

PARTICULAR SPECIFICATION – CORROSION PROTECTION

01 - CORROSION PROTECTION – GENERAL

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PREAMBLE

This Particular Specification deals with general corrosion protection principles and serves as an introduction to the suite of corrosion protection specifications not dealing with cathodic protection.

The following summarises the index and broadly define the contents for the corrosion protection Particular Specifications.

The numbering system for this suite of corrosion specifications follows the following layout:

PA CXX Y

PA – Indicating that this specification is part of the Particular Specifications

C – Indicating that it is a “corrosion” specification.

XX – This shows the number of the specific specification compared to the full suite of corrosion specifications contained in the Particular Specifications.

Y – Shows the paragraph number within the particular specification.

Example:

PA C01 1 – In this case indicates that it is a Particular Specification, from the corrosion suite of specifications and in the example, the first in the series named Corrosion Protection_General, referring to paragraph 01 which is the INTRODUCTION.

PA Spec_01_Corrosion Protection_General

The general requirements for corrosion protection and corrosion protection mechanisms are detailed.

PA Spec_02_Linings and Coatings

This Particular Specification deals with coatings and linings in general, including all types of linings.

Linings and coating are detailed with specific reference to the different coatings and linings applicable to the contract.

Linings listed are

- cement mortar
- epoxy
- Rilsan
- galvanising

Coating listed are

- FBMDPE
- Sintakote
- 3 layer
- Rilsan
- Galvanising
- Epoxy for pipe specials and pipework and specials in chambers

The mixing of twin pack epoxy is detailed.

Coating and Lining repair is addressed.

Technical requirements for coating and lining is stated.

PA Spec_03_Surface Preparation of steel surfaces for coating and lining rehabilitation

Bare Metal Surfaces_Degreasing

Wire Brushing

Sand Blasting

External surface preparation for tape wrapping – Wire Brushing

External surface for epoxy coating – Sand Blasting

Internal surface for epoxy coating – Sand Blasting

Internal surface for cement mortar lining – Wire Brushing

PA Spec_04_Holiday Testing

Holiday testing - general

Before and during Construction

Spark Detection of lining and coatings

On Tape Wrap Systems

On epoxy coating systems

On pipe linings (internal)

On fittings and manufactured specials

Upon completion of Construction

Wet Sponge testing

DCVG testing

PA Spec_05_Application of Tape Wrap systems

Application of tape wrap systems to ensure effective corrosion protection.

1. Rehabilitation of externally welded joints
2. Rehabilitation of shop manufactured segmented bends to be backfilled with bedding
3. Rehabilitation of external pipe coating where a tape wrap application is required
4. Rehabilitation/corrosion protection of bolted connections

PA Spec_06_Corrosion Protection of buried joints, couplings and flanges

This Particular Specification deals with corrosion protection of buried flanges, bolted connections, couplings, joints, fittings and adaptors. These components need to be protected from corrosion and special requirements are applicable if buried.

Mastics and rock shields are detailed.

PA Spec_07_Transition Zone Repairs

This Particular Specification deals with transition zones and the complications of ensuring a continuous corrosion protection mechanism over these zones.

PA Spec_08_ Internal Lining and External Coating repair on pipe

This Particular Specification deals with the repair of internal linings and external coatings where such linings and coatings have been damaged as a result of construction or manufacturing processes and activities.

Internal lining repair
Cement Mortar Lining
Epoxy Lining

External coating repair
Epoxy
Sintakote/3 layer/MDPE

PA Spec_09_Pipe Specials_Lining and Coating Repair

This Particular Specification deals with the repair of internal linings and external coatings on pipe specials where such linings and coatings have been damaged as a result of construction or manufacturing processes and activities.

Segmented Bends
Internal
External

Tie piece and Y branch specials

Air collector pipes

PA Spec_10_Cathodic Protection_Project Specific

Cathodic Protection_Project Specific

PA Spec_11_Free issue pipe material_Management of coating and lining defects

This Particular Specification deals with managing coating and lining defects in free issue pipe materials.

At pipe yards

At work fronts

PA C01 1 INTRODUCTION

The tendered rates for the laying of pipe, effecting of butt, fillet and collar welds of pipe joints, the manufacturing of pipe specials and the fitment of all fittings to the pipe line system, or any activity during the construction process which could damage corrosion protection coatings and linings, or activities which result in the bare pipe surfaces to be included into the permanent Works, are deemed to include for all the corrosion protection mechanisms required to reinstate the pipe work with a fully functional corrosion protection coating and lining, outside and inside.

Holiday detection is specified for the coatings and linings at different phases of the work in order to ensure that the pipeline is laid and commissioned without any holidays in its external coating or internal lining.












A control test will be done on the pipeline, once constructed, in order to verify that the pipeline coating is holiday free.

No section of pipe, pipe special, pipeline component and or fittings and equipment shall be allowed to be introduced into the pipeline without effective corrosion protection mechanisms.

The corrosion protection suite of particular specifications deal with the different aspects of corrosion protection and corrosion mechanisms to repair damaged systems/mechanisms and in the case of cathodic protection, to continuously protect constructed pipelines.

Various specific products are specified with a caveat of “similar approved”. Similar approved means that approval of a product needs to be sought well in advance and rejection of the request, on technical basis does not entitle a contractor to dispute declaration. Rates applied to items where “similar approved” is an option implies that the tendered rates will be applicable, regardless of whether the item is “approved” or not.

PA C01 2 INDEX FOR SUITE OF CORROSION PROTECTION PARTICULAR SPECIFICATIONS

-  PA Spec_01_Corrosion Protection _ General
-  PA Spec_02_Linings and Coatings
-  PA Spec_03_Surface Preparation of steel surfaces for coating and lining rehabilitation
-  PA Spec_04_Holiday Testing
-  PA Spec_05_Tape Wrap Systems application
-  PA Spec_06_Corrosion Protection of buried joints and couplings
-  PA Spec_07_Transition Zone repairs
-  PA Spec_08_Internal Lining and External Coating repair for pipelines
-  PA Spec_09_Pipe Specials_Lining and Coating Repair
-  PA Spec_10_Cathodic Protection_Project Specific
-  PA_Spec_11_Free issue pipe material_Management of coating and lining defects

PA C01 3 DEFINITIONS APPLICABLE TO THE CORROSION PROTECTION SUITE OF DOCUMENTS

The following terminology and descriptions are utilised in the corrosion protection suite of particular specifications:

“corrosion protection” collectively refers to protection of steel surfaces from corrosion.

“corrosion protection mechanisms” collectively refers to any action taken, application made or equipment fitted to assist with corrosion protection for example a tape wrap fitted on a welded joint, a lining fitted to the inside of a pipe, a repair done on a pipe coating that was damaged, etc.

“cathodic protection” is a mechanism used for corrosion protection but specifically deploying the science of cathodic protection to curb corrosion on constructed pipelines.

“DCVG testing” and “PCM testing” refers to the methods of testing for holidays in pipe coatings after the pipe has been laid and backfilled. DCVG testing is normally specified.

PA C01 4 RATE OF INTERNAL JOINT REINSTATEMENT

The Contractor shall ensure that internal joints are reinstated and rehabilitated soonest and under no circumstances shall internal joint reinstatement lag behind the pipe laying front by more than 100 metres. (This distance may be further restricted in the project specifications)

Should the Engineer, at any stage, note that the mentioned reinstatement rate is lagging behind the specified rate, work will be stopped at that specific front until the internal reinstatement has been completed to satisfaction, in order to comply with the required progress rate.

PA C01 5 QUALITY CONTROL

The Contractor shall make provision in his Quality Control Plan, for the necessary hold points for inspection of each and every repair to internal and external lining or coating effected to pipe surfaces as a result of damage, manufacturing, fitting of specials or any other process which could inflict damage to linings and coatings.

The tendered rates for pipe laying shall be deemed to include for all eventualities regarding the Quality Control Plan.

PARTICULAR SPECIFICATION – CORROSION PROTECTION

02 – LININGS AND COATINGS

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PREAMBLE

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- epoxy
- Rilsan
- galvanising

Coating listed are

- FBMDPE
- Sintakote
- 3 layer
- Rilsan
- Galvanising
- Epoxy for pipe sections and pipe specials located in chambers

The mixing of twin pack epoxy is detailed.

Coating and Lining repair is addressed.

Technical requirements for coating and lining is stated.

PA C02 1 THE TYPES OF LININGS AND COATINGS

This specification deals with the following linings:

Cement mortar
Epoxy (Solvent free)
Rilsan
Galvanising

The following coatings are being dealt with:

FBMDPE
Sintakote
3 layer
Rilsan
Galvanising
Epoxy for pipe and pipe specials located in chambers

PA C02 2 ACCESS TO THE INSIDE OF A LINED PIPE (LARGE DIAMETER PIPE)

In order to avoid damage to the pipe lining occurring as a result of construction activities, all possible care shall be exercised during construction. The following procedures are required:

- Wet sacking or rubber matting shall be placed on the pipe invert at areas where welding or flame cutting operations are in progress to prevent damage to coating from weld spatter or molten metal. This requirement shall be strictly enforced.
- Foam shall be provided for the placing of tools etc on the internal pipe surface.
- Soft-soled shoes shall be worn by all personnel working inside the pipe.

PA C02 3 INSPECTION OF PIPE WITH SMALL DIAMETERS

All pipe sections with a diameter too small to allow internal access for inspection by the Engineer upon completion of lining shall be required to be video graphed for inspection. The rates for the laying of the pipe and manufacturing of pipe specials shall be deemed to include for all the video footage required for complete internal inspections.

PA C02 4 REPAIRS TO COATINGS AND LININGS

PA C02 4.1 EXTERNAL REPAIRS – FBMDPE/3 LAYER COATING/SINTAKOTE

Detection of defects in coating is to be done by holiday testing or visible assessment.

Surface Preparation of steel surfaces shall be in accordance to specification PA C03.

Cleaning of Area to be Repaired shall be in accordance to specification PA C03.

Where the repair area is less than 400 mm², the application of a hot spatula shall be used to repair the defect, provided there is a residual layer of polyethylene still adhering strongly to the steel surface. If inadequate virgin material is available to complete the hotwork patch repair with an adequate thickness, virgin material shall be required from an external; source.

The length of a repair shall not exceed the nominal pipe diameter in the circumferential direction, nor twice the nominal pipe diameter in the longitudinal direction.

Where the repair is larger than 400mm² it will be required to melt virgin coating material into the damaged area after which a tape wrap shall be applied over the repaired area.

All patched areas shall be wrapped after effecting of repair.

Joint repairs (including bends) on pipes that are to be buried shall be wrapped before backfilling.

Scour and air valve tees and crotch plates

Scour and air valve tees and crotch plates that are to be buried shall be protected in accordance with the requirements of the particular corrosion specification.

PA C02 5 EXTERNAL REPAIRS TO EPOXY COATINGS

Defects in epoxy are to be located by holiday testing, alternatively shall by isolated through visual inspection.

Where epoxy of exposed pipe in chambers need to be repaired, the required epoxy repair kit will be utilised to effect repair.

The requirements of epoxy repair and the preparation of the repair area shall conform to the requirements for internal repairs of epoxy lined pipes.

PA C02 5.1 INTERNAL REPAIRS – EPOXY LINED PIPES

Defects in epoxy coating detected by holiday testing if not visually presented.

Refer to section discussion of epoxy repairs

PA C02 5.2 INTERNAL REPAIRS – CEMENT MORTAR LINED PIPES

Surface Preparation of bare steel to be in terms of PA C04.

Refer to section on cement mortar linings.

PA C02 6 THERMOPLASTIC POWDER COATING AND LINING

Where a thermoplastic powder coating and lining is to be used the coating shall be similar and approved of by the Engineer to “Plascoat PPA 571 Aqua”. The requirements for the “Plascoat PPA 571 Aqua” thermoplastic powder coating system are identical to the requirements for the thermoplastic powder lining system.

The preferred means of application of the coating and lining is by either Electrostatic Spray (ES) or Fluidised Bed Coating (FB) and Flame Spraying (FLS) to be used for field repairs.

Where pipe specials fitted with flanges are to be coated with “Plascoat PPA 571 Aqua” special methods shall be utilized to ensure that “Plascoat PPA 571 Aqua” is not applied to the flange face. Under no circumstances shall scraping or grinding of “Plascoat PPA 571 Aqua” on flange faces be allowed.

PA C02 7 RILSAN COATING AND LINING

Rilsan or similar approved fusion bonded powder products shall be applied to a minimum DFT of 300 micrometres, on prepared surfaces, where specified. The surface preparation of the substrate, the application and curing of the product shall be in terms of the supplier's specifications and recommendations.

All steel pipes of nominal bore up to and including DN300, to be used for the manufacture of pipe specials and fittings, shall be coated and lined with Rilsan or similar approved. In special cases a galvanised coating might be specified.

Where pipe specials fitted with flanges are to be coated with Rilsan, special methods shall be utilized to ensure that Rilsan is not applied to the flange face. Under no circumstances shall scraping or grinding of Rilsan on flange faces be allowed.

