted for each product.

(b) Acceptance of the Departmental Quality Control Plan for Corrosion Protection - refer to DWS 2020 QCC1.

3.2 PRE-QUALIFICATION REQUIREMENT

Due to the specialized nature and importance of corrosion protection, pre-qualification is generally required for products, service providers and skills in corrosion protection. Users of the specification would typically be Water Service Providers/Authorities who shall stipulate detailed pre-qualification requirements.

3.3 APPLICATION APPROVALS

(a) Qualification of personnel

(b) Quality of equipment

(c) Pre-preparation

(d) Surface preparation

(e) Application

(f) Final acceptance

4. QUALITY REQUIREMENTS

4.1 QUALITY ASSURANCE AND PROCEDURES

The Contractor shall ensure that he is fully conversant with the requirements of this specification and the relevant coating systems.

Quality procedures as specified in DWS 2020 shall be adhered to.
The production and application shall be in accordance with SABS ISO 9000, Quality System.

4.1.1 QUALITY PLAN AND DOCUMENTATION

A detailed quality plan shall be submitted for approval and completion by the Corrosion Engineer before manufacture/coating is initiated – refer to DWS 2020 QCC1 section 1.

4.1.2 INSPECTION AND TESTING PLAN (ITP) / QUALITY CONTROL PLANS (QCP)

(a) An ITP or QCP is a master Quality Control Plan or document which shall include pass/fail criteria for inspections & must be agreed between Asset Owners' Corrosion Engineer or Representative and Project Manager(s) by means of pre-approval of quality control documentation generated and submitted by the contractors for approval. The master Quality Control Plan shall contain hold points agreed to by the Corrosion Engineer.

(b) After approval of the master Quality Control Plan, the documentation shall be reproduced to be used on a daily basis or per section of work completed or per batch to record all

measurements and requirements. These QCP records must include at least surface preparation standards and profile measurements, salt tests, temperature, humidity and dew point measurement, Dry Film Thickness (DFT) measurements, Electrical Insulation Defects (EIDs) & adhesion testing: all in accordance with the relevant standards and specifications.

4.1.3 METHOD STATEMENT

(a) The Method Statement is the document describing the procedures, methods, equipment, and tools to be used for surface preparation, coating and lining application.

The Application schedule shall state the time and place when the following will be conducted:-

- Inspection of material;
- Fettling or dressing;
- Degreasing;
- Water soluble salts testing;
- Blast cleaning and application of the first coat;
- Application of intermediate and final coat(s);
- The commencement of site repairs.

(b) Coating and Lining products.

4.2 QUALIFIED STAFF

4.2.1 APPLICATION

The highest standard of workmanship is required. Only experienced personnel shall be used to carry out corrosion protection work.

All work shall be carried out under the constant supervision of a qualified supervisor.

4.2.2 REPAIR WORK AT SITE

All repair work shall be undertaken by competent personnel of the approved applicator under the supervision of a qualified supervisor.

4.3 COMPATIBILITY OF MATERIALS

The Contractor shall ensure that metals or alloys are compatible or are adequately protected if, in the galvanic series, there is a 0,3 volt difference in the galvanic potential.

4.3.1 DESIGN PRECAUTIONS

All equipment shall be designed to suppress corrosion in an exposed environment.

4.3.1.1 ACCESSIBILITY

Easy access for protection and maintenance shall be provided. The use of back to back angles, partially open box sections or inaccessible stiffeners shall be avoided.

Corrosion protection of areas that are unavoidably inaccessible shall be individually specified or approved by the Corrosion Engineer.

4.3.1.2 WATER RETENTION AREAS

Pockets, recesses and crevices in which water and dirt may collect shall be avoided. Water retention areas shall be properly drained by holes as large as possible i.e. 150 mm diameter – minimum 50 mm diameter.

Surfaces of corrodible metals, such as the insides of tanks or hollow sections that cannot be protected by any method (e.g. painting or dipping), shall be avoided; or where not possible, be fully sealed against ingress of air and moisture.

4.3.2 CORROSION PREVENTION

The Contractor shall ensure that the following steps are taken to minimise corrosion:-

(a) If dissimilar metals are used:

  (i) Coat all surfaces of the whole assembly including the more noble member of the galvanic series.

(b) If the noble member of the assembly cannot be entirely covered:

  (i) Keep the anode/cathode ratio as large as possible in the particular component.

  (ii) Use electrical insulators between two metals. Insulation must be complete: a bolt requires a sleeve as well as washers of an insulating material.

