PARTICULAR SPECIFICATION DLD

LEFT BANK OUTLET WORKS REFURBISHMENT

REVISION 0

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Name	Signature	Date

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DLD 1 SCOPE

DLD 1.1 Background and Site Description

Darlington Dam (previously known as Lake Mentz) is situated in the Eastern Cape, 112 kilometres by road South East from Kirkwood. The Dam has multiple outlet works, one of which being the Left Bank Outlet Works. The Left Bank Outlet Works consists of six vertical shafts with 3 independent inlets per shaft (each vertical shaft shall hereby be referred to as Line i.e. Vertical Shaft 1 referred to as Line 1). The dam currently utilizes the bottommost (Level A) inlet from each line to release water for irrigation purposes. Hydraulically actuated sleeve valves are used to control the release of water from the Left Bank Outlet Works. The upper two inlets (Levels B & C) of each line are blanked off on the downstream end. All 18 inlets consist of 1295 mm I/D cast iron pipes encased in the concrete dam wall. The lines are numbered 1 to 6 from left to right (when looking downstream). The refurbishment (corrosion protection) of Line 3 has been completed. The remaining 5 shafts remain in the existing un-refurbished condition. Currently installed at the inlets of Line 3, is a caisson which was used to conduct the refurbishment of the abovementioned line. The dam makes use of an emergency gate for upstream isolation of the individual intakes. There is a 10 Ton gantry crane available on the dam NOC. Refer to Table 1 below for a list of relevant Engineering Drawings describing the Left Bank Outlet Works.

Table 1: List of Drawings

Drawing Description	DRG No.
Emergency Gate Frames	25197/50 ME
Emergency Gate Frames and Guide Rails	25622/50 ME
Left Bank Outlets	29536/52 ME
1295 mm I/D Downstream Pipework and Sleeve Valves	104374/88 ME
Plan View of Outlet Structure	108057/90
Sleeve Valve 1000 NB	108559/90 ME
Discharge Curve of 1000 mm NB Sleeve Valve	108560/90 ME
100 mm NB Drainage Assembly	109013/90 ME
Clearance Diagram of 10 Ton Gantry Crane	128691/98 ME
Refurbishment of Left Bank Outlet Works	181910/25 ME
Caisson Extension	12N701-001

DLD 1.2 Overview and Site Requirements

The Main Contractor shall be responsible for his own plant and equipment necessary to perform the task at hand, unless otherwise specified in this Specification or agreed (in writing) by the Engineer. It is imperative that the Main Contractor, during the compulsory meeting held at the Site, familiarise himself with Site conditions, layout and available resources on the Site to determine a feasible methodology to perform the scope of work.

If any mechanical or electrical equipment on Site that are deemed necessary to perform and execute the scope of work, or any existing Site conditions are found by the Main Contractor to be lacking in performance or serviceability, the Main Contractor shall bring it to the attention of the Engineer, in writing, prior to any work commencing.

After handing over of the Site to the Main Contractor, he shall put in place lockout procedure(s) on Site access and equipment operation in agreement with the relevant Departmental personnel. The Main Contractor shall be responsible for the actions of all personnel on Site upon handover of the Site.

A contingency plan shall be in place while performing the tasks at hand and shall include the following:

- The Main Contractor shall maintain Site security, preventing any unauthorised personnel or persons from entering or operating any equipment, by the lockout procedures that have been put in place.
- The Main Contractor shall maintain the relevant Occupational Health and Safety regulations while executing the scope of work.