Repair work to Rilsan coated pipes and pipe specials shall be limited to the absolute minimum. Should Rilsan be affected by welding which in turn requires repairs to be effected, the Rilsan shall be removed by grinding up to a point where the Rilsan coating is sound and adheres to the pipe material without traces of disbonding, spalling or flaking. The 25mm edge of Rilsan, onto which repair epoxy is to be applied, will be abraded with 80 or 100 grit emery paper to ensure adhesion of repair epoxy in the area. The bare metal, where repair epoxy has to be applied shall be grit blasted to render a surface finish of St2 before the application of the epoxy. Feathering from bare metal to sound Rilsan shall be done.

The requirements for the "Rilsan" or similar approved fusion bonded powder system are identical to the requirements for the "Rilsan" lining system.

Damaged epoxy/Rilsan as a result of heat transfer shall be removed by means of mechanical wire brushing.

Bare metal surfaces shall be prepared as specified.

Once surface preparation has been completed, an EPOXY repair kit shall be applied to the pipe as per specification. (NORDBAK 1 or similar approved)

Once the flanged joint is completed, it shall be protected as required .

PA C02 8 PROTECTIVE UV COATING AND COATING OF PERMANENTLY EXPOSED PIPE

All pipes and specials coated which are to be permanently exposed or above ground shall be over-coated with three or more coats of "Carboline, Carbothane 134 Clear Coat" or similar approved light coloured UV protection acrylic polyurethane resistant coating to a total minimum dry film thickness of 300 microns for UV protection. The pipe surface shall be prepared and the coating applied in strict accordance with the manufactures instructions or shall be protected with the "Denso Acrylic Pipeline Tape (Steelcoat 500)" system or similar approved UV Resistant coating.

PA C02 9 GALVANISING

In certain instances galvanising might be specified as a coating and or lining. Galvanised coatings and linings shall under all circumstances consist of application through hot dipped processes.

Galvanised coatings and lining for pipe work may not be damaged as no repair to galvanised coatings and linings will be allowed.

PA C02 10 EPOXIES INCLUDING TWIN PACK EPOXIES

Only solvent free Epoxy repair kits shall be utilized to repair the internal linings of pipe lines.

Two part Epoxy as an epoxy repair kit which consists of any epoxy repair kit made up of a base and an activator approved by the Engineer, could be products similar to DENSO ST100, SIGMA SF 523, NORDBAK, etc. The Contractor's attention is drawn to the fact that the Employer might have specific preferences in this regard and that specific kits might be specified. For the repair of cement mortar linings, Epidermix 338 or similar approved will be required.

The Contractor's tendered rates for the laying of the pipe shall be deemed to include for all the Two Part Epoxy repairs that have to be applied in order to deliver a serviceable and acceptable pipe line. (This costing arrangement excludes such repairs as instructed by the Engineer as a result of manufacturing defects)

The requirements for a solvent free epoxy coating system are identical to the requirements for a solvent free epoxy lining system.

Pipes and fitting to be externally coated and internally lined with a two component cross linked epoxy shall comply with the requirements of SANS 1217.

The cure rate of liquid epoxy coating is very dependent on temperature with the rate of cure being very slow below 10°C and the reaction generally ceasing below 5°C. Contractors tendering for this type of coating are therefore expected to have a heated shop or warm air blowers with suitable heat insulating tunnels to enable the temperature of the coating to be maintained at not less than 15°C from the time of application until full cure has taken place where applicable, for example shop manufactured specials. Adverse weather conditions will not be accepted as a reason for delay in the programme or for solvent retention in multi-coat solvent borne systems.

Application of liquid epoxy coating inside a constructed pipe is applicable to internal joint rehabilitation after welding of an epoxy lined pipe. The Contractor shall ensure that he can maintain the optimum required conditions inside the pipe when epoxy is applied in order to ensure proper curing of the epoxy.

Application shall be by means of two component hot airless equipment or by single component airless equipment, as appropriate and as recommended by the material manufacturer. The coating shall be applied in a uniform manner and, when cured, shall comply with all the appropriate requirements of the specification.

In the application of the epoxy the following shall be strictly in compliance with the manufacturer's instructions:

- a) Method of application (Type of Brush or roller.)
- b) Over coating time.
- c) Temperature range for application.
- d) Method of mixing base and activator.
- e) Number of coats to achieve the specified thickness.
- f) Safety aspects e.g. Eye and hand protection, ventilation, fire precautions, etc.
- g) Note that roller and brush applicators shall be replaced once the product application expiry time has been reached on any specific applicator tool.

The specified thickness shall be achieved in one application for solvent free epoxies. In the event of the thickness being less than the minimum specified the coating shall be removed and the pipe length shall be re-blasted and re-coated to comply with the specification.

The Contractor's tendered rates for the laying of the pipe and fabrication of specials shall be deemed to include for all the Two Part Epoxy repair systems that have to be applied in order to deliver a serviceable and acceptable pipe line.

PA C02 10.1 MIXING OF TWO PART (TWIN PACK) EPOXY

The two components shall be thoroughly and completely mixed in the proportions specified by the manufacturer, according to his specifications.

Mixing in the original container will only be permitted by means of methods that ensure full integration of different parts of the compound into a homogeneous compound with the characteristics as intended by the manufacturer.

The different parts of the compound shall not be diluted.

Mixing shall only be allowed with full batches and reduction of volumes from mixing packs by means of weight or volume measurement, which will result in smaller portions to be mixed, will not be allowed.

The Contractor shall ensure that the correct paddle is utilised for mixing. Utilisation of off cut lengths of re bar will not be allowed, neither will pieces of wood picked up from the scrap heaps be allowed,

The Contractor shall ensure that the bottom corners of containers containing the materials are well scraped in order to ensure total removal of the decanted part and total mixing of the two parts in containers.

PA C02 10.2 THICKNESS OF EPOXY LAYER

The thickness of lining and coating for pipes and pipe specials for fusion bonded lining and coatings shall be a minimum of 300 microns DFT. No deviation from this will be allowed at any location.

The thickness of lining and coating for pipes and pipe specials for solvent free epoxy lining and coatings shall be a minimum of 300 microns DFT.

PA C02 10.3 SUPRFACE PREPARATION BEFORE EPOXY APPLICATION

Two part Epoxy repair kits shall only be applied on prepared steel surfaces in terms of the Particular Specification for surface preparation of steel surfaces for coating and lining rehabilitation.

Transition areas from Epoxy internal lining, to bare metal which have been grit blasted, shall be smooth without rough edges or flaking appearances.

PA C02 10.4 EPOXY REPAIRS

At each pinhole detected by the holiday test, the surrounding area shall be abraded to 25 mm beyond the defective area. It is noted that any cluster of pinholes within a radius of 25 mm shall be regarded as one defect. The abrasion shall be carried out with clean emery paper of 80 to 100 mesh so as to provide a suitably rough surface profile without causing the removal of excessive amounts of coating material.

The damaged and abraded area shall be covered with the approved epoxy repair kit to the specified thickness.

All damaged and blistered epoxy lining shall be removed back to sound epoxy by mechanical grinding or other approved means.

The roughened area of lining and the defect shall be repaired by the application of a solvent free epoxy repair material (such as "Copon Hycote 151", "Arc 982", "Arc 855", or similar approved) to a minimum dry thickness of 300 microns.

A "halo" of 1 to 2 mm of the abraded material shall be left uncovered around the repair.

The patch material shall be of a different colour to the pipe lining material.

In the application of the epoxy the following shall be strictly in compliance with the manufacturer's instructions:

- Method of application (type of brush or roller.)
- Over coating time
- Temperature range for application
- Mix proportions of activator to base. This shall be strictly enforced, and splitting of manufacturer-supplied packs shall be allowed only if subsequent bending is carried out strictly by mass to the correct proportions.
- Method of mixing base and activator.
- Number of coats to achieve the specified thickness.
- Safety aspects eg: eye and hand protection, ventilation, fire precautions, etc.

After the repair has been adequately cured, the repair and the surrounding 250 mm of epoxy lining shall be tested for electrical insulation defects. No defects will be permitted.

The repair of EPOXY internal linings on manufactured pipe specials, welded joints where a flange has been welded to the pipe, crotch plates, collar plates, or where pipe specials have been welded to the pipe, the internal lining shall be repaired by means described above and with the relevant two part EPOXY repair kit, according to the manufacturer's specification, after suitable surface preparation of the steel surface in terms of the specification.

PA C02 10.4.1 REPAIR OF EPOXY LININGS (SMALL AREAS)

A small area repair will be represented by a defect up to 100mm² in area.

At each pinhole detected by the Wet Sponge test, the surrounding area shall be abraded to 25mm beyond the defective area. It is to be noted that any cluster of pinholes within a radius of 25mm shall be regarded as one defect. The abrasion shall be carried out with clean emery paper of 80 to 100 mesh so as to provide a suitably rough surface profile without causing the removal of excessive amounts of lining material. Feathering of sound lining material shall be done from bare metal to full thickness epoxy.

All damaged and blistered epoxy lining shall be removed back to sound epoxy by mechanical grinding.

Exposed steel surfaces shall be prepared as required in the specifications.

The roughened area of lining and the defect shall then be repaired by the application of a solvent free epoxy repair kit as detailed in this specification (for example NORDBAK 1 or similar approved) to a minimum dry film thickness of 300 micrometres. The repair area shall be masked in order to limit the area of repair and to allow for a "halo" of not less than 5mm of the abraded material to be left uncovered around the repair.

Application of the repair epoxy material shall be by means of spatula or brush application.

The patch material shall be of a different colour to the pipe lining material.

After the repair has been adequately cured, the repair and the surrounding 250mm of epoxy lining shall be tested for electrical insulation defects by means of the "wet sponge" detector set at 90 Volts.

Any pinhole defects found are to be repaired in terms of the specification.

Any burning effect noticed visually on the lining, but which have not been tested

positively for holidays, shall be repaired in terms of this specification.

Once an internal lining has been repaired, nobody will be allowed to enter the pipe, except for cleaning purposes and the final inspection by the Engineer.

PA C02 10.4.2 REPAIR OF EPOXY LININGS (LARGE AREAS)

Application of the repair kit shall be by means of roller application or air blast equipment as previously described.

Repair to large areas of damaged Epoxy linings or areas of Epoxy which has to be reinstated at joints where Epoxy was removed in order to facilitate jointing by welding, shall follow the following the same procedure as for small repairs with the exception that the repair area shall not be masked.

The exposed steel surface shall be degreased in terms of the specification.

The exposed steel surface shall be grit blasted in terms of the specification.

All damaged and blistered epoxy lining shall be removed back to sound epoxy by mechanical grinding.

The surrounding area of sound epoxy shall be abraded to 25mm beyond the defective area and shall be feathered back.

The abraded area of lining and the defect shall be repaired by the application of a solvent free epoxy repair epoxy (such as NORDBAK 1 or similar approved) to a minimum dry film thickness of 300 micrometres.

After the repair has been adequately cured, the repair and the surrounding 250mm of epoxy lining shall be tested for electrical insulation defects by means of the "wet sponge" detector set at 90 Volts.

All pinhole defects found are to be repaired.

Once an internal lining has been repaired, nobody will be allowed to enter the pipe, except for cleaning purposes and for inspections required by the Engineer.

PA C02 10.4.3 REPAIR TO EPOXY INTERNAL LINING ON MANUFACTURED PIPE SPECIALS (NOT SEGMENTED BENDS)

The repair of Epoxy internal linings on manufactured pipe specials shall be in terms of this specification by means of the relevant Epoxy repair kit, after suitable surface preparation of the steel surface has been undertaken.

The cost of the reinstatement shall be deemed to be included in the rates for the manufacturing, laying, bedding and jointing of the shop fabricated specials

PA C02 11 CEMENT MORTAR LINING (CML)

PA C02 11.1 CML – GENERAL

Cement mortar linings are either repaired with an Epidermix type or similar approved to the same thickness of the CML or it is replaced with an epoxy lining in total, in which case attention is to paid to the transition zone repair.

Cement mortar linings in pipelines are normally delivered as per manufacturers specifications for the pipe with CML lining.

As a result of handling and storage, CML can crack and deteriorate.

Damage to CML lining is a regular occurrence, although it is not supposed to take place. CML lining also get damaged or removed as a result of the manufacturing of pipe specials.

CML lining repair is required where such lining should be in place but have spalled, broken, deteriorated, etc.

PA C02 11.2 MAKING GOOD OF CML AT WELDED JOINT

Where the steel pipe is supplied with cement mortar lining cut back 50mm from each end, this entire void shall be filled with Epidermix 338 (or similar approved) and rendered smooth and flush with the surrounding lining as described below when internal lining is repaired.

Where the spigot and socket steel pipe is supplied with cement mortar lining flush with the plain end of the pipe, the pipe is to be joined with a minimum of 5mm and a maximum of 10mm gap (for pipe DN500mm and larger) in the cement mortar linings which shall be filled with Epidermix 338 (or similar approved) and rendered smooth and flush with the surrounding lining as described below.

Where small diameter plain ended pipe has to be joined (access for rehabilitation not possible) by means of butt welding a collar shall be welded onto the one pipe to allow for spigot and socket type fitment. The requirements for spigot and socket CML lining repair then applies.

Once the spigot has been inserted into the socket and the pipes have been welded into position, the excess epoxy (Epidermix 338) shall be smoothed off with pig being pulled through the pipe where the pig is 5mm smaller than the internal diameter of the pipe.