(c) Joints and crevices between metals shall be sealed.

(d) Where fastening is unavoidable, the fasteners shall be more noble (cathodic) than the base material. Fasteners shall be coated where possible and/or adequately electrically insulated between fasteners and the base material.

4.4 EQUIPMENT

4.4.1 MEASURING EQUIPMENT

The Contractor shall have the following measuring equipment site at all times:

- Ambient temperature gauge;
- Replica tape for blast profile measurement;
- Visual comparators for surface cleanliness;
- Dew point instrument;
- Dry film thickness gauge;
- Electrical Insulation Defect detector;
- Surface temperature gauge;
- Relative humidity measuring instrument;
- Wet film comb.

All test equipment shall have current valid calibration certification.

Calibration of all instruments shall be verified daily, except where otherwise specified by manufacturers', to achieve the required accuracy.

Dry film thickness gauges shall be calibrated on a flat surface, provided that the surface profile is in accordance with the specification.

4.4.2 SPRAY EQUIPMENT

Equipment used for application of coatings shall be maintained in clean condition and in good working order. Spray gun orifices shall be cleaned using a suitable solvent in accordance with recommendations of the coating manufacturers' together with brushes, pipe cleaners or other suitable means to mechanically remove all coating. Plural component spray gun machines shall be regularly stripped in accordance with the manufacturers' recommendations to ensure internal cleanliness. The Engineer may require the Contractor to demonstrate that the machine is delivering components in the correct mix ratio at any reasonable time requested.

Spray equipment shall be suitable for the production of high quality work, capable of properly atomising the coating or lining material and equipped with suitable pressure regulators and gauges. Air caps, needles and nozzles shall be of the type recommended by the coating or lining manufacturer.

All spray equipment shall be fitted with suitable oil and moisture traps.

4.4.3 MIXER

A low speed mixer, which does not introduce air into the coating material being mixed, shall be utilised only.

Payment for in situ-applied linings and coatings shall be for completed linings at the rates scheduled.

5. RECOMMENDED COATING SYSTEMS

5.1 TOXICITY OF LINING MATERIAL

Materials used for the lining of pipes shall be non-toxic and shall not impart any odour, taste, or colour to the water. Certification shall be submitted to the Corrosion Engineer for his approval.

5.2 PROPRIETARY ITEMS

Components that are supplied painted or protected e.g. gearboxes, actuators etc. **shall only be accepted** provided that they meet the corrosion protection requirements of this specification. If this specification cannot be adhered to, the Contractor **shall submit full details of the equivalent coating systems** at tendering stage, for approval by the Corrosion Engineer.

5.3 COATING SYSTEMS FOR PIPES AND SPECIALS

Selection of all corrosion protection systems shall be cleared with the Corrosion Engineer before finalisation of the Project Specification.

The following tables are abbreviated guidelines and the systems are not listed in order of preference.

See **NOTES** under paragraph 5.10.

5.9 MINIMUM THICKNESS

The tables above contain the thickness specification for DFT

The default method of DFT measurement shall be in accordance with SSPC PA - 2 Procedure for the determining conformance to dry coating thickness requirements, with specific reference to Section 9 of SSPC PA - 2 and a restriction level of 1.
The method of measuring and evaluating coating and lining thickness shall be a minimum thickness which shall mean that no readings below the minimum thickness are allowed to be accepted.

5.10 ABBREVIATIONS AND NOTES

ABBREVIATIONS

DFT : Dry film thickness
FBE : Fusion-bonded Epoxy
FBPE : Fusion-bonded Polyethylene
HDG : Hot-dip galvanized
MS : Mild steel – grade 300WA
SS : Stainless steel – grades 304L
UV : Ultra Violet
3Cr12 : Corrosion resistant steel
µm : Micrometer