DLD 1.3 Services Required

The scope of work shall include the supply of all materials, manufacture, shop assembly and testing, corrosion protection, delivery to Site, installation at Site, corrosion protection at Site, putting to work, testing, Tests on Completion of the work listed below and as further indicated in DRG. No.: 181910/25 ME:

- Sleeving of existing cast iron 1295 mm I/D pipes with new stainless steel 304L 1000 mm NB pipes, including new stainless steel 316L 1000 mm NB breastplates (as indicated in DRG. No 181910/25 ME).
- Downstream pipes and specials of Level A (bottom) inlets consisting of a 1000 mm NB 24-degree pipe bend, with access manhole and accompanying anchors, fasteners and gaskets.
- Refurbishment of five (5) existing sleeve valves installed on Lines 1, 2, 4, 5 and 6, including accompanying hydraulic power pack and valve position indicators.
- One (1) off 5 Ton rated manually operated low head room type chain hoist as detailed further in this Particular Specification
- Six (6) off 5 Ton rated crawl beams complete with supplementary equipment detailed further in this Particular Specification.
- Removal, refurbishment and installation of existing caisson. Relocation of the caisson between the intake shafts shall form part of the services required by the Main Contractor.
- New emergency gate guide rails (with gate stops) and trash screen guide channels.
- New trash screens (replicated from existing manufactured trash screens - 6 sets required) together with “As-Built” drawings thereof.
- Associated diving work surrounding the work covered in this Particular Specification.
- Grouting between the existing cast iron equipment and new stainless steel equipment.
- Delivery to- and from Site of any plant, equipment, newly manufactured-, refurbished- and decommissioned items.

DLD 1.4 Conditions of Contract

The conditions governing this contract are set out in the document ‘General Conditions of Contract for Construction Works – Third Edition (2015)’.

Contracts for this Particular Specification will only be awarded to South African-based contractors who, after assessment by the Department, are found to be experienced with the manufacture and supply of equipment and services to the required standard. Only Contractors who can demonstrate that they or their Sub-contractors are legitimate and bona fide manufacturers of the equipment specified in this Specification, with their own local manufacture- and service facility within the Republic of South Africa, are eligible to submit a bid. Workmanship shall conform to acceptable industrial standards and welders shall be coded. The size of the instruments and equipment used shall be proportional to the task at hand.

The Department of Water and Sanitation reserves the right to purchase the equipment outlined in the Bill of Quantities from any of the received offers. The splitting of the equipment purchase in this manner shall not affect the Quotation Price indicated in the Bill of Quantities for any of the offered items.

Due to potential changes to the Scheme's layout and requirements, the equipment specification may be modified. Prior to placing an order, the Department reserves the right to unconditionally change the quantity of any equipment without incurring any penalties from the Contractor. The pricing for any such modifications made after the order has been placed will be negotiated at that time.

The Contractor shall not alter or modify any portion of the design, or the equipment offered under this Contract without the Engineer's written consent. The Department shall not accept any additional costs for any portion of this Contract resulting from non-compliance with this Particular Specification.

The Contractor shall make available appropriate personnel with decision-making authority from his company for meetings with the Department (this may include technical or justifiable personnel based at the Site, namely Darlington Dam) when scheduled by the Engineer. No additional costs will be considered for such meetings.

DLD 1.5 Defects Liability Period

The Defects Liability Period as stipulated in the Particular Conditions of Contract for Mechanical & Electrical Works (General), shall read 12 (twelve) months from the date of issue of the Commissioning Certificate by the Engineer to the Contractor and shall terminate with the issue of the Final Certificate by the Department. It is envisaged that commissioning will take place within 30 days of completion of all outstanding points. The Contractor’s Guarantee shall include all aspects of the manufacturing and installation process done by any Sub-contractors.

DLD 1.6 Target Date for Delivery

The Main Contractor shall submit a detailed project schedule indicating the initiation and completion of the project within 36 months after appointment.

It is important to note that any early delivery is sought and it is essential that delivery periods indicated by the Main Contractor in his bid are realised, otherwise penalties may be enforced.

The Main Contractor shall supply a draft program with the bid for this Particular Specification.

DLD 1.7 Technical Schedules

Appendix A contains all technical schedules relevant to this Particular Specification. These schedules shall be completed at the time of bidding.

DLD 2 INTERPRETATIONS

DLD 2.1 Specifications and Supporting Standards

This Particular Specification shall where applicable, have preference over all other sections of this Bid Document or any Standard Specifications referred to.