Where access into the pipe for joint rehabilitation is possible, the Epidermix or similar approved material shall be applied with spatula and smoothed off to match surrounding CML thicknesses.

Bare metal surfaces shall be prepared as specified.

The internal surface of the bellmouth is to be power or hand wire brushed from the pipe end to the cement mortar lining to remove dirt, scale, rust and other foreign matter. An Epidermix 338 sausage shall be applied in the beel after surface preparation.

The plain end of the adjoining pipe shall be pushed into the bellmouth in such a way that the Epidermix band is compressed and makes contact with the transverse face of the concrete lining of both pipes. The excess lining material which is squeezed into the pipe shall be removed by drawing a plug which is 5 mm smaller in diameter than the bore of the pipe, across the joint. The plug shall be so shaped as to apply a smooth even surface to the lining material at the joint.

When fabricating steel specials (e.g. gusseted bends, tees, etc.), any cement mortar lining which de bonds or spalls from the internal steel surface shall be removed back to sound mortar and made good with "Epidermix 338", or similar approved, neatly formed to meet the adjacent cement mortar.

For accessible pipes larger than DN700 the joint shall then be made good with "Epidermix 338" or similar approved, neatly formed to meet the adjacent cement mortar.

If cement mortar lined pipe of small diameters are supplied with plain ended conditions, the jointing shall be effected by means of a collar welded to one end of the pipe in order to simulate the spigot and socket condition. Repair of the CML shall be similar to that used when spigot and socket pipes are welded and CML repaired.

PA C02 11.3 MAKING GOOD OF CML IN STRAIGHT PIPE WHERE LINING IS DAMAGED (NOT AS RESULT OF WELDING AT JOINTS OR SPECIAL MANUFACTURING)

The damage to be repaired can be either a crack or a large spalled area with a resultant effect similar to CML removal and repair at a welded joint. (large area). The repair method should follow the methodology specified in this specification for either crack repair or CML reinstatement for shop manufactured pipe specials.

Damaged CML in small diameter pipe which does not allow access into the pipe will result in the pipe being rejected.

PA C02 11.4 REPAIR PROCEDURE FOR CRACKS IN CML

The crack shall be ground out using a mechanical grinder down to the steel wall to form a “dove-tail” groove with a minimum width of 8 mm. The groove shall be filled with Epidermix 338 (or equal approved), mixed and applied in accordance with the manufacturers specifications.

PA C02 11.5 REINSTATEMENT OF CML IN SHOP FABRICATED SPECIALS

Where shop fabricated specials are manufactured from cement mortar lined steel pipe, the mortar lining shall be reinstated after fabrication of the special.

In order to manufacture the pipe special, the CML will be chipped away to allow for welding and grinding.

Depending on the size and shape of area of CML to be reinstated, the CML needs to be re instated to similar thickness of existing CML, alternatively transition zone repair is required. (repair with epoxy that joins with CML)

Any cement mortar lining which disbonds or spalls, or shows signs of hairline cracks in the vicinity of the repair area, shall be removed by approved means.

Bare steel is to be prepared as required, for either an epoxy repair or a CML/Epidermix repair.

Any transition zones where cement mortar lining joins Epoxy lining shall be treated in a manner specified under “TRANSITION ZONE REPAIR”.

The cost of the reinstatement shall be deemed to be included in the rates for the manufacturing, laying, bedding and jointing of the shop fabricated specials.

In general, a typical segmented bend fabricated from a CML pipe will see all the CML removed internally and reinstatement of internal lining shall be with an epoxy liner.

PA C02 12 MAKING GOOD OF FIELD WELDED JOINTS, REPAIRS AND PUDDLE FLANGES

This specification is based on “Denso” products. Alternative products may be accepted at the discretion of the Employer’s Representative. Once welding is complete and all weld splatter and burnt coatings have been removed, all welded pipe joints shall be prepared and wrapped in the following manner:

Surface Preparation

The bare metal shall be cleaned and wire brushed to St.2 standard and, if necessary, degreased with white spirit. The adjacent coating shall be cleaned to a minimum of 300mm either side of the joint.

Primer

The pipe barrel at the joint shall be degreased with white spirit and primed with “Denso Primer D” (or equal approved) extending 200mm onto sound coating. The primer shall cure for 30 minutes prior to the application of a tape system.

Profiling Tape

Apply 1,0mm x 75mm wide “Ultraflex sealing tape (yellow)” to the full circumference of the weld bead and steel interfaces. Care shall be taken to ensure a smooth profile and to avoid air bubbles being trapped beneath the tape. The tape shall not be stretched.

Tape System

Tape joint shall be wrapped with “Denso Ultraflex 1250/300 (Blue)” (or equal approved) (55% overlap) extending 150mm onto sound coating. Even tension shall be applied throughout the wrapping procedure and care shall be taken to prevent air bubbles from being trapped beneath the tape, regardless of profile being wrapped.

Repairs

Damaged pipe coating shall be repaired in the same manner with the repair extending at least 150mm either side beyond the edge of the damaged coating. “Spot” tape repairs will not be acceptable. Damage caused by the Contractor shall be repaired at the Contractor’s expense. Damage caused prior to the Contractor accepting responsibility for the pipes shall be repaired under this contract.

Puddle Pipes

All puddle pipes shall be primed and wrapped in accordance with the above procedure. The wrapping shall extend from (but shall not include) the puddle flange to 150mm beyond the concrete surface.

Hot- Dip Galvanizing

Hot-dipped galvanizing shall be done in accordance with the requirements of SANS 763 – 1977, as amended. On site fabrication processes such as welding, drilling, threading, etc. are to be avoided. All hot-dipped galvanized items shall be passivated immediately after hot dipping.

PA C02 12.1 EXTERNAL COATINGS – FBMDPE/SINTAKOTE/3 LAYER

PA C02 12.1.1 REPAIR OF FBMDPE/3 LAYER COATING/SINTAKOTE (LARGE AREAS)

A large area repair is defined as an area larger than 400mm².

All damaged and blistered FBMDPE/3 layer coating caused by welding or other mechanical means shall be removed back to sound coating by mechanical grinding or other approved means.

The exposed steel surface shall be power wire brushed to remove dirt, scale, rust and other foreign matter to a surface profile equivalent to a Class St 2 finish. Weld spatter shall be removed by chipping or grinding to a smooth surface flush with the surrounding steel. Welds shall have a smooth contour free from sharp edges, protrusions and undercut. Sharp edges and protrusions shall be removed by grinding to a smooth radius of curvature of not less than 3mm. Degreasing of the exposed steel surface shall be done.

The surrounding sound FBMDPE/3 layer surface shall be feathered from steel surface to maximum thickness and then abraded to a distance of 100mm beyond the defective area. The abrasion shall be carried out with clean emery paper of 80 to 100 mesh so as to produce a suitably rough surface profile without causing the removal of excessive amounts of protective material.

Virgin Sintakote powder is to be melted into the defect to ensure proper mechanical bonding with the steel surface and chemical bonding with the existing Sintakote. The melting of the virgin material shall be such that melting is not effected with an open flame. The melted powder shall be shaped with a hot spatula to form a smooth surface over the repair area.

Under no circumstances will patching of damaged areas by means of pieces of tape wrap, be allowed.

PA C02 12.1.2 REPAIR OF FBMDPE/3 LAYER COATING/SINTAKOTE (SMALL AREAS)

A small area repair is defined as an area less than 400mm².

A small area repair is effected by means of the application of a hot spatula to repair the defect, provided that there is a residual layer of polyethylene adhering strongly to the steel surface. Alternatively, virgin pipe coating powder material may be melted with heated spatula over the damaged area, to fill the mechanical damages in the coating and fuse with the surrounding coating material, all as per the manufacturer's recommendations.

At each pinhole detected by the Holiday test, the surrounding area shall be abraded to 25mm beyond the defective area. The abrasion shall be carried out with clean emery paper of 80 to 100 mesh so as to provide a suitably rough surface profile without causing the removal of excessive amounts of coating material. A hot spatula shall be utilized to work pipe coating material into the pinhole defects.

It is noted that any cluster of pinholes within a radius of 25mm shall be regarded as one defect.

PA C02 12.1.3 REPAIR TO FBMDPE/3 LAYER COATING/SINTAKOTE ON MANUFACTURED PIPE SPECIALS (NOT SEGMENTED BENDS)

The repair to FBMDPE/3 Layer coating or Sintakote on the outside of manufactured pipe specials shall either be by means of external tape wrap in accordance with the tape wrapping specification or by fusing virgin pipe coating material to the damaged areas or by means of the application of an approved Epoxy repair kit.

The cost of the reinstatement shall be deemed to be included in the rates for the manufacturing, laying, bedding and jointing of the shop fabricated specials

The surface preparation of the steel surfaces before repair shall be in accordance with the requirements of the contract specification.

PA C02 13 COATING OF PERMANENTLY EXPOSED PIPE

All pipe which is to be permanently exposed shall, in addition to corrosion protection at joints, be protected with the "Denso Acrylic Pipeline Tape (Steelcoat 500)" system or similar approved UV Resistant coating. The pipe surface shall be prepared and the coating applied in strict accordance with the manufacturer's instructions.

PA C02 14 COATING AND LINING THICKNESS

The following table lists the materials and corrosion protection system to be applied to various components of a pipeline system:

Environment	Material	Corrosion Protection System	Min DFT (µm)
Pipe specials * ≤ DN500 or ≤1500mm long	Mild Steel Grade X42, X52 and X65	Coating: Plascoat PPA 571 Aqua or similar approved Lining: Plascoat PPA 571 Aqua or similar approved	300
Pipe specials * ≤ DN500 or >1500mm long	Mild Steel Grade X42, X52 and X65	Coating: Two Pack Epoxy Lining: Two Pack Epoxy	500 **

Environment	Material	Corrosion Protection System	Min DFT (µm)
Pipe specials * > DN500 or <=1000 mm long	Mild Steel Grade X42, X52 and X65	Coating: Two Pack Epoxy Lining: Two Pack Epoxy	500 **
Pipe specials * > DN500 or >1500mm long	Mild Steel Grade X42, X52 and X65	Coating: Two Pack Epoxy Lining: Two Pack Epoxy	500 **
Valves and Water Meters	Manufacturers Standard	Fusion Bonded Epoxy (FBE)	Manufacturers standard
Flange adaptors and couplings	Low Carbon Steel	FBE or Two Pack Epoxy	Manufacturers standard
Weld on flanges	Mild Steel	Two Pack Epoxy (excluding flange face)	500 **
Nuts, bolts and washers Anchor bolts	Mild Steel	Hot dipped galvanised carbon steel to SANS 1461	65
Buried Bolted connections and couplings		Petrolatum tape wrapping (Denso or similar approved)	N/A

(*) Pipe specials include internal lining rehabilitation of welded joints with two pack epoxy lining repair kits.

(**) Overcoat time to be according to manufacturers specification with particular care to be taken to ensure that under coats dryness is adequate to ensure that final curing is not hampered as a result of overcoat application.

PA C02 15 REQUIREMENTS FOR COATINGS AND LININGS

PA C02 15.1 REQUIREMENTS FOR SOLVENT FREE EPOXY LININGS AND COATINGS

Performance Criteria

Applied coatings and linings shall comply with all the requirements given in Table 1 below:

Table 1: Requirements of Solvent Free Epoxy

TEST	PROPERTY	REQUIREMENT	TEST METHOD
1	Visual	Smooth glossy or semi glossy finish, free from excessive runs, sags, orange peel, occlusions or other visible defects.	Use an experienced observer.
2	Coating Thickness	See table under section 14 above.	SANS Method 141. Take a minimum of 2 readings per m ² of surface up to 300mm nominal bore, or 1 per m ² over 300mm nominal bore.
3	Electrical Insulation Defects	<u>Solvent-free</u> : Nil defects at 90 Volts, 10 Mega-ohm.	SANS 1217, Section 8.12.1
4	Impact Resistance	No defect at 1 Joules	SANS 1217, Section 8.7 but modified as given in Note 1.

5a	Degree of cure: Static Test	No softening or discolouration when fully cured.	SANS 1217, Section 8.9. Cure time shall be in accordance with the manufacturer's data.
5b	Dynamic Test	No softening or discolouration when fully cured.	50 Double rubs with cotton wool swab soaked in MEK. Cure time shall be in accordance with the manufacturer's data.
6	Adhesion (Hot water soak)	Not more than 15mm disbonding from point of V.	Immerse in water at 75°C for 48 hrs. Make V cut at 30° angle. Test adhesion when panel has cooled to 25°C.
7	Cathodic Disbonding	Total disbonded area not to exceed 40mm diameter after 30 days. Current flow not to exceed 5mA.	ASTM G8 Method B - Magnesium Anode - 20°C - 7mm holiday.
8	Cathodic Disbonding (Accelerated)	Total disbonded area (including holiday) not to exceed 20mm diameter.	Impressed current - 3,5 volts potential at 75°C for 48 hrs. 3mm artificial holiday.

NOTE 1: Impact resistance shall be carried out on a sample of production pipe firmly clamped and choked (to be rebound free) to a rigid base. No electrical insulation defects shall be detected at the point of impact when tested at 1 Joule.