NOTES

The following items shall be approved by the Corrosion Engineer

1.	Hot-dip galvanizing	- Only for pipes up to 200 mm diameter maximum and flow less than 2 m/s. - Pipes shall not be embedded in concrete. - Water analysis shall be provided. - Pipes over 200 mm diameter to be coated with a duplex system
2.	Sealant	- Interfaces of different environments shall be sealed with a Polyurethane or Polysulphide flexible sealant to be applied in accordance with the manufacturer's data sheets.
3.	Un-coated stainless steel	- Only to be used if no galvanic reaction and anaerobic conditions are found.
4.	Pickle and passivate	- If not in contact with less noble material. - If exposed to anaerobic conditions seal-coat all crevices with Elastoplastic Epoxy. - Shall be done by the dipping process.
5.	Galvanic cells	- Where a galvanic cell is situated within a water path <150 mm and concrete cover <75 mm, both the MS, 3Cr12 or SS shall be coated.
6.	Anaerobic conditions	- SS grade 316L shall be used under anaerobic and aggressive water conditions.
7.	Polyurethane for colour coding	- Re-coatable or pure Aliphatic Polyurethane where required for colour coding. Only UV resistant Polyurethane shall be used.
8.	Primers	- Primers shall only be used in special cases i.e. over-coating of galvanized surfaces.
9.	3CR12	- In view of superior corrosion resistance, coated 3CR12 material is preferred
10.	Mild steel	- Mild steel may only be used where the pipe lining can be refurbished in situ
11.	Epoxy primer	- Epoxy primer may not be required if appropriate two pack Epoxy/ Re-coatable or pure Aliphatic Polyurethane is being used.

6 MANUFACTURE AND PRE-PREPARATION

STANDARDS

SANS	1344	Medium duty solvent detergent.
SANS	5770	Preparation of steel substrate before the application of paints and related products – Test for the assessment of cleanliness of blast-cleaned steel surfaces for painting - Freedom from certain soluble salts.
SANS	5772	Preparation of steel substrate before the application of paints and related products – Surface roughness characteristics of blast-cleaned steel surfaces - Profile of blast-cleaned steel surfaces by a micrometre profile gauge.
SANS	5502-3	Preparation of steel substrate before the application of paints and related products – Test for the assessment of surface cleanliness – Part 3: Assessment of dust of steel surfaces prepared for painting (pressure sensitive tape method).
SANS	8501-1	Preparation of steel substrates before application of paints and related products – Visual assessment of surface cleanliness – Part 1: Rust grades and preparation grades of un-coated steel substrates and of steel substrates after overall removal of previous coatings.
SANS	8501-3	Preparation of steel substrates before application of paints and related products – Visual assessment of surface cleanliness – Part 3: preparation grades of welds, edges and other areas with Surface imperfections.
SANS	8504-2	Preparation of steel substrates before application of paints and related products – Surface preparation methods – Part 2: Abrasive blast cleaning.
SANS	10064	The preparation of surfaces for coating.
SANS	14713-2	Zinc coatings – Guidelines and recommendations for the protection against corrosion of iron and steel in structures. Part 2: Hot dip galvanizing.
SANS	12944-3	Paints and varnishes – Corrosion protection of steel structures by protective paint systems. Part 3: Design considerations.
ISO	11125	Preparation of steel substrates before application of paints – Metallic blast-cleaning abrasives.
ISO	11127	Preparation of steel substrates before application of paints – Non- metallic blast–cleaning abrasives.
NACE	SP0178	Fabrication details, surface finish requirements, and proper design considerations for tanks and vessels to be lined for immersion service. Appendix C - Visual comparator for acceptable weld contours.
SSPC	PA - 2	Procedure for the determining conformance to dry coating thickness requirements, with specific reference to Section 9 of SSPC PA - 2 and a restriction level of 1.
NACE/SSPC	WJ-1	Water Jetting to bare metal

6.1 RESPONSIBILITY

6.1.1 PRE-PREPARATION

The Manufacturer or Refurbisher shall be responsible for all the pre-preparation of equipment prior to surface preparation. Pre-preparation shall be carried out to the approval of the Corrosion Engineer and the Corrosion Protection Contractor.

6.1.2 PERSONNEL

Pre-preparation shall be carried out by competent personnel, under the supervision of an experienced supervisor.

6.1.3 MARKING

All items shall be permanently and indelibly marked to identify each individual item as specified by the Engineer.

6.2 FABRICATION REQUIREMENTS

6.2.1 SURFACE DEFECTS

All extrusions rolled steel and castings shall be clean and free of score marks, pits, protrusions, blisters, porosity, blowholes, cracks or any other flaws which may be detrimental.

Laminations, scabs or occluded scale shall be ground out. If such grinding penetrates deeper than 7% of the metal thickness, the area shall be repaired by welding, or the metal shall be rejected at the discretion of the Engineer.

6.2.2 UNDERCUTS, CAVITIES AND PITS

Weld undercuts and cavities as well as pits in metal surfaces are not permitted.

All undercuts, cavities and pits shall be ground out, re-welded and ground to a smooth contour.

6.2.3 WELDS

The weld finish requirements for proper corrosion protection shall be read together with SANS 8501-3 grade P3 or NACE SP0178 grade C for liquid or powder applied systems and grade B for tape and shrink sleeve systems. Furthermore, where any discrepancies may arise, the more stringent specification shall apply.