This Particular Specification shall be read in conjunction with the following (of which the latest editions shall apply):

(a) American Water Works Association

AWWA C207: Steel pipe flanges "100 mm through 3600 mm"
AWWA MANUAL M11: Steel Pipe – A guide for Design and Installation

(b) American Petroleum Institute:

API 5L: Specification of line pipe
API 1104: Standard for welding pipelines and related facilities

(c) British Standard:

BS 806: Specification for design and construction of ferrous piping installations for and in connection with land boilers.

BS 2782: Methods of Testing Rubber

BS 2853: 2011 Specification for the testing of steel overhead runway beams for hoist blocks

(d) British Standard European:

BS EN 13001-1: Cranes; General design; General principles and requirements.

BS EN 13001-2: Crane safety; General design; Load effects.

BS EN 13157: Cranes; Safety; Hand powered cranes

(e) Departmental Standard Specifications (which are available on request):

STANDARD SPECIFICATION DWS 1601: GENERAL MECHANICAL SPECIFICATION (November 2015 edition)

STANDARD SPECIFICATION DWS 1602: PREPARATION OF MECHANICAL AND ELECTRICAL ENGINEERING DRAWINGS (September 2017 edition)

STANDARD SPECIFICATION DWS 2020: QUALITY CONTROL SPECIFICATION (October 2001 edition)

STANDARD SPECIFICATION DWS 2510/01: SUPPLY OF VALVES – GENERAL VALVE SPECIFICATION (January 2007 edition)

STANDARD SPECIFICATION DWS 2510/13: SUPPLY OF VALVES – SLEEVE VALVES (January 2007 edition)

STANDARD SPECIFICATION DWS 9900: CORROSION PROTECTION SPECIFICATION (Second Edition: July 2022)

(f) South African Bureau of Standards:

SANS 121: Hot dip galvanized coatings on fabricated iron and steel articles – Specifications and test methods

SANS 719: Electric welded low carbon steel pipes for aqueous fluids (ordinary duties)

SANS 1594: Manually operated chain blocks

SANS 1700: Fasteners

SANS 10044:	Welding
SANS 10160:	Basis of structural steel design and actions for buildings and industrial structures
SANS 10162:	Limit state design of hot-rolled steelwork
SANS 10167:	The quality evaluation of fusion welded joints in steel structures
SANS 50025:	Hot rolled products of structural steels

(g) Occupational Health and Safety Act, 1993 (Act 85 of 1993)

(h) Other:

ASME IX:	Boiler and Pressure Vessel Code
DIN 15401	Lifting hooks for lifting appliances; Single hooks; Finished parts with threaded shank
ISO 3302-1:	Rubber – Tolerances for products

DLD 2.2 Definitions and Abbreviations

Main Contractor: The party to whom the contract comprising this Particular Specification is awarded to.

Employer: Department of Water and Sanitation (DWS).

Engineer: Employers Agent, represented by Directorate: Strategic Infrastructure Asset Management (SIAM) – Sub-Directorate: Mechanical Asset Management

Installation: This shall include, as applicable, all handling and transport to- and from storage, if necessary, all erection and setting to work. All installation shall be done by the Main Contractor.

Site: The location: Darlington Dam in the Eastern Cape

Sub-contractor: The party to whom parts of this Particular Specification is sub-contracted to by the Main Contractor.

Specification: This Particular Specification together with any references therein to other documents.

Supply: This shall include, as applicable, the purchase of materials or goods, manufacture and fabrication, any specified corrosion protection measures and any off-site inspection or testing.

Tests on Completion: This shall include, as applicable, all functional tests requested by the Engineer as specified within this Particular Specification.