PA C02 15.2 REQUIREMENTS FOR FUSION BONDED AND THERMOPLASTIC POWDER LININGS AND COATINGS

Performance Criteria

Applied coatings and linings shall comply with all the requirements given in Table 2 below:

Table 2: Requirements of Fusion Bonded and Thermoplastic Powered

TEST	PROPERTY	REQUIREMENT	TEST METHOD
1	Visual	Smooth glossy or semi-glossy finish, free from excessive runs, sags, orange peel, occlusions or other visible defects	Use an experienced observer.
2	Coating Thickness	See table under section 14 above.	SANS Method 141. Take a minimum of 2 readings per m ² of surface up to 300mm nominal bore, or 1 per m ² over 300mm nominal bore.
3	Electrical Insulation Defects	Nil defects at 3 500 volts. For conditions for repair see Clause 3.9.2.3	SANS 1217, Section 8.12.2
4	Impact Resistance	No defect at 2 Joules	SANS 1217, Section 8.7 but modified as given in Note 2.
5a 5b	Degree of cure: a) Static Test b) Dynamic test c) Thermal characteristics	No softening or discolouration when fully cured. No softening or discolouration when fully cured. Chemical conversion shall be not less than 90%	SANS 1217, Section 8.9. Cure time shall be in accordance with the manufacturer's data. 50 Double rubs with cotton wool swab soaked in MEK. Cure time shall be in accordance with the manufacturer's data.
6	Adhesion (Hot water soak)	Not more than 5mm disbonding from point of V.	Immerse in water at 75°C for 48 hrs. Make V cut at 30° angle. Test adhesion when panel has cooled to 25°C.
7	Cathodic Disbonding	Total disbonded area not to exceed 40mm diameter after 30 days. Current flow not to exceed 5mA.	ASTM G8 Method B - Magnesium Anode - 20°C - 7mm holiday.

8	Cathodic Disbonding (Accelerated)	Total disbonded area (including holiday) not to exceed 10mm diameter.	Impressed current - 3,5 volts potential at 75°C for 48 hrs. 3mm artificial holiday.
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NOTE 2: Impact resistance shall be carried out on a production pipe. The inside of the pipe shall be supported by a wooden block fitted vertically across the internal pipe diameter and chocked so as to fit tightly and immediately beneath the point of impact. Damage to the coating shall be assessed by measuring electrical insulation defects at the point of impact. No defect is permitted after impact at 2 joules. Alternatively, the test may be carried out on a sample cut from the pipe and rigidly supported beneath the point of impact.

PA C02 16 FREQUENCY OF TESTING OF LININGS AND COATINGS

Tests 1 to 3 of TABLE 1 shall be applied to each and every pipe or pipe special.

Tests 4, 5(a) and 5(b) of TABLE 1 shall be applied to at least one pipe selected at random from the first day's production or from each batch of liquid epoxy, whichever is more frequent.

Tests 6, 7 and 8 of TABLE 1 shall be applied to at least one pipe or pipe special selected at random from the first day's production of each item.

Tests to be conducted on internal lining repair shall be on 3 tests per joint for every 10 pipe joints.

Should the Contractor experience difficulties in achieving this specification, additional tests may be required by the Employer until the problem(s) has been identified and rectified.

Such additional tests shall be to the Contractor's account.

PARTICULAR SPECIFICATION – CORROSION PROTECTION

03 - SURFACE PREPARATION OF STEEL SURFACES FOR COATING AND LINING REHABILITATION

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PREAMBLE

This Particular Specification deals with the preparation of steel surfaces when pipe coatings or pipe linings have to be repaired. This specification is applicable to all pipe steel surfaces which have been stripped of its corrosion protection layer, internally or externally, as a result of the manufacturing of specials, construction activities or pipe laying, welding and/or damages caused by handling or latent defects in application.

Bare Metal Surfaces_Degreasing
Wire Brushing
Sand Blasting

External surface preparation for tape wrapping – Wire Brushing
External surface for epoxy coating – Sand Blasting
Internal surface for epoxy coating – Sand Blasting
Internal surface for cement mortar lining – Wire Brushing

PA C03 1 PREPARATION OF PIPE/METAL SURFACE

The following specifies the applicable method for preparation of all exposed steel surfaces for application of a repair for internal lining and/or external coating. This specification is applicable to all pipe steel surfaces which have been stripped of its corrosion protection layer, internally or externally, as a result of the manufacturing of specials, construction activities or pipe laying, welding and/or damages caused by handling or latent defects in application.

The surfaces of all pipes and specials to be lined and coated, irrespective of the lining and coating type used, shall be prepared in accordance with the following requirements:

- a) All damaged and blistered lining and/ or coating caused by welding shall be removed back to sound lining or coating by mechanical grinding or other approved means.
- b) The exposed steel surface shall be power or hand wire brushed to remove dirt, scale, rust and other foreign matter.
- c) Weld splatter shall have been removed by chipping or grinding to a smooth surface flush with the surrounding steel.
- d) Weld seams shall have a smooth contour, free from sharp edges, protrusions and undercuts.
- e) Sharp edges and protrusions shall have been removed by grinding to a smooth radius of curvature of not less than 3mm.
- f) The surrounding sound coated surface shall be abraded beyond the defective area. The abrasion shall be carried out with clean emery paper of 80 or 100 grit profile without causing the removal of excessive amounts of protective material.
- g) All pipes for coating shall be in rust condition A to C of Swedish Standard SIS 05 5900. Pipes in rust condition D will be rejected.
- h) Where existing coatings or linings are sound and repair work has to tie into the sound existing condition. The required feathering will be done.

PA C03 2 DEGREASING

Any bare metal surface shall be degreased in order to remove grease and oil from the pipe surface as a first step in the preparation process, before grit blasting and or power brushing starts. Degreasing shall be done with a non volatile solvent (e.g. "Aquasolve", "Chesterton Nr. 261 Safety Solvent Cleaner" or similar approved.) The surface shall then be cleaned with potable water and left to dry completely before the next step is taken.

- All surfaces to be coated shall be tested for oil and grease contamination by using the water break free test.
- All residues shall be removed from steel surfaces prior to surface preparation in accordance with SANS 10064 clauses 3.3 and 3.4 .
- Surfaces shall be tested after degreasing and shall show no signs of oil, grease and chemical contamination after degreasing.
- Care shall be taken to avoid entrapment of cleaning materials and cleaning agents in recesses or other retention areas.

PA C03 3 BARE METAL SURFACES - PREPARATION FOR LAYER APPLICATION

PA C03 3.1 WIRE BRUSHING

Power brushing of any bare metal surface shall take place after degreasing of the area as specified above. The area that has been power brushed shall be free from rust, laitance, dust, oil or other deleterious matter before application of primer. Any areas in the region where power brushing took place shall be free from signs of disbonding of lining and or coating.

The surface finish, once power brushing has been completed shall conform to minimum St3 standard.

PA C03 3.2 GRIT BLASTING

The surface of the pipe to be coated or lined shall be blast cleaned by centrifugal or air blast cleaning methods, then vacuum cleaned or blown off to achieve the following standards:

The profile produced by blast cleaning shall be angular and shall have an average peak to valley height of 60 to 100 microns, when tested in accordance with SANS method 772, to Sa2 ½.

Hackles shall be removed with coarse abrasive paper. Residual dust and debris shall not exceed 0.2% when tested in accordance with SANS Method 769.

Any laminations revealed by blast cleaning shall be ground out and re-blast cleaned to meet the above requirements. If grinding penetrates the steel to a depth greater than 3.5% of the nominal wall thickness, the pipe shall be rejected.

The pipe surface shall not be contaminated by oil, grease or other harmful contaminant.

Grit blasting shall under all circumstances be carried out with equipment suitable for the size of the work to be undertaken. Grit shall not be recycled and re used.

The Contractor shall provide the Engineer with a method statement for grit blasting, for approval before work commences.

PA C03 4 EXTERNAL SURFACES – TAPE WRAPPING

Power brushing is required.

PA C03 5 EXTERNAL SURFACES – EPOXY COATING

Grit blasting is required.

PA C03 6 INTERNAL SURFACES – CEMENT MORTAR LINING

Power brushing is required.

PA C03 7 INTERNAL SURFACES – EPOXY LINING/COATING

Grit blasting is required.

PA C03 8 RULE OF THUMB

For all epoxy applications grit blasting of bare metal surfaces is required as a surface preparation.

For tape wrapping primer and CML linings, power brushing is required.

PA C03 9 OTHER COATINGS AND LININGS

Surface preparation of bare steel for the application of a Rilsan coating or galvanising shall be according to the manufacturers/applicators requirements who shall be utilising SANS specifications for their work.

Galvanising shall be applied according to the relevant SANS specifications.

PA C03 10 HANDLING OF CLEANED PIPE

After cleaning, the pipe surface shall not be contaminated in any way. Operators shall wear clean gloves and all surfaces in contact with the pipe surface shall be clean and free from oil, grease, grit, dirt and other contamination.

PA C03 11 CUT BACK OF COATED PIPE

The blast cleaned surface shall be stopped off or cut back by suitable masking which shall not contaminate the cleaned surface as follows:

- i) All pipes up to & including 200mm nominal diameter - 80mm from both ends of the pipe.
- j) All pipes from 250mm nominal diameter up to and including 500mm nominal diameter - 50mm from the belled end of the pipe and 50mm from the plain end of the pipe.
- k) All pipes 600mm nominal diameter and larger - 50mm from both ends of the pipe.
- l) The maximum cut-back shall be 100mm.

PARTICULAR SPECIFICATION – CORROSION PROTECTION

04 - HOLIDAY TESTING

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PREAMBLE

This Particular Specification deals with holiday testing of internal linings and external coatings of steel pipelines, manufactured pipe specials and coated Plant.

Holiday testing - general

Before and during Construction

Spark Detection of lining and coatings

On Tape Wrap Systems

On epoxy coating systems

On pipe linings (internal)

On fittings and manufactured specials

Upon completion of Construction

Wet Sponge testing

DCVG testing

PA C04 1 HOLIDAY TESTING

All Holiday Testing shall be carried out with an instrument approved by the Employer's Representative. The sparking detection test shall conform to the standards as set out in SANS 1217:2001.

It shall be a requirement of this contract that the holiday testing apparatus be calibrated and approved by the Engineer prior to conducting any holiday tests. Calibration shall take place on site, by the operator of the equipment, with the test voltage suitable for the coating to be tested.

The Contractor shall familiarise himself with the di-electric strength (breakdown strength) of all the coatings and linings he works with for the different pipe sizes. The Contractor shall also have an in depth knowledge of the holiday testing equipment he works with, in order to calculate the Corona discharge effect for the typical brush being utilised, with reference to the specific ambient conditions for any specific test.

All Holiday Testing will be executed at a voltage which is set at 50% of the value of the di-electric strength of the lining or coating being tested for the required nominal DFT of applied coating. The Contractor shall carefully analyse the loss in test voltage as a result of the Corona Effect, specific to the ambient conditions surrounding the test. The test voltage of the holiday testing equipment shall be adjusted such that the voltage drop as a result of the Corona Effect, will be taken into account when the actual 50% threshold of the di-electric strength is utilized as a testing voltage applied to the surface of the coating.

Method statements for the process of holiday testing shall be submitted to the Employer's Representative for approval.

The holiday test equipment is to be calibrated for the required "closed circuit" voltage on site on commencement of testing. Each piece of equipment shall have a unique identification number with calibration certificates and detail of equipment utilized shall be submitted to the Employer's Representative for approval.

The holiday test voltage shall be adjusted every 30 minutes for battery condition and operating efficiency or every time a test at a different location is started.

The correct equipment for the type of application will be utilized. For example, where pin holes have been repaired and retesting for effectiveness of repair work is being done, the Contractor shall utilize the correct equipment to effect same and this shall include the use of a pencil brush which concentrates the efforts of holiday testing at the repair. Where spark tests are performed on Tape Wrap systems, the minimum brush width shall be 300mm. The brushes utilized shall be brass bristle cone brushes. The typical brush speed shall be 200 to 300 mm/sec when doing spark tests.

Wet sponge tests shall be done to detect holidays on internal linings of the pipeline.

The Contractor shall allow in his rates for testing of each and every surface area, that is internal epoxy lining as well as external coating, during construction as per this specification. Testing for holidays shall be done after inclusion of materials, manufactured specials and equipment, as well as pipes, into the permanent works. No additional payment will be considered for holiday testing over and above stated rates.

Any defects found through holiday testing shall be repaired and the costs for remedial work shall be deemed to be included in the tendered rates for the construction of the pipeline. (excluding requirements for manufacturing and supplier delivery defects in free issue materials) These tests and results shall be recorded on the quality control plan as approved by the Employer's Representative.

PA C04 2 EXTERNAL HOLIDAY DETECTION ON PIPE COATING

PA C04 2.1 HOLIDAY TESTING OF PIPE AT WORK FRONTS

The coating of each pipe shall be inspected and holiday detected by the Contractor, immediately prior to being laid and these inspections will be witnessed and signed off by the Employer's Representative or an appointed third party inspection authority. Two thirds of the circumference will be inspected outside the trench, after the pipe has been transported to the construction site where the pipe will be laid and the balance of the circumference will be inspected once the pipe has been laid into the trench and rotated 180°. All testing shall be marked on the pipe from start of test point to completion of test point. All remedial work shall be effected immediately upon detection of any holidays. The cost of holiday testing and effecting remedial work to the coating of the pipe at the installation location, as a result of construction or transportation damage by the Contractor, shall be deemed to be included in the tendered rates for the laying of the pipe.