All welds shall be continuous and shall have a smooth contour. The shape of welds shall be gently convex, and the height of the weld bead shall not exceed 1mm internally and 3mm externally. Undercuts, sharp protrusions, steep angles, blowholes, and discontinuity of reinforcement are not permitted. The weld finish shall be suitable and appropriate to the type of corrosion protection.

Areas adjacent to welds shall be free from weld spatter. Such spatter shall be removed by grinding or scraping.

Welding processes used shall limit heat input to a minimum to restrict the heat affected zone.

6.2.4 LIFTING LUGS

Where required, lugs shall be fitted by the manufacturer to the requirements of the Corrosion Contractor and the approval of the Engineer.

6.2.4.1 LUGS TO BE REMOVED

After removal the damaged coating area shall be repaired in accordance with the original Specification.

6.2.4.2 PERMANENT LUGS

Lugs, not intended to be removed, shall be manufactured of equal or more noble grade than the base material in accordance with the Specification.

6.3 REFURBISHMENT

6.3.1 INSPECTION PROCEDURE

Corrosion damage must be exposed by manual, mechanical or abrasive blast-cleaning for inspection. The refurbishment procedures shall then be specified by the Engineer.

6.3.2 PREPARATION METHODS

Allowable depth of pitting is 0,8mm . Pits need to be repaired by blending in i.e. removal of sharp edges surrounding the pit. If larger pits are found these will be evaluated and if necessary repaired by means of welding and then ground smooth. This will be tendered as a rate only item.

6.4 PRE-PREPARATION

6.4.1 GENERAL REQUIREMENTS

6.4.1.1 PROTRUSIONS

Protrusions shall be removed by grinding and dressing to a smooth contour.

6.4.1.2 SHARP EDGES

Burrs shall be removed by grinding.

All sharp edges shall be radiused to a minimum of 2 mm.

6.4.1.3 WELDS

Welds shall be free from slag, slag inclusions, cracks, surface cavities and under-cuts.

Irregular projections shall be ground to a smooth contour.

Areas adjacent to welds shall be free from weld spatter. Such spatter shall be removed by grinding or scraping.

6.5 PRIMARY CLEANING

The Manufacturer or Refurbisher shall remove oil, grease, silicon weld spatter release agent or other surface contaminants with a water-soluble solvent degreaser followed by rinsing with clean, soft water before the items are despatched to the Corrosion Protection Contractor. Carry out a reliable and suitable test to ensure oil and grease is removed.

6.5.1 WELD SPATTER RELEASE AGENTS

The use of weld spatter release agents is not acceptable on the project as the typical formulations contain silicone which is difficult to observe and remove and such weld spatter release agents may result in poor adhesion of coatings and linings.

7 SURFACE PREPARATION

The best possible degree of surface cleanliness is always preferred before the application of corrosion protection materials. Should any doubt arise a cleaner surface and more stringent specification shall be required.

7.1 STANDARDS

SANS	1344	Medium duty solvent detergent.
SANS	5770	Preparation of steel substrates before application of paints and related products – Test for the assessment of cleanliness of blast-cleaned steel surfaces for painting - Freedom from certain soluble salts.
SANS	5772	Preparation of steel substrate before the application of paints and related products – Surface roughness characteristics of blast-cleaned steel surfaces - Profile of blast-cleaned steel surfaces by a micrometre profile gauge.
SANS	8501-1	Preparation of steel substrates before application of paints and related products – Visual assessment of surface cleanliness – Part 1: Rust grades and preparation grades of un-coated steel substrates and of steel substrates after overall removal of previous coatings.
SANS	8502-2	Preparation of steel substrates before application of paints and related products – Test for the assessment of cleanliness Part 2: - Laboratory determination of chloride on clean surfaces.
SANS	8502-3	Preparation of steel substrates before application of paints and related products – Test for the assessment of cleanliness Part 3: - Assessment of dust on steel surfaces prepared for painting (pressure-sensitive tape method).
SANS	8502-5	Preparation of steel substrates before application of paints and related products – Test for the assessment of cleanliness Part 5: - Measurement of chloride on steel surfaces prepared for painting – ion detector tube method.
SANS	8504-2	Preparation of steel substrates before application of paints and related products – Surface preparation methods – Part 2: Abrasive blast cleaning.
SANS	10064	The preparation of surfaces for coating.
SANS	12944-4	Paints and varnishes – Corrosion Protection of steel structures by protective paint systems. Part 4: Types of surface and surface preparation.
ISO	11125	Preparation of steel substrates before application of paints – Metallic blast-cleaning abrasives.
ISO	11127	Preparation of steel substrates before application of paints – Non- metallic blast–cleaning abrasives.
NACE	SP0178	Fabrication details, surface finish requirements, and proper design considerations for tanks and vessels to be lined for immersion service. Appendix C - Visual comparator for acceptable weld contours.