Abbreviations:

ABS	:	Acrylonitrile-butadiene-styrene
Al	:	Aluminium
BOQ	:	Bill of Quantities
CI	:	Cast iron - grade 220
CS	:	Cast steel
c/w	:	Complete with
DCA	:	Die cast aluminium
DFT	:	Dry film thickness
Fasl.	:	Feet above sea level
FBE	:	Fusion-bonded Epoxy
FBP	:	Fusion-bonded Polyester
FBPE	:	Fusion-bonded Polyethylene
FSL	:	Full Supply Level
GRP	:	Glass fibre reinforced Polyester
HDG	:	Hot-dip galvanized
HDPE	:	High Density Polyethylene

Masl.	:	Meter above sea level
NOC	:	Non-overspill crest
RL	:	Reduced Level (in masl.)
PC	:	Polycarbonate
PVC	:	Polyvinylchloride
MS	:	Mild steel or any carbon steel
SG	:	Spheroidal graphite cast iron – grade 420
SS	:	Stainless steel – grades 304, 304L, 316 and 316L
UV	:	Ultraviolet
3Cr12	:	Corrosion resistant steel
µm	:	Micrometer

DLD 3 MATERIAL

DLD 3.1 Pipes & Specials

Unless otherwise indicated on the drawings or supplementary schedules:

- Pipes and specials of 600 kPa rating and nominal diameter of 600 mm and larger shall be manufactured from stainless steel 304L and in accordance with SANS 719, irrespective of being cast in concrete or not.
- Breastplates, bell mouths and sealing strips shall be manufactured from stainless steel 316L.

DLD 3.2 Emergency gate guide rails and trash screen guide channels

Emergency gate guide rails shall be manufactured from mild steel to SANS 50025 S355 or equivalent. Trash screen guide channels shall be manufactured from stainless steel 316L.

DLD 3.3 Trash Screens

Trash screens shall be manufactured from stainless steel grade 316L and corrosion protected in accordance with Clause DLD 7.3.2.

DLD 3.4 Flanges

All flanges (including blank flanges) shall be manufactured from mild steel to SANS 50025 S355 or equivalent, preferably by forging or cut from plate, or (less preferably) by welded ring segments according to AWWA C207. Flange drilling shall be in accordance with SANS 1123 Table 1000/3.

DLD 3.5 Gaskets

Gaskets shall be manufactured from EPDM, nitrile or other similar approved equivalent material which complies with a shore hardness between 60-65. All gaskets shall be 3 mm thick and purpose made to the dimensions of the matching flanges.

DLD 3.6 Bolts and nuts

Unless otherwise stated on the drawings, bolts, nuts, studs and washers shall comply with SANS 1700 and shall be hot dip galvanized in accordance with SANS 121.

DLD 3.7 Sleeve Valves

Sleeve valve components, such as rings, bearings, spacers and various shaft components shall be manufactured from the materials as specified in DWS 2510/13. Components to be manufactured shall be identified after the valves have been stripped and inspected by the Engineer and Sleeve Valve Specialist.

DLD 3.8 Monorails

Monorails shall be manufactured from mild steel to SANS 50025 S355 or equivalent and shall be hot dip galvanized in accordance with SANS 121.

DLD 4 PLANT

The Main Contractor and all Sub-contractors shall utilise such plant and equipment as is necessary to safely and efficiently carry out the manufacturing, installation, testing and commissioning of the items covered by this Particular Specification, all in accordance with the Occupational Health and Safety Act 85 of 1993.

DLD 5 MECHANICAL DETAILS AND REQUIREMENTS

DLD 5.1 Pipes and Specials

DLD 5.1.1 Welding of Pipes and Specials

SANS 1476, SANS 719, BS 2633 and BS 534 shall be also deemed to apply to the manufacture of pipes and specials from submerged arc spirally – or longitudinally welded "cans", rolled from low carbon steel plate, 3CR12, 304L, 316L and 2205 stainless steel plate of designated specification and then joined by submerged circumferential welding or MIG flux core welding to form suitable pipe lengths.

When two dissimilar metals are welded together, the appropriate weld procedure shall be used and the integrity of the weld ensured.

The following additional requirements shall apply with regards to welding of pipes and specials:

(a) All butt-welds and branch fillet welds on specials, where practical, shall have an internal weld. The weld bead of this internal weld shall not extend above the prolongation of the original inside surface of the pipe by more than 1,0 mm. Internal reinforcement in the form of backing rings at weld seams shall not be permitted.