PA C04 2.2 HOLIDAY DETECTION OF TAPE WRAP SYSTEMS

Each and every external coating repair at welded joints, which has been repaired with a tape wrap system, shall be holiday tested and approved and signed off of in terms of the relevant Quality Control Plan. All the costs for holiday detection and any costs for effecting remedial work shall be deemed to be included in the tendered rates for applying tape wrap systems.

PA C04 2.3 EXTERNAL HOLIDAY DETECTION ON EPOXY COATING SYSTEMS

All pipe specials being corrosion protected with an external coating, shall be holiday tested before being incorporated into the works as well as holiday tested after inclusion into the works. All the costs of holiday detection and any costs for effecting remedial work on such pipe specials shall be deemed to be included in the rates for the laying of the pipe.

PA C04 2.4 EXTERNAL HOLIDAY DETECTION ON CORROSION PROTECTION MECHANISMS FOR FITTINGS AND MANUFACTURED SPECIALS

The corrosion protection systems on all fittings and manufactured specials shall be holiday tested once included into the permanent works. All the costs of holiday detection and any costs of effecting remedial work on corrosion protection systems shall be deemed to be included in the tendered rates for the laying of the pipe.

PA C04 3 INTERNAL HOLIDAY DETECTION ON PIPE LININGS

All internal epoxy linings shall be tested for defects by means of a wet sponge test. The testing equipment shall be calibrated and set at 90V in order to ensure the correct potential difference for the test to be executed.

The surface areas to be tested shall be wetted with potable water to which a suitable wetting agent has been added in adequate quantities in order to ensure the breaking down of cohesion forces within the water.

The appropriate wet sponge tests shall also be conducted on the internal surfaces of all epoxy lined reinstated joints of manufactured specials and repairs to linings, before final cleaning of sections of the pipeline that are completed.

All the costs for wet sponge holiday detection and any costs for effecting remedial work on internal linings shall be deemed to be included in the rates for the laying of the pipeline.

PARTICULAR SPECIFICATION – CORROSION PROTECTION

05 - TAPE WRAP SYSTEMS APPLICATION

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PREAMBLE

This Particular Specification deals with the application of tape wrap systems for the following applications:

1. Rehabilitation of externally welded joints
2. Rehabilitation of shop manufactured segmented bends to be backfilled with bedding
3. Rehabilitation of external pipe coating where a tape wrap application is required
4. Rehabilitation/corrosion protection of bolted connections

PA C05 1 SURFACE PREPARATION FOR TAPE WRAP SYSTEMS

Surface preparation shall be done in terms of the Particular Specification of the corrosion protection suite of documents – PA Spec_Surface Preparation of steel surfaces for coating and lining rehabilitation.

Where Tape Wrap is applied to protect butt welded joints, the adjacent external coating shall be cleaned to a minimum of 300mm either side of the joint and the edges “feathered” by power brushing. The sound, parent coating surface shall be roughened with emery paper of 80 or 100 grit, over an area 250 mm from the joint.

Should Tape Wrap be applied over previously applied Tape Wrap, the existing Tape Wrap shall be thoroughly cleaned with soapy water to remove all grime and dirt. The cleaned area shall be left to dry and primed before application of the next layer of Tape Wrap.

PA C05 2 TAPE WRAP SYSTEMS

This specification is based on “Denso” products, but alternative products may be accepted at the discretion of the Engineer.

Tape wrapping is specified for the corrosion protection of welded joints. This applies to both joints in straight lengths of pipe as well as joints in segmented manufactured bends.

PA C05 2.1 PRIMERS

The pipe surface up to 250mm on either side of the joint, shall be primed using Denso Primer D (or similar approved) to the prepared surfaces at a nominal coverage rate of 8m² per litre. Care shall be taken to obtain an even film with no runs or sags. The primer thickness shall be 300um DFT.

The primer shall cure for the minimum time stipulated by the manufacturer before application of the tape commences. This time lapse shall not be less than 30 minutes. Primer shall only be applied over areas that can be wrapped within the specified time as stipulated by the manufacturer. Any areas primed too long in advance of application of tape wrap shall be re-primed before wrapping. The manufacturer’s specifications in this regard shall be adhered to and under no circumstances shall the maximum time lapse between primer application and Tape Wrap application be more than 8 hours.

With reference to PA C05 2.3, the Contractor shall ensure that dust control is applied under all circumstances.

If primed areas are to be left overnight, these areas shall be re-primed before wrapping.

A 1.5mm thick x 50mm wide Denso Mastic Sealing Tape (profiling tape) shall be applied to the full circumference of the weld bead in accordance with the manufacturer’s requirements. Care shall be taken to ensure a smooth profile and to avoid air bubbles being trapped beneath the tape as a result of poor profiling of the weld bead tape. (Note: The profiling tape may be omitted at the discretion of the Engineer. The Contractor shall however, allow for the profiling tape in his tendered rates).

PA C05 2.2 APPLICATION OF TAPE WRAP

The approved plastic adhesive tape wrapping shall be applied in conformance with SANS 1117:2000 and SANS 10129:2006 latest edition.

The manufacturers requirements shall be met at all times.

Tape wrapping of joints shall only take place on well prepared surfaces. On the larger pipe sizes which are to be butt jointed, the joint shall be spirally wrapped (minimum 55% overlap) with Denso Ultraflex 1250/300, Denso CPT 1250 tape system or similar

approved, starting at the roughened section on the pipe coating (250mm from the welded joint) in accordance with the manufacturer's requirements, to create a 500mm wide wrapping, centred over the welded joint. A 100% overlap is required on the first and last revolutions of the tape wrapping operation. It is important that tension in the tape be released when wrapping the last half circumference of the pipe. Termination of the tape shall always be at 3 o' clock or 9 o' clock on the pipe circumference, on the downwards run of the tape, in order to prevent gravitational damage to the ends once backfilling starts and also to guard against gravitational flow of water between layers where the tape is terminated. The Contractor shall ensure that the wrapping overlaps a minimum of 150mm of the sound pipe coating.

Should it be required to repair a small defect on an existing Tape Wrap, the additional Tape Wrap shall be wrapped around the circumference at least once with an additional half circumference overlap in order to ensure that the single band of tape wrap does not lose its applied tension i.e. start at 9 o'clock and in clockwise movement finish at 3 o'clock.

The Contractor shall pay specific attention to applying even tension to the tape whilst wrapping. The tension shall be such that the desired elongation, in terms of the manufacturers' specification, is achieved.

The width of the tape utilized shall be according to the manufacturer's specifications. The Contractor shall adhere to the manufacturers specifications for application at all times and this shall include, but is not limited to the following:

- Temperature of pipe surface to which Tape is applied.
- Ambient temperature of working environment.
- Dew Point temperatures
- Required tension on tape to provide the required elongation which ensures maximum adherence.
- Required dryness of primer to ensure adequate evaporation of solvents

No air-gap will be permitted between the tape and steel surface and tape width and the application tension shall be such as to ensure that the tape "dresses down" over steel surface irregularities. This applies particularly on belled-end pipes.

Gusseted bends requiring two or more welded joints shall be fully externally wrapped extending 150 mm outside the two outermost welded joints.

Should single rolls not be adequate for the completion of a specific repair and should additional rolls be required to complete the repair, the Contractor shall ensure that the new roll starts with a 100% overlap over a distance of 1.5 the circumference before tensioning is changed to effect the 55% overlap.

NOTE: Should the Contractor want to utilize shorter lengths of pipe than those supplied, for construction purposes, in order to work in confined areas, and should the Engineer have approved the cutting of the pipe for this purpose, the costs associated to any additional wrappings at joints, as a result of cutting pipes into shorter lengths, shall be borne by the Contractor.

PA C05 2.3 CANOPIES AND DUST CONTROL

Tape wrapping will not be allowed under dusty and wet conditions. A suitable canopy will be erected over the wrapping area, should it be required, in order to ensure that wrapping can be undertaken in the shade, keeping out dust, any light rain and direct sunlight which will have an effect on the application process.

PA C05 2.4 TAPE WRAPS APPLIED TO BELL ENDED JOINTS

Should a Tape Wrap system be applied to bell end jointed, welded pipe, the following shall apply:

- The surface preparation shall be in terms the PA Specification for Surface Preparation of steel surfaces for coating and lining rehabilitation
- The joint shall be smoothed over with mastic in order to provide a smooth surface before the application of a Tape Wrap system.
- The required primer will be applied before tape wrapping commences.
- The tape wrap shall be applied as stated in this specification.

This method is also applicable to a collar welded joint.

PA C05 3 TAPE WRAPPING OF A SPOT REPAIR

All spot repairs of coatings shall be wrapped with a tape wrap system after repair. The sticking of a cut piece of tape from the roll, over the spot repair, shall not be allowed.

A tape wrap, covering the spot repair, shall consist tape applied in length at least one and a half the circumference of the pipe with edges of the tape wrap extending at least 80mm beyond the edge of the spot repair edge.

PA C05 4 SHRINK WRAP SYSTEMS

Shrink wrap systems may be considered for smaller diameter bell ended pipes, at the discretion of the Engineer. Should the Contractor wish to use such a system, full details of the particular product as well as a detailed method statement shall be provided for consideration by the Engineer.

PA C05 5 FINAL COATING OF PERMANENTLY EXPOSED PIPE

All pipe which is to be permanently exposed shall, in addition to corrosion protection at joints, be protected with the "Denso Acrylic Pipeline Tape (Steelcoat 500)" system or similar approved UV Resistant coating. The pipe surface shall be prepared and the coating applied in strict accordance with the manufacturer's instructions.

One coat of Densoflex Fire Retardant shall be applied to the exposed pipe at a nominal application rate as specified by the manufacturer.

PA C05 6 SPARK TESTS ON COMPLETED WRAPPED JOINTS

Spark tests shall be performed on each and every wrapped joint and the results shall form part of the required Quality Control sheets. The tendered rates for the laying of the pipeline and the preparation of Quality Control documentation shall be deemed to include for all spark tests required.

PA C05 7 QUALITY CONTROL PLAN

The Contractor shall submit a Quality Control Plan that details the steps to be taken to ensure 100% quality control on the specified tape wrap system.

The Engineer shall call for peel tests as and where required to prove specific quality criteria, after which the relevant repair procedure will be implemented to repair the damaged tape wrap. Should the peel test be proved not to conform to the required specification, the specific tape wrap shall be replaced at the Contractor's cost.

The peel test shall be done according to the tape wrap supplier's specifications.

The Quality Control Plan shall include a hold point for each and every tape wrap, to

ensure that the Engineer has the opportunity to inspect and approve.
The tendered rates for the application of the tape wrap system shall be deemed to include for development and maintenance of the Quality Control procedures required.

PARTICULAR SPECIFICATION – CORROSION PROTECTION

06 - CORROSION PROTECTION OF BURIED JOINTS, COUPLINGS AND FLANGES AND FITTINGS/VALVES

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PREAMBLE

This Particular Specification deals with corrosion protection of buried flanges, bolted connections, couplings, joints, fittings and adaptors. This includes buried valves. These components need to be protected from corrosion and special requirements are applicable if buried.

Mastics and rock shields are detailed.

PA C06 1 INTRODUCTION

All buried flanges and flexible joints shall, bolted connections, couplings, joints, fittings and adaptors in addition to being epoxy/ thermoplastic powder/ Rilsan coated or galvanised or fusion bonded epoxy coated, be protected as described below. This specification is based on a tape wrap system. Alternative products will be subject to the approval of the Engineer.

PA C06 2 APPLICATION OF CORROSION PROTECTION MECHANISM

PA C06 2.1 SURFACE PREPARATION

Surface preparation shall be as required in the particular specification dealing with surface preparation of steel surfaces for coating and lining rehabilitation, where applicable.

The entire joint/fitting area and at least 500mm of pipe either side of the joint/fitting shall be cleaned of mud and other deleterious matter before application of corrosion protection mechanism.

PA C06 2.2 PRIMER APPLICATION

The cleaned joint and pipe shall be primed with “Denso Priming Solution” or similar approved, or if moisture is present, “Denso S105 Paste” or similar approved. The priming shall extend to at least 400mm beyond either side of the joint/fitting.

PA C06 2.3 MASTIC APPLICATION

Narrow strips cut from “Denso Mastic Blankets” or similar approved shall be applied to the joint to achieve a smooth profile with a 50mm splayed fillet being formed at the joint/fitting/pipe interface. Care shall be taken, particularly at bolts, to avoid the formation of air pockets. Complete “Denso mastic Blankets” shall then be applied (mastic side down) to the joint/fitting until the joint/fitting is completely enveloped.

PA C06 2.4 TAPE WRAPPING

The ends of the blanket shall be bound to the barrel of the pipe on each end with 100mm wide “Denso Petrolatum Tape” or similar approved. “Denso Petrolatum Tape” overlaps shall be 50mm and shall extend 100mm onto the blanket and 150mm onto the pipe barrel. All exposed bolts on flexible couplings and flanges adaptors are to be wrapped.

PA C06 2.5 POLYETHYLENE WRAPPING

The entire joint shall be wrapped with 350 micron polyethylene sheeting which shall end 400mm beyond the joint. The protective sheeting shall be secured to the pipe barrel and along the seam with 48mm wide “Denso Adhesive Tape” or similar approved.