The default surface preparation requirement shall be Sa3 as described in SANS 8501-1 and in addition shall be subject to time limitation between obtaining the degree of surface cleanliness and application of corrosion protection as described in the section that deals with quality control of coatings and linings.

In addition to this default requirement there may also be project specific surface preparation standards that will take precedence.

7.2 RESPONSIBILITY

7.2.1 SURFACE PREPARATION

The corrosion protection Contractor shall be responsible for preparation of all surfaces to be coated.

On completion of the Contract, all plant, equipment, temporary structures and materials shall be removed from the site.

7.2.2 PERSONNEL

The Contractor carrying out the surface preparation shall have competent personnel with the necessary technical knowledge of the processes involved.

All work shall be carried out under the supervision of an experienced supervisor.

7.2.3 EQUIPMENT

The Contractor carrying out the surface preparation shall have competent personnel with the necessary technical knowledge of the processes involved. All work shall be carried out under the supervision of an experienced and qualified supervisor.

To ensure skills, quality and reliability of water infrastructure and supply services, minimum qualifications and experience are required.

(a) Equipment and air supply free of oil and moisture.

(b) Compressors shall have a capacity and pressure output to achieve the required nozzle pressures. (Worn nozzles shall be replaced).

(c) All plant, equipment and temporary structures shall at all times be maintained in good and safe working order.

If the correct surface preparation is not achieved due to inadequate plant and equipment, the Engineer may order the Contractor to obtain such plant and equipment as may be necessary to achieve the specified results.

7.2.4 WORKING CONDITIONS

Surface preparation shall not take place when conditions are likely to affect the corrosion protection processes adversely.

The Contractor shall provide screens, covers, trestles or any other equipment necessary to avoid contamination of surfaces and to minimise time delays caused by inclement weather.

7.2.5 HEALTH AND SAFETY

The Contractor shall at all times enforce health and safety measures necessary to comply with the Occupational Health and Safety Act No. 85 of 1993 and the manufacturer's requirements.

7.3 PROCEDURE

7.3.1 APPROVAL OF WORKS AND PROGRAMME

The Contractor's programme, plant and equipment and works shall be approved by the Corrosion Engineer prior to commencement of surface preparation.

7.3.2 INITIAL INSPECTION

The corrosion protection Contractor shall check the initial condition of the surface for:

(a) Visible surface defects
(b) Corrosion or contamination
(c) Any required metal dressing
(d) Elimination of burrs and radiusing of edges

(f) Suitable lifting lugs

and shall bring any concerns relating to the above to the attention of the Corrosion Engineer. The Corrosion Engineer shall issue instructions for the correction thereof.

Areas subjected to chemical attack, salt spray, fungus or bacteria shall be neutralised, rinsed with clean potable water before abrasive blast-cleaning.

7.3.3 DEGREASING

All surfaces to be coated shall be tested for oil and grease contamination by the water break free test or ultra-violet light or any other method agreed to by the Corrosion Engineer.

Oil and grease contamination shall be removed by:

- Steam-cleaning.
- An emulsifiable or aqueous detergent applied in accordance with SANS 1344.
- An alkaline cleaning solution.

Allow to react, and then rinse off with clean, potable water to remove all residues prior to surface preparation, all in accordance with clauses 4.3 and 4.4 of SANS 10064.

The surfaces shall be tested after degreasing and show no oil, grease and chemical contamination after degreasing.

Care shall be taken to avoid entrapment of cleaning agents in recesses or other retention areas.

7.3.4 ROUGH / PRE-BLASTING

All rust, mill scale, old coating or marking paint shall be removed by rough / pre-blasting.

The Engineer shall be advised when blast-cleaning of the appropriate section will be completed so that an inspection can be carried out to determine if repairs are required.

Blast-cleaning shall be done in accordance with the code of practice SANS 10064 to achieve a cleanliness of Sa 2. (SANS ISO 8501-1)

7.3.5 WATER SOLUBLE SALTS

The blast cleaned surfaces to be coated shall be tested for water soluble salts. The maximum level of salts allowable on the surfaces shall not exceed the values given below.

Should these values be exceeded, the surfaces shall be cleaned by: -
(a) A liquid soluble salt remover approved by the Corrosion Engineer or
(b) Washing with a high-pressure jet of clean potable water or
(c) Water injected blast-cleaning.

Followed by re-blast or flash blast-cleaning until the soluble salts are within the specified limits.

Water soluble salt decontamination may require repeated washing and re-blasting cycles.

Prepared surfaces shall be in accordance with the table below.

WATER SOLUBLE SALTS	FOR IMMERSED OR BURIED CONDITIONS
Maximum at any point	Chloride - max 70 mg/m^2 Soluble Ferrus ion contaminants - Max 100 mg/m^2 Sulphate contaminants - max of 170 mg/m^2

NOTE: The conversion factor for salt concentration on a steel surface to change between milligrams per square metre and micro grams per square centimetre is 10 mg/m^2 to 1 $microgram/cm^2$

When so required by the Corrosion Engineer, the surface should be assessed for chloride contamination in accordance with SANS 8502-2 or SANS 8502-5, as agreed by manufacturer.

7.3.6 FINAL-BLAST

7.3.6.1 FINAL-BLAST

7.3.6.1.1 Humidity and Temperature

Final-blasting and corrosion protection shall not be carried out if the steel temperature is less than 3°C above dew point.

At the discretion of the Corrosion Engineer, and in the event that the relative humidity is consistently between 80% and 90% blast-cleaning may only take place if the steel is at least 5°C above the condensation temperature (dew point) of the air and if the steel is coated **within one hour** after blasting, provided that the paint or coating systems that are used under conditions of high humidity are **not moisture sensitive**.

For maintenance and refurbishment work of the Corrosion Engineer shall have the discretion to issue a written concession that relaxes the time limitation after grit blasting and substitutes this with a hold point inspection of the blast cleanliness standard to ensure that no deterioration has occurred due to the elapse of time. Any dispute relating to cleanliness of blasted steel that has aged shall be settled by blasting test patches to ensure that there is no colour variation between the old blasted steel and the freshly blasted steel.

7.3.6.1.2 Blasting-material

Final blast-cleaning shall be carried out using clean, uncontaminated blast-medium in accordance with paragraph 7.4.2.

7.3.6.1.3 Blast Cleanliness

All surfaces for "wet/submerged conditions" and for "dry conditions" shall be blast-cleaned to Sa 3 accordance with SANS 8501-1.

7.3.6.1.4 Profile

The required surface profile specified in paragraph 7.4.1 shall be achieved by final-blasting in accordance with SANS 10064 and/or ISO 8504-2.

7.3.6.1.5 Residual Dust and Debris

Prior to coating, dust and debris shall be removed by vacuum-cleaning. A dust and debris test shall be done in accordance with SANS 8502-3.

Only with prior approval by the Corrosion Engineer may dust and debris be removed by blowing with clean uncontaminated compressed air.

For the internal field joint as well as internal patch repairs of pipelines, all blasting grit must be removed from the pipeline before application of the protective lining.
Then contractor shall provide mobile platforms with soft wheels or stable tower scaffolding or similar to create access to the underside of the roof of large diameter pipes and tunnels.

7.3.6.1.6 Contamination

After final-blasting, the un-coated steel shall not be touched with bare hands. All applicators shall wear white gloves and shoe covers where applicable.

7.3.6.2 FLASH-BLAST

Flash blast-cleaning shall be carried out to reinstate the surfaces specified in paragraph 7.4.1, in accordance with paragraph 7.3.6.1.

7.4 SURFACE PREPARATION REQUIREMENTS

SURFACE CONDITIONS

The surface preparation requirements in the table below in Sections 0 (7.4.1 SURFACE PREPARATION PARAMETERS FOR NEW STEEL) and 0 (7.4.2 BLAST PROFILES FOR CORRODED STEEL AND CAST IRON) are general requirements. In addition to these general requirements there will also be detail projects specific surface preparation standards that will take precedence.

Refer to the notes below table in Section 0 (7.4.1 SURFACE PREPARATION PARAMETERS FOR NEW STEEL) for more information.