PA C06 2.6 SPARK TESTS ON COMPLETED WRAPPED JOINTS

Spark tests according to the particular specification for holiday testing shall be performed on each and every wrapped joint.

PA C06 3 EXTERNAL CORROSION PROTECTION OF BURIED VALVES AND FLANGES

All buried valves and flanges shall, in addition to being epoxy coated, be protected as described below. This specification is based on a “Denso” system. Alternative products may be used, subject to approval by the Engineer.

PA C06 3.1 SURFACE PREPARATION

The entire joint and at least 500mm of the pipe on either side of the joint shall be cleaned of mud and other deleterious matter.

PA C06 3.2 PRIMING

The cleaned joint and pipe shall be primed with “Denso Priming Solution,” or if moisture is present, with “Denso S105 Paste” or similar approved. The priming shall extend to at least 400mm either side of the joint.

PA C06 3.3 APPLICATION OF MASTIC BLANKETS

Narrow strips cut from “Denso Mastic Blankets” or similar approved, shall be applied to the joint to achieve a smooth profile with a 50mm splayed fillet being formed at the joint/pipe interface. Care shall be taken, particularly at bolts, to avoid the formation of air pockets. Complete “Denso Mastic Blankets” shall then be applied (mastic side down) to the joint until the joint is completely enveloped.

The blanket shall be overlapped at least 50mm and shall extend at least 150mm along the pipe barrel on each side of the joint. The ends of the blanket shall be bound to the barrel of the pipe on each end with 100mm wide “Denso Tape.” The “Denso Tape” or similar approved overlaps shall be 50mm and shall extend 100mm onto the blanket and 150mm onto the pipe barrel.

PA C06 3.4 APPLICATION OF PROTECTIVE SHEETING

The entire joint shall be wrapped with 350 micron polyethylene sheeting which shall extend 400mm beyond the joint. The protective sheeting shall be secured to the pipe barrel and along the seam with 48mm wide “Denso Adhesive Tape” or similar approved.

PA C06 4 EXTERNAL – CORROSION PROTECTION OF CROTCH PLATES

Crotch plates will be externally protected with an EPOXY repair kit (NORDBAK 1 or similar approved). In order to prevent water from collecting in the crotch area a 25mm hole will be drilled into the top “crotch” area where the crotch plate joins the main pipe and care shall be taken to ensure free drainage of water from this area, should any water tend to collect in this area. This hole shall be corrosion protected in terms of this specification and care shall be taken not to block the water drainage hole.

The tendered rates for manufacturing of pipe specials and the fitment of crotch plates shall be deemed to include for the drilling and corrosion protection as mentioned in this clause.

PA C06 5 EXTERNAL AND INTERNAL COATING AND LINING REPAIR AS RESULT OF THERMAL WELDING OF CABLES ONTO PIPE

Removal of existing tape wrap to effect thermal welding shall be by means of cutting a 50mm by 50mm square out of the existing tape wrap.

Thermal welding shall be done in terms of the manufacturer's specifications, by cathodic protection technicians, as employed by the Employer.

The cables shall be flattened on the pipe in a longitudinal direction and the thermal weld area shall be completely covered with a Densotherm HD or similar approved. The cable shall be covered over a longitudinal distance of 500mm past the thermal welded point, with the applicable mastic.

The approved Tape Wrap system shall be applied over the existing tape wrap system from a distance of 300mm before the thermal weld to a distance of 500mm after the thermal weld, over the mastic coated cables.

The existing tape shall be well degreased and cleaned before application of the layer of tape that covers the cables and the thermal weld.

Internally the lining shall be repaired as per the corrosion protection specification.

PARTICULAR SPECIFICATION – CORROSION PROTECTION

07 - TRANSITION ZONE REPAIRS

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PREAMBLE

This Particular Specification deals with transition zones and the complications of ensuring a continuous corrosion protection mechanism over these zones.

PA C07 1 DEFINITION OF A TRANSITION ZONE

A transition zone is defined as an area over a length of pipe, pipe special or fitting where a coating or lining system changes from one to another, or where there is a gap between two ends of a lining or coating system. Typical transition zones are, but not limited to:

- Cement mortar lining to epoxy lining where, for example, an epoxy lined pipe specials are fitted to a cement mortar lined pipe.
- Epoxy lining to bare steel where an epoxy lining repair is being done or where a pipe special is welded to a pipeline that is lined.
- The zone where external pipe coating and internal lining is terminated short of a pipe end. (Refer to pipe supplied from the manufacturer with specified end conditions)
- The zone where a welded joint has been completed and transition zones exist internally and externally changing from coating to steel or lining to steel.
- The welded zone where two pieces of pipe have been welded together.

PA C07 2 TRANSITION ZONE PREPARATION FOR REHABILITATION

All existing linings and coatings, to be repaired or where repair requires replacement of a corrosion protection mechanism, shall be thoroughly checked around the area where the said lining and coating needs to remain. Any spalling, disbonding or un-acceptably thin remaining thicknesses shall be marked and addressed.

Disbonding and spalling linings and coatings shall be removed in an applicable manner. Linings and coatings that are too thin at the transition zone interface shall feathered to ensure that after repair, the repair mechanism will ensure adequate thickness with adequate adhesion by repair kit to existing feathered mechanism.

Epoxy lining and coating shall always be feathered from bare steel to full thickness where repairs are due.

The first 15mm to 20mm of sound epoxy shall be roughened with 150 grit paper before repair mechanism is applied, be it epoxy that has to overlap the sound epoxy or an epidermix or similar approved paste/mortar overlapping with the epoxy.

Weld splatter shall be removed in welded transition zones before corrosion repair mechanisms are applied to the steel surface.

Cement mortar linings shall not be feathered when repaired. The cement mortar lining shall always be stopped with a 90 degree angle to the steel surface before repair commences.

Steel surface preparation shall be in terms of the requirements of the particular specification for surface preparation of steel surfaces for coating and lining repair.

PA C07 3 TRANSITION ZONE REPAIR – CONCRETE MORTAR LINING TO EPOXY LINING

At transition zones, where for any specific reason the internal lining changes from cement mortar lining (CML) to an epoxy lining at, for example, reducers, flanges, weld on flanges or fabricated specials, which do not require cement mortar lining internally, the transition zone shall be specially prepared and reinstated with Epidermix 338 or similar approved.

The cement mortar lining shall be inspected for spalling, disbonding and or cracks and any such portions of lining found shall be removed.

Existing epoxy in the transition zone shall be inspected for thickness and disbonding and should any area of epoxy be found unacceptable in terms of the requirements the damaged

epoxy shall be ground down to bare metal.

Once sound cement mortar lining and epoxy lining has been established, the following shall apply:

- Cement mortar lining shall be chipped and edged to provide a 90 degree angle with the steel surface over the full circumference.
- The epoxy lining shall be feathered and roughened over a length of at least 15mm.
- The bare metal shall be degreased and power brushed to specification.

Epidermix 338 or similar approved shall be applied in the transition zone in such a manner that it starts as a thin layer of 1mm thick, over the roughened epoxy with an overlap of 10mm on to the epoxy and feathered to the cement mortar lining in order to form a smooth transition from the low to high point.

Application of the Epidermix or similar approved shall be according to the manufacturers requirements and the contractor shall ensure that the atmospheric conditions at the repair area are conducive to proper curing on the epoxy utilised to effect the repair.

PA C07 4 TRANSITION ZONE REPAIR – EPOXY TO EPOXY

Epoxy to epoxy transition zone repair shall be repaired with an epoxy coating applied to manufacturers specifications.

Existing epoxy in the transition zone shall be inspected for thickness and disbonding and should any area of epoxy be found unacceptable in terms of the requirements the damaged epoxy shall be ground down to bare metal.

Once sound epoxy lining has been established, the following shall apply:

- The remaining epoxy lining shall be feathered and roughened over a width of at least 15mm.
- The bare metal shall be degreased and grit blasted to specification.
 - Grit blasting shall slightly overlap onto the existing epoxy after which the existing epoxy shall

The epoxy repair kit shall be applied over metal surface and onto the abraded epoxy on both sides. Application shall be as per manufacturers specifications to minimum dry film thickness required but not less than 300um.

PA C07 5 TRANSITION ZONE REPAIR – RILSAN TO EPOXY

The repair method is similar to that of epoxy to epoxy repair in that the Rilsan needs to be checked for soundness and removed where not sound. Rilsan needs to be abraded and roughened and feathered and there after epoxy repair material shall be applied.

PA C07 6 TRANSITION ZONE REPAIR – RILSAN TO CEMENT MORTAR LINING

Rilsan to cement mortar lining transition zones shall be treated in the same manner as for CML lining to epoxy lining.

PA C07 7 TRANSITION ZONE REPAIR – GALVANISING TO ANOTHER SYSTEM

Damaged galvanised lining or coating shall not be accepted. If galvanising has been damaged the section shall be re galvanised at a galvanising plant, according to supplier and SANS standards.

PARTICULAR SPECIFICATION – CORROSION PROTECTION

08 - INTERNAL LINING AND EXTERNAL COATING REPAIR FOR PIPELINES

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PREAMBLE

This Particular Specification deals with the repair of internal linings and external coatings in pipelines with pipe specials where such linings and coatings have been damaged as a result of construction or manufacturing processes and activities. Some repair areas can be reached by hand and other areas not. Details of approach for each situation is stated.

Internal lining repair

Cement Mortar Lining

Epoxy Lining

External coating repair

Epoxy

Sintakote/3 layer/FBMDPE

Transitions zones

PA C08 1 INTRODUCTION

All steel pipe laid either have joints welded or for smaller diameter pipe, mechanical couplings could be used as a jointing mechanism.

Steel pipe is normally supplied pre lined and pre coated and lining and coating is normally cut back at the ends to effect welding or jointing in general.

End conditions for pipe supplied vary.

It is required, after jointing, to have pipe end conditions corrosion protected.

Line pipe could also have lining and coating being supplied with defects that occurred during the manufacturing process, alternatively, lining and coating could be compromised during the construction process. The defects are to be repaired effectively. This to be read in conjunction with free issue pipe as free issue pipe supplied with defects in coating and lining would require repair at the Employer's cost, however pipe supplied by the contractor would require repair to coating and lining at the contractor's cost.

PA C08 2 PIPE LAYING

Each pipe length shall first be placed on suitable dunnage adjacent to the trench. The Contractor shall then arrange for holiday tests to be undertaken on the accessible portion of the pipe coating surface by the non-destructive testing firm appointed in terms of this contract or the Employer's Representative instruction, whichever is applicable.

It shall be a requirement of this contract that the holiday testing device utilised by calibrated and approved by the Employer's Representative prior to the conducting of any holiday tests.

Once the pipe has been found acceptable for laying, the pipe shall be placed on the bedding after rotation such that the bottom third of the pipe not having been tested alongside the trench, can be tested inside the trench for holiday on the coating.

Refer to PA C11 – Free issue pipe material_Management of coating and lining defects, for accepting free issue pipe coating and lining before laying of pipe.

PA C08 3 CEMENT MORTAR LINED PIPE - INTERNAL REPAIR

PA C08 3.1 PIPES DN600 AND SMALLER WHERE THE JOINTS CAN NOT BE REACHED BY HAND

Pipe of this diameter is normally cement mortar lined.

- The internal surface of the bell mouth is to be power brushed from the pipe end to the cement mortar lining to remove dirt, scale, rust and other foreign matter.
- Any grease and oil shall be removed from the pipe surface with a non-volatile solvent (e.g. "Aquasolve", "Chesterton Nr.261 Safety Solvent Cleaner" or similar approved). The surface shall then be cleaned with water and dried and a 30 mm wide x 30 mm thick band of "Epidermix 338", or similar approved shall be applied internally on the uncoated steel adjacent to the cement lining.
- The plain end of the adjoining pipe shall be pushed into the bell mouth in such a way that the Epidermix band is compressed and makes contact with the transverse face of the concrete lining of both pipes. The excess lining material which is squeezed into the pipe shall be removed by drawing a suitable pig, approved by the Engineer, across the joint. The pig shall be so shaped as to apply a smooth even surface to the lining material at the joint.

Where small diameter pipe is supplied with cement mortar lining and without a spigot and socket end condition, the joint shall be effected by means of a collar welded onto the one end of the a pipe in order to facilitate a spigot and socket type end condition. Repair of the internal CML lining has to be effected as described above.

PA C08 3.2 PIPES LARGER THAN DN600 WHERE A PERSON IS ABLE TO REACH THE JOINT

For CML:

- The exposed steel surface shall be power brushed to remove dirt, scale, rust and other foreign matter. Burrs, weld spatter etc. shall be filed away.
- Any grease and oil shall be removed from the pipe surface with a non-volatile solvent (e.g. "Aquasolve", "Chesterton Nr. 261 Safety Solvent Cleaner" or similar approved), flushed with potable water and completely dried.
- The joint shall then be made good with "Epidermix 338" or similar approved, neatly formed to meet the adjacent cement mortar.

PA C08 3.2.1 EPOXY LINED PIPE – INTERNAL REPAIR

Small diameter pipe is not supplied with an epoxy lining

Pipe with epoxy lining shall be repaired with the applicable solvent free epoxy repair pack.