7.4.1 SURFACE PREPARATION PARAMETERS FOR NEW STEEL

Prepared surfaces shall be in accordance with the table below:

PROPERTY	FOR WET, BURIED CONDITIONS
Cleanliness to SANS 8501-1 (min)	Sa 3
Residual dust and debris SANS 8502-3 maximum particle size	Class 3

Residual dust and debris SANS 8502-3 maximum quantity	Rating 2 *(refer note)
Oil, grease and perspiration	Nil
Surface Profile (min) Coats up to 400 µm (max)	40 µm 80 µm
Surface Profile (min) Coats >400 µm (max)	50 µm 100 µm
Surface Profile (min) Solvent Free Coats	50 µm No maximum
Water soluble salts at any point (refer note)	Chloride - max 70 mg/m^2
	Soluble Ferrus ion contaminants - Max 100mg/m² mg/m^2
	Sulphate contaminants - max of 170 mg/m^2

NOTES:

- The conversion factor for salt concentration on a steel surface to change between milligrams per square metre and micro grams per square centimetre is 10 mg/m^2 to 1 $microgram/cm^2$
- (1ppm is equal to 1 mg/l and 1 micro grams/ml)
-
- For solvent free coatings there is no upper maximum limit for blast profile.
- For maintenance work it is recommended that the Corrosion Engineer be consulted concerning tests for bacterial contamination.
- Grit blasting DOES NOT remove all salts and bacteria and a decontaminating wash may be required followed by re-blasting.
- *Under field conditions the Corrosion Engineer may issue a relaxation so that the dust contamination shall not be in excess of dust Quantity Rating 2 as per the pictorial standard and a size Class 3 in accordance with SANS 8502-3.

7.4.2 BLAST PROFILES FOR CORRODED STEEL AND CAST IRON

Corroded steel inherently has a higher roughness surface profile due to wasting of the surface. Therefore, blast profiles on corroded steel may tend to be towards the higher of the ranges specified in Section 7.4.1 SURFACE PREPARATION PARAMETERS FOR NEW STEEL) above.

Average blast profiles above 100 microns prohibits the use of solvent borne thin coatings because of the risk of the high points greater than 25% grinning through the coating film and resulting in measle corrosion. Solvent entrapment can occur in the valleys of the high blast profile.

For blast profiles above 100 microns it is only permissible to use solvent free coatings or coatings with a volume solid 95% or above.

When using solvent free coatings, higher blast profiles may lead to an improved mechanical key due to the better anchor pattern and higher adhesive bond strengths.

7.4.3 ABRASIVE MATERIAL

7.4.3.1 MATERIAL

The blast-cleaning abrasive shall be composed of clean, sound hard particles free from foreign substances such as dirt, oil, grease, toxic substances, organic matter, water soluble salts and

foreign metals. The abrasive material shall be washed, screened and graded for size. The blasting abrasive type shall meet the requirements as specified in ISO 11125 for Metallic abrasives and ISO 11127 for Non-Metallic abrasives.

The type of grit to be used should be inert synthetic mineral with similar chemical and physical properties to aldamine garnet (Ecoblast or equivalent) Crushed or granulated slag is not permitted

7.4.3.2 CERTIFICATION

The abrasive material supplier shall certify that all products supplied conform to all the requirements specified.

7.4.3.5 pH

The pH of the prepared slurry mixture shall not be below 6,2.

7.4.3.6 WATER SOLUBLE SALTS

The conductivity of slurry shall be less than 25 mS/m in accordance with ISO 11127.

7.4.3.7 MOISTURE CONTENT

The moisture content for abrasive material shall not exceed 0,2 percent.

7.4.3.8 RE-CYCLING

Re-cycled blasting-material shall only be used if:

(a) Blasting-materials were only used on degreased surfaces
(b) Dust and debris is removed from the blasting-material
(c) Particles are kept angular and within specified sizes

Re-cycled blasting-material may only be used for rough blasting and pre-blasting.
Re-cycled blasting-material shall not be used for final blasting.

7.4.4 AIR SUPPLY

Air supply equipment shall be fitted with efficient oil and water traps to avoid contamination of the surface. At least one oil and one water trap shall be fitted at the compressor and one water trap at the blast pot.

Some tunnel liners are 1500m from the access addit therefore piping and size of compressor is important to achieve proper blast.

The air pressure shall be a minimum of 600 kPa at the nozzle measured with a needle pressure gauge but not withstanding the contractor shall ensure that both the volume and the pressure of the air is sufficient to achieve the required blast cleanliness and blast profile standard at the required rate of production.

The air pressure supply at the compressor shall, as a guideline be a minimum of 700 kPa or preferably more, to provide the minimum required nozzle air pressure.

The contactor shall be responsible for his own lack of efficiency and productivity if the compressed air that he supplies is inadequate.

(Testing Compressed Air For Oils (REFER SANS 8573)).

7.5 SURFACE PREPARATION OF OTHER MATERIALS

7.5.1 GALVANIZED SURFACES TO BE COATED

Main line bulk water pipe and buried pipes shall not be galvanized.
Structural steel for C1 to C3 atmospheric conditions as defined by ISO 12944-2 classification of environments may be hot-dip galvanized or duplex coated as per ISO 12944-5.

The use of galvanized surfaces inside valve chambers is not permitted, due to high levels of humidity that is generally found in the chambers.

7.5.1.1 PASSIVATION

Surfaces to be coated shall **not** be passivated.

7.5.1.2 DEGREASING

Galvanized steel surfaces shall be degreased prior to coating, in accordance with Section 7.3.3 and the manufacturer's instructions, or a mild acid-detergent degreasing solution to be approved by the Corrosion Engineer.

7.5.1.3 PROFILE

7.5.1.3.1 Sweep-blasting

Large areas shall be prepared by sweep-blasting with non-metallic abrasive in accordance with paragraph 7.3.6.3.

7.5.1.3.2 Mechanical

Surfaces that cannot be sweep-blasted shall be abraded manually or mechanically with abrasive paper grade 220 or by using non-metallic abrasive pads.

7.5.1.4 DUST AND DEBRIS

Finally, all dust and debris shall be removed by vacuum-cleaning.

7.5.1.5 PRIMER

Primer for galvanised surfaces shall be applied immediately after surface preparation, not exceeding the time limits specified in paragraph 7.3.6.1.1.

7.5.2 ALUMINIUM SURFACES TO BE COATED

Aluminium surfaces to be coated shall be treated as follows:

7.5.2.1 DEGREASING

Surfaces shall be degreased in accordance with paragraph 7.3.3.

7.5.2.2 PROFILE

Sweep-blast with non-metallic abrasive in accordance with paragraph 7.3.6.3.

7.5.2.3 DUST AND DEBRIS

All dust and debris shall be removed by vacuum-cleaning.

7.5.2.4 PRIMER

Primer for aluminium surfaces shall be applied immediately after surface cleaning, not exceeding the time limits specified in paragraph 7.3.6.1.1.

7.5.3 CORROSION RESISTANT AND STAINLESS STEEL

Components fabricated from corrosion resistance and stainless steel shall not be contaminated with iron or mild steel through the use of contaminated grinding discs, wire brushes, scratch marks, steel grit etc.

Conventional slag abrasives often contain up to 35% ferrous and ferric compounds where the resultant iron residues can set up corrosion cells on the surface of stainless steels. The blasting abrasive type shall meet the requirements as specified in ISO 11127 for Non-Metallic abrasives.

Note that platinum slag and garnet may contain iron in the form of ferrous and ferric compounds and should therefore preferably not used.

Permissible abrasives for blasting stainless steel which is to be coated and immersed shall be:
- Aluminium Oxide
- Glass Grit
- Stainless Steel Grit

Care must be taken to ensure that specified surface profile is achieved because stainless steel is harder than mild steel and therefore more difficult to obtain roughness.

7.5.3.1 UN-COATED SURFACES

Stainless steel surfaces shall not be contaminated with carbon steel, scratched or stressed.

The following areas shall be pickled and passivated:

(a) All un-coated areas.

(b) Ground and sheared edges.

(c) Heat affected zones caused by welding or cutting.

It is recommended that, if possible, pickling and passivation be done by the dipping process.

Proprietary pickling and passivation chemicals (as supplied by approved suppliers) shall only be used in accordance with the manufacturer's recommendations. Care shall be taken not to exceed the maximum contact time recommended.

After pickling and passivation, surfaces shall be very thoroughly washed with clean potable water to remove all traces of acid. Surfaces shall be allowed to dry, then polished where necessary, using polishing compounds recommended by the stainless steel manufacturer.

7.5.3.2 SURFACES TO BE COATED

7.5.3.2.1 Degreasing

Surfaces shall be degreased in accordance with paragraph 7.3.3.

7.5.3.2.2 Profile

Corrosion resistant steel surfaces shall be blast-cleaned with stainless steel grit or non-metallic abrasive to create a profile in accordance with table in Section 0 (7.4.1 SURFACE PREPARATION PARAMETERS FOR NEW STEEL).The use of steel shot and steel or cast-iron grit is strictly prohibited. Stainless steel tends to have a harder surface and is more difficult to obtain blast profile. Surface profile shall be a minimum of 30 µm for atmospheric corrosion conditions and 50 µm for immersed corrosion conditions.