Surface preparation before repair of lining shall be in terms of PA C 03 .

PA C08 4 EXTERNAL CORROSION PROTECTION OF BUTT WELDED JOINTS

All Sintakote/FBMDPE/3 layer coated pipes for butt welding are supplied with the coating cut back 100 mm from each pipe end. Where pipes are to be cut on site, the Sintakote coating shall be cut back 100 mm from the welded joint. (internal lining shall be removed over sufficient distance to ensure that welding and joint preparation can be done satisfactorily). Once welding is complete and all weld splatter and burnt coating is removed and feathered, all butt welded pipe joints shall be wrapped by means of an approved adhesive tape wrapping system.

The tape wrap shall be applied in accordance with the tape wrap system specification.

Where butt welds are to be repaired where such butt welds are located in chambers, epoxy coating repair shall be applicable.

PA C08 5 TRANSITIONS BETWEEN A THICKER LAYER AND A THIN LAYER

CML linings are much thicker than epoxy linings.

A FBMDPE/3 layer/Sintakote coating is thicker than an epoxy coating or a Rilsan coating.

In order to repair linings and coatings of different thicknesses which are adjacent to each other, the transition zone repair specification requirements shall be followed.

PARTICULAR SPECIFICATION – CORROSION PROTECTION

09 - PIPE SPECIALS – LINING AND COATING REPAIR

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PREAMBLE

This Particular Specification deals with the repair of internal linings and external coatings on pipe specials where such linings and coatings have been damaged as a result of construction or fabrication processes and activities.

Segmented Bends

Internal

External

Tie piece and Y branch specials

Air collector pipes

PA C09 1 INTRODUCTION

All pipe specials normally come about as a result of some kind of fabrication process taking existing coated and lined pipe and repurposing this into a different configuration. This results in linings and coatings that existed before the re fabrication commenced, in all probability be damaged or removed and should therefore be repaired.

Fabricated pipe specials typically consist of:

- Air valve assemblies
- Scour valve assemblies
- Segmented bends
- Y pieces and T pieces
- By pass assemblies (a derivative of Y pieces with additional pipe work)

Traceability of pipe data used in fabrication of pipe specials needs to be ensured.

PA C09 2 TRACING OF ORIGINAL PIPE DATA

Pipe supplied under the contract or pipe supplied as free issue material, is supplied with pipe data originating from the supplier, with each pipe uniquely numbered. Pipe numbers and data pertaining to diameter, wall thickness and grade of steel need to be incorporated onto the weld map.

It is the Contractor's responsibility to develop the weld map and his rates for pipelaying shall be deemed to include for the weld map development and maintenance.

Pipe data of pipe specials, manufactured from lien pipe cut into smaller pieces, shall be incorporated onto the weld map.

The pipe number from which a section is cut shall be bead welded onto each segment of pipe cut for which the original pipe number is not visible.

PA C09 3 COATING AND LINING OF FABRICATED STEEL SPECIALS

Any pipe special fabricated for inclusion into the works, shall be fabricated according to the drawings and reinstatement of internal and external linings shall conform to the specifications at all times.

At no stage shall any pipe, fitting or special be included into the works without adequate repair and or rehabilitation to the internal lining and or external coating. This shall include due cognizance of all the specifications related to Epoxy/solvent free epoxy linings, Rilsan linings and coatings, cement mortar linings and Sintakote/FBMDPE/3 Layer coatings or galvanised lining and coatings.

The mating flange of a fabricated steel special shall require one coat of rust inhibitor (Plascon Rustix 84 or equal approved). The flange profiling shall be clearly visible and no runs or drips will be permitted.

Following the coating and installation of the pipe special, the coating is to be free from all electrical insulation defects and the lining shall not show any signs of holidays.

PA C09 4 EXTERNAL COATING REPAIR ON PIPE SPECIALS WHICH ARE NOT BURIED

External corrosion protection of all mild steel specials to be installed within chambers, shall generally be carried out by reinstating the coating material with an EPOXY repair material such as NORDBAK 1 (or similar approved), to a minimum DFT thickness of 300 micrometers. The repair material shall overlap the abraded original coating by a minimum of 150 mm.

The surface preparation shall be in terms of this specification.

When applying the external protective coating layer on crotch plated specials care shall be taken not to block up water drainage holes in crotch plate.

Any holes drilled in wrapper/compensation plates during construction, shall be welded up before coatings for corrosion protection are applied.

PA C09 5 SEGMENTED BENDS

Segmented bends shall be fully corrosion protected by a specified and applicable system.

PA C09 5.1 INTERNAL

Segmented bends are to be internally protected against corrosion by means of an epoxy lining (solvent free twin pack)

Application shall be preceded by surface preparation as described and application shall conform with the requirements of the corrosion protection particular specification.

PA C09 5.2 EXTERNAL

Segmented bends are to be protected on the outside with a tape wrap system which should be applied in terms of the particular specification for corrosion protection for tape wrap systems.

PA C09 5.3 SEGMENTED BENDS WHICH ARE NOT BURIED

Segmented bends which are not buried are normally located in chambers and will under such circumstances be epoxy coated on the outside.

PA C09 6 T PIECES AND Y BRANCHES

T Pieces and Y branches shall be fully corrosion protected by a specified and applicable system after having been fabricated. Fabrication shall follow a format such that all internal surfaces can be reached to effect internal lining repair.

In its simplest form a scour or air valve assembly is a T piece, and can be generally be described as starting as an un equal or equal T in the manufacturing process.

By passes typically start off as a Y branch in the manufacturing process.

PA C09 7 AIR COLLECTORS AND AIR VALVE ASSEMBLIES

Air collector pipes can be described as a T piece pipe special with additional fittings added to it. All surfaces of the air collector pipe as well as the line pipe where air collector pipe meets the line pipe, are to be corrosion protected.

The installation of air valves in pipe lines in some instances see air collector pipes being cut into pipe after line pipe has been laid. This will only be allowed if access to the line pipe is adequate to see internal lining protected against damage with mats at the bottom, access is possible for cleaning purposes and access is sufficient to safely repair lining damage once air collector pipe has been fitted.

Air collector pipes will be fitted as T piece pipe specials on all pipe smaller than DN700.

Air valve assemblies can consist of the following size off takes for air collector pipes:

- On DN1600 and DN1400 pipe: DN600
- On DN1200 and DN1000 pipe: DN600
- On DN600 and DN500 pipe: DN300
- On DN400 pipe: DN 200
- On DN300 pipe: DN 200

Air valve assembly take offs are to be fabricated in different configurations, depending upon size and location. There are in principle two fabrication and installation processes:

DN600 assemblies for pipe sizes DN1600, DN1400, DN1200 and DN1000:

- The air collecting pipe that is to be fitted onto the main line shall be fabricated in a workshop, complete with flanges and branches (single, dual and triple air valves).
- The 600mm pipe is normally cement mortar lined and FBMDPE/3 layer coated on the outside.
- The cement mortar lining as well as the FBMDPE/3 layer coating shall be removed from the pipe required for the manufacturing of the pipe special.
- The whole air collecting assembly is to be fabricated as a T-piece pipe special in a workshop.
- Once the portions of or the pipe special have been fabricated in the workshop, (that is, the air collector pipe with the required flanges, branches and or reducers and or the full T-Piece assembly) these pipe specials shall be grit blasted and coated with solvent free two part epoxy, DENSO ST 100 or similar approved.
- Fitment of the air collector pipes and relevant collar plates, wrappers or crotch plates may be done in a workshop as part of the air collecting assembly which is fabricated as a T-piece pipe special. Internal protection for pipe lining during fitment of air collector pipes is to be provided as stated elsewhere in this specification, and the protection of the inner lining of the pipe into which the air valve assembly is cut, shall conform to this specification.
- Repair to outer coating and inner lining to be according to this specification.

DN300 and DN200 assemblies, or pressed cap assembly, for pipe sizes DN600, DN500, DN400 and DN300:

- The air collecting assembly shall be fabricated as a T-piece pipe special in a workshop.
- The T-piece shall be fabricated from free issue stock, which is cement mortar lined and Sintakote coated. The cement mortar lining as well as the Sintakote coating shall be removed from the pipe required for the manufacturing of the pipe special.

- The barrel of the T-piece shall be as short as feasible in order to facilitate rehabilitation of internal lining from the outside.
- The DN300 or DN200 air collector take-off section shall be pre-fabricated with all required fittings, complete with saddle plates, wrappers or crotch plates where required and coated internally and externally with solvent free two part epoxy, DENSO ST 100 or similar approved.
- Once the air collector T piece special has been fitted and joined to the main line pipe, the internal lining and external coating of the butt welded joints will be repaired as stated in this specification.

The fitment of the air valve assembly pipe special (T-piece) to the main line is to be executed as per the drawings as follows:

The air valve pipe special shall be fitted to the main line by means of collar plate welded joints in the case of smaller diameters, or one collar plate weld on the one side and a spigot and socket joint on the other side, depending upon the sequence of construction at that point. External coatings shall be repaired as required. In the case of larger diameter pipe, the air valve assembly will be butt welded into position.

The contractor shall allow in his rates for the manufacturing of the air valve assembly, for the welding into position of the assembly, inclusive of mitring and preparation of the joints as required, as well as for the reinstatement of the internal lining and external coating in terms of this specification.

The methods described above, in this clause, will also apply to air collector pipe assemblies that have to run horizontally to a suitable location, away from the paved road surface.

PA C09 8 SCOUR VALVES ASSEMBLIES

Scour valve assemblies can be described as a T piece pipe special with additional fittings added to it. All surfaces of the air collector pipe are to be corrosion protected

Scour valves on DN1600, DN1400, DN1200 and DN1000 pipes:

- Scour valve assemblies are to be fabricated in a workshop, prior to fitting onto the main pipe line. This includes the scour pipe running from the main pipe line, with flange for fitting of scour valve, collar plate at pipe take-off and long radius bend as per the drawings.
- The section of the scour pipe, stretching from the main pipe line to the flange where the scour valve will be fitted, shall be Rilsan coated.
- The scour valve assembly may be fabricated as a T-piece pipe special in a workshop.
- The repair of the internal lining and external coating shall be in terms of the clauses contained in the corrosion protection specification.

Scour valves on DN600, DN500, DN400 and DN300 pipes:

- A scour valve assembly T-piece pipe special shall be fabricated, similar in principle to that of the air valve assembly T-piece pipe special.
- The scour valve pipe with collar plate, long radius bend and flange, shall be fabricated and coated as stated in this clause for 1000mm and larger above.
- The scour valve pipe from the scour valve flange to the main pipe line shall be Rilsan coated,
- The repair to the internal lining and external coating of the main pipe line shall be in terms of this specification.
- The fixing of the scour T-piece pipe special to the main line shall be in terms of the specification for the fitment of the air valve T-piece pipe special as noted above.
- The contractor shall allow in his rates for the manufacturing of the scour valve assembly, for the welding into position of the assembly, inclusive of mitring and

preparation of the joints as required, as well as for the rehabilitation of the internal lining and external coating in terms of this specification.

Once bare metal surfaces have been prepared, a two part epoxy repair procedure shall be applied to all exposed bare metal.

The transition zone between Sintakote/FBMDPE/3 layer and epoxy repair coating shall be treated similar to transition zone requirements as specified and according to the requirements for buried flanges, that is, an application of mastic (Denso Therm or similar approved) with mechanical protective PVC tape.

In cases where small diameter pipe is specified with galvanised coating and lining, the scour take off shall be flanged for bolting the scour pipe to the scour special. This flanged bolted connection shall be in a chamber and shall not be buried.

The tendered rates in the Bill of Quantities, for the laying of pipe, shall be deemed to include for all eventualities in this regard.

PA C09 9 COLLAR PLATES AND CROTCH PLATES

Crotch plates will be externally protected with an Epoxy repair kit (NORDBAK 1 or similar approved).

In order to prevent water from collecting in the crotch area a 25mm hole will be drilled into the top “ crotch “ area where the crotch plate joins the main pipe and care shall be taken to ensure free drainage of water from this area, should any water tend to collect in this area. This hole shall be corrosion protected with an epoxy coating. and care shall be taken not to block the water drainage hole as a result of epoxy application.

The tendered rates for manufacturing of pipe specials and the fitment of crotch plates shall be deemed to include for the drilling and corrosion protection as mentioned in this clause.

Crotch plates that are buried shall be covered with a mastic/bitumen blanket with an applicable rock shield.

Collar plates shall be epoxy coated once installed.

PA C09 10 CORROSION PROTECTION OF FLANGES WELDED TO PIPE

The mating flange of a fabricated steel special shall require one coat of rust inhibitor (Plascon Rustix 84 or equal approved). The flange profiling shall be clearly visible and no runs or drips will be permitted.

Corrosion protection of bolt holes to be adequate

Where flanges have been welded to pipe sections, the transition zone of existing epoxy/CML internally and FBMDPE/Sintakote/3 layer shall be treated as per the transition zone requirements.

All buried flanges shall be protected with a mastic blanket and rock shield after corrosion protection as described in the specification for corrosion protection of buried joints, couplings and flanges.

PA C09 10.1.1 INTERNAL REPAIR AT WELDED JOINT WHERE FLANGE HAS BEEN WELDED ONTO PIPE

Surface preparation shall be in terms of the specifications.

An epoxy repair kit shall be applied to repair the internal epoxy lining, according to the manufacturer's specification. (NORDBAK 1 or similar approved)

Where is flange is welded to a CML pipe pipe, the CML shall be suitable re instated as detailed elsewhere in the corrosion protection specification.

PA C09 10.2 EXTERNAL REPAIR AT WELDED JOINT WHERE FLANGE HAS BEEN WELDED ONTO PIPE

PA C09 10.2.1 EXTERNAL SINTAKOTE,3 LAYER or FBMDPE COATED PIPE

All burnt coating is to be removed mechanically without heating, by means of chiselling. The coating edge is to be feathered and thereafter abraded with 80 or 100 grit emery paper to a width of 100mm onto virgin coating.

Bare metal is to be prepared as required.

The bare metal is to be coated with an epoxy repair kit in terms of the manufacturer's specification. (NORDBAK 1 or similar approved)

Once the flanged joint is completed, it shall be protected as per specification for buried flanges. Should the flanged joint not be buried, the epoxy repair kit application is sufficient.

Flange faces are not to be coated.

PA C09 10.2.2 EXTERNAL EPOXY/RILSAN COATED PIPE

Damaged epoxy/Rilsan as a result of heat transfer shall be removed by means of mechanical wire brushing.

Bare metal surfaces shall be prepared as per the specification requirements.

Once surface preparation has been completed, an epoxy repair kit shall be applied to the pipe to specification. (NORDBAK 1 or similar approved)

Once the flanged joint is completed and is to be buried it shall be protected as per the requirements specified for buried flanges. Should the flanged joint not be buried, the epoxy repair kit application is sufficient.

Flange faces are not to be coated.

PA C09 11 PAYMENT FOR CORROSION PROTECTION OF PIPELINE, FITTINGS AND PIPE SPECIALS

The tendered rates for the laying of pipe, effecting of butt, fillet and collar welds of pipe joints, the manufacturing of pipe specials and the fitment of all fittings to the pipe line system, or any activity during the construction process which could damage corrosion protection coatings and linings, or activities which result in the bare pipe surfaces to be included into the permanent Works, are deemed to include for all the corrosion protection mechanisms required to reinstate the pipe work with a fully functional corrosion protection coating and lining, outside and inside.

Holiday detection is specified for the coatings and linings at different phases of the work in order to ensure that the pipeline is laid and commissioned without any holidays in its external coating or internal lining.

A control test will be done on the pipeline, once constructed, in order to verify that the pipeline coating is holiday free.

PARTICULAR SPECIFICATION – CORROSION PROTECTION

10 - CATHODIC PROTECTION – PROJECT SPECIFIC

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PREAMBLE

This Particular Specification deals with the particular requirements for Cathodic Protection of steel pipelines.

PA C10 1 CATHODIC PROTECTION - GENERAL

Cathodic protection is specified by the Employer, based upon input from a CP Specialist. The Contractors attention is drawn to the details as provided on the drawings and in the specifications. All construction methods must accommodate good Engineering practice for Cathodic Protection and allow for fundamental cathodic protection principles as required by the Engineer.

The Contractor shall be required to install equipment and fittings related to Cathodic Protection, as instructed by the Engineer.

Interim Cathodic Protection mechanisms will be applied and implemented during the construction phase in order to ensure that the pipeline is protected during construction.

PA C10 2 DCVG AND PCM TESTING

Once newly laid pipe has been backfilled to a level 300 mm above the obvert of the pipe, DCVG testing (Direct Current Voltage Grading testing), ACVG testing or PCM testing will be executed in order to test for holidays which might have been effected as a result of construction. The purpose of these tests are not to find deficiencies in the coating of the pipe as a result of the manufacturing process.

The described DCVG or alternative testing has to take place only after a set duration after backfilling and bedding of pipe has expired. This duration is to be agreed with the Engineer and the Contractor has to make provision for this time lapse in his construction programme.

The results for the first section which undergoes testing, will be utilized to establish a baseline for remedial work to be effected to damaged coating as a result of construction activities. The baseline defining the maximum size (1x16 mm² defect per 100 m² of surface coating) of allowable coating defects will be established utilizing reference coupons. The agreement on this baseline, between the Contractor and the Engineer, will set the criteria for the repair requirements by the Contractor.

The Employer will also utilize this information for the establishment of Cathodic Protection criteria.

The Contractor shall be required to do repairs to all sections of the pipe line where holidays outside the acceptable parameters were found and established to be above the set baseline as determined above. The cost for such repairs shall be borne by the Contractor.

DCVG testing is normally prescribed as the most desirable test.

The Contractor is to programme DCVG testing to proceed before surfacing of a road is required where the pipeline is situated under a road with paved surface.

PA C10 3 THERMIC WELDING

Should the Employer require that thermic welding of cables to the newly laid pipe be required for Cathodic Protection purposes, as instructed by his CP specialist, the Contractor shall provide the Employer with adequate access for same. The Contractor shall be required to expose the metal of the pipe at the said location by removing the coating and/or wrapping for thermic welding. After the thermic welding process has been completed, either by an external CP specialist or the Contractor, the Contractor shall be required to repair the coating to a standard acceptable to the Engineer. The inside lining at the thermic welding location shall also be repaired to the satisfaction of the Engineer, in terms of this specification. The tendered rates for the repair of lining and coating as a result of thermic welding shall fully cover all the cost for the work required.

PA C10 3.1 THERMIC WELDING – CABLE INSTALLATION

Removal of existing tape wrap to effect thermal welding shall be by means of cutting a 50mm by 50mm square out of the existing tape wrap.

Thermal welding shall be done in terms of the manufacturer's specifications, by cathodic protection technicians, as employed by the Employer.

The cables shall be flattened on the pipe in a longitudinal direction and the thermal weld area shall be completely covered with a Densotherm HD or similar approved. The cable shall be covered over a longitudinal distance of 500mm past the thermal welded point, with the applicable mastic.

The approved Tape Wrap system shall be applied over the existing tape wrap system from a distance of 300mm before the thermal weld to a distance of 500mm after the thermal weld, over the mastic coated cables.

The existing tape shall be well degreased and cleaned before application of the layer of tape that covers the cables and the thermal weld.

Internally the lining shall be repaired as per the corrosion protection specification.

PA C10 4 CROSS BONDING

At locations where existing pipelines run parallel to the newly constructed pipeline, it would be required to cross bond the newly constructed pipe to the existing pipe for cathodic protection purposes. These locations will be as directed by the Engineer, based upon input from the Employers specialist corrosion protection consultant.

This will require horizontal trenching from the existing pipe trench to the pipeline next to the existing pipe line. An item for inclusion of rates for this purpose is provided in the Bill of Quantities.

PA C10 5 CATHODIC PROTECTION LUGS AND INSULATING FLANGES

The Cathodic Protection (CP) System for underground pipe lines will normally be installed by a specialist contractor appointed by the Employer unless otherwise specified.

The Contractor may be required to weld CP lugs to the pipelines and fit isolation flange kits as indicated on the drawings.

The following points are highlighted for the installation procedure for Insulating Flanges:

- The insulating sleeves use up all the clearance between the stud bolt and the bolt hole in the flange. Alignment of flanges is therefore critical. Particular care is to be taken to align flanges either side of the valves or temporary spool pieces.
- The annular space between flanges, when installing an insulating gasket must be kept free of debris since this can make electrical contact and short the flange.
- Once the joint is fully assembled and the joint electrically tested, the annular space is to be filled with hot or cold electrical isolation compound and the outer periphery taped with a 0.3mm to 0.5mm layer of PVC tape.
- Any paint applied over the completed insulated joint is to be non-conductive.
- After the installation of an insulating joint, the electrical resistance of the joint should be checked. This resistance should be at least 10 000 ohms and if the resistance check reveals a resistance of less than 10 000 ohms, the joint should be inspected for damage, the damage repaired and the joint re-tested until the resistance falls within the limits as specified.
- The Contractor shall ensure that all flanged joints that are not deemed to be isolation joints, are in fact electrically continuous.

- The Contractor shall ensure that any Cathodic Protection cables or equipment installed by himself or other Contractors are fully protected during the course of the Works.
- Cross bonding to other services will be done by the Employer but the Contractor may be required to assist in this regard.

The tendered rates for the laying of the pipe and the installation of specials and fittings, shall be deemed to include for the provision and installation of isolation flanges as indicated on the drawings.

PA C10 6 EXTERNAL AND INTERNAL COATING AND LINING REPAIR AS RESULT OF THERMAL WELDING OF CABLES ONTO PIPE

Removal of existing tape wrap to effect thermal welding shall be by means of cutting a 50mm by 50mm square out of the existing tape wrap.

Thermic welding shall be done in terms of the manufacturer's specifications, by cathodic protection technicians, as employed by the Employer.

The cables shall be flattened on the pipe in a longitudinal direction and the thermal weld area shall be completely covered with a Densotherm HD or similar approved. The cable shall be covered over a longitudinal distance of 500mm past the thermal welded point, with the applicable mastic.

The approved Tape Wrap system shall be applied over the existing tape wrap system from a distance of 300mm before the thermal weld to a distance of 500mm after the thermal weld, over the mastic coated cables.

The existing tape shall be well degreased and cleaned before application of the layer of tape that covers the cables and the thermal weld.

Internally the lining shall be repaired as per this specification where the effects of the thermic welding heat are prevalent on the coating system.

The main contractor shall allow in his programme for the construction of the Works for work pertaining to Cathodic Protection where this allowance shall include for coating and lining repair and DCVG testing.

PARTICULAR SPECIFICATION – CORROSION PROTECTION

11 - FREE ISSUE PIPE MATERIAL_MANAGEMENT OF COATING AND LINING DEFECTS

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PREAMBLE

This Particular Specification deals with managing coating and lining defects in free issue pipe materials.

At pipe yards

At work fronts

PA C11 1 INTRODUCTION

Where the Employer provides free issue pipe, the pipe will typically be stored in a pipe yard, either close to the construction site or at the Employer's depot. The Contractor has to uplift free issue pipe as delivered and assume responsibility for the pipe in a condition agree to at the point of upliftment. This means that existing coatings and linings and pipe condition in general needs to be verified before transfer of the responsibility thereof and or mechanisms need to be in place to rectify defects after acceptance of transfer of responsibility.

PA C11 2 HOLIDAY TESTING OF PIPE AT PIPE YARDS UPON DELIVERY FROM SUPPLIER

The Employer will, at his cost, have the external pipe coatings checked at the point of delivery, as supplied by the pipe manufacturer. All defects are indicated on the Independent Third Party test reports and the Contractor shall be required to repair same at the cost of the Employer.

The Contractor shall execute holiday detection tests on all the pipe coatings and linings in the pipe yard before uplifting and transportation commences for pipe to be incorporated into the Works. This will be witnessed and signed off by the Employer's Representative or the Engineer. This assessed condition will determine the baseline for use when handling and transportation damage for construction purposes need to be addressed.

Once the Contractor has accepted pipe from the Employer in terms of the pipe yard assessment, any subsequent damage will be repaired at the Contractor's cost in accordance with the procedure below.

Pipes with coatings and linings damaged prior to acceptance shall be recorded by both the Contractor and the Employer's Representative or the Engineer and repaired in accordance with the procedure below. The Contractor will be compensated for repairs effected to linings and coatings which were damaged as a result of the manufacturing process or as a result of handling and transportation to the pipe yard and off loading at the pipe yard by the supplier.

PA C11 3 REPAIR OF LINING AND COATING DEFECTS - EMPLOYERS DELIVERED PIPE

The Contractor shall, when he executes spark tests on free issue pipe in pipe yards, clearly mark all defects found which are deemed to be unacceptable. Defects as detected shall be incorporated into the pipe weld and pipe data maps and signed off by the Engineers Representative.

The Contractor shall be required to effect repairs of coating and lining as agreed to be Employers risk damage. A provisional quantity is allowed for this purpose under the Preliminary and General section of the Bill of Quantities against which the Contractor should enter a rate. The rate provided for these repairs shall be deemed to fully cover the cost of all work required to complete the repairs as agreed to.

PA C11 4 UPLIFTMENT OF PIPE FROM PIPE YARD – INSPECTION REQUESTS

The Contractor shall give notice to the Engineer, 24 hours before upliftment is scheduled, in order for the Engineer to make the required arrangements for a representative to be available for the pipe inspection in the pipe yard.

The Contractor's attention is drawn to the fact that, should he not have the required equipment and staff ready at the pipe yard at the agreed time, the scheduled upliftment will be cancelled and another scheduled agreement on time will have to be determined.

PA C11 5 UPLIFTMENT AND REMOVAL OF FREE ISSUE PIPE TO THE WORK FRONTS

Once the pipe lining and coating has been checked in situ in the pipe yard and agreement has been reached on the pipe condition as well as lining and coating condition, the Contractor shall commence with upliftment procedures.

No claim for defect of general pipe condition as a result of the pipe being deemed free issue material shall be entertained after the pipe has been checked and condition assessment has been agreed upon. It will be the Contractor's responsibility to ensure that pipe is uplifted and transported to the work front in such a manner that the pipe integrity remains intact. Any damage inflicted to the pipe, the lining or coating, in the process of upliftment and transportation will be the responsibility of the Contractor.