(b) All pipes and specials shall be subjected to a hydraulic pressure test in the manufacturer's workshop, as specified in Clause DLD 8.3.

(c) In relation to Site welds, the radiographic technique, adjudication of radiographs and repair of defects shall be in accordance with API 1104.

(d) Site welding of pipes shall be carried out as indicated in DRG. No. 181910/25 ME.

DLD 5.1.2 Qualification of Welders

All manual or semi-automatic welds and repair welds shall only be undertaken by welders qualified under tests laid down in the latest issue of the ASME "Boiler and Vessel Code", Section IX for the relevant scope of welds specified. Circumferential site welds shall conform to DRG. No. 181910/25 ME.

DLD 5.1.3 Non-destructive Tests and Adjudication of Workshop and Site Welds

The radiographic technique, adjudication of radiographs and repair of defects shall be in accordance with API 1104. Ultrasonic inspection techniques, interpretation and repair of defects shall be in accordance with API 5L.

DLD 5.2 Specific Requirements for Pipes and Specials

DLD 5.2.1 Dimensional Requirements

All dimensions and tolerances shall be in accordance with the drawings. Where not indicated, tolerances shall be in accordance with SANS 719 Clause 5.1.

Pipe ends to be joined by Site welding require appropriate spider-jacks and pipe chain clamps to ensure the acceptable ovality tolerance mentioned above is achieved and to accommodate the combined tolerance of the two adjacent connecting pipes. All such tools shall be provided by the Contractor free of charge.

DLD 5.2.2 Specials

Specials shall generally be manufactured from pipe conforming to this Particular Specification (i.e. pipe that has been successfully subjected to a hydraulic pressure test as specified in Clause DLD 8.3). Where detailed drawings of the specials are provided, the specials shall comply in all respects with the drawings. Where constructional details are not indicated on the drawings, these issues shall be communicated in writing by the Main Contractor to the Engineer before any work is carried out.

(a) Weld Bead:
The internal weld bead on circumferential and longitudinal welds, measured from the pipe inner surface, shall not exceed 1,0 mm.

(b) Bends:
Bends shall have their vertical "centre plane" marked with two small punch marks close to both ends of the bends to facilitate correct positioning of the bends during installation and/or assembly.

(c) Branches and Nozzles for Bypasses, Drains, Air Valves, Pressure Gauges, etc.:
Centre lines of nozzles and branches shall be at right angles to the barrel of the pipe, unless indicated otherwise on the drawings.

DLD 5.2.3 Flanges and Gaskets

All flanges shall be supplied complete with bolts, nuts, washers, full face gaskets and (where applicable) isolating sleeves.

All bolts and nuts shall be in accordance with DWS 1601 – "General Mechanical Specification". All bolt sizes shall conform to the requirements set forth in clause DLD 3.6 and Table 3.

Flanges shall be drilled "off-centre" and in accordance with Table 3 below and the drawings. Flange thickness shall be in accordance with the drawings. Flange faces shall be in accordance with Table 2 below. Where not indicated, flanges shall be designed to have a uniform thickness, adequate in terms of an appropriate design code, to withstand the design working pressure within specified stress levels, and subject to the approval of the Engineer. The flange face shall have a circular or gramophone finish with a maximum surface roughness as indicated in the drawings.

The following shall apply unless stated otherwise in the drawings:

Table 2: Schedule of Flange Types according to Size and Pressure Rating

PIPE DIAMETER NB (mm)	PRESSURE RATING ≤ 1600 kPa	PRESSURE RATING ≥ 2500 kPa
0 ≤ Ø ≤ 400	Full face gasket (i.e. flat faced flange)	Full face gasket (i.e. flat faced flange)
400 < Ø ≤ 2 500	Full face gasket (i.e. flat faced flange)	Raised face
Ø > 2 500	O-ring	O-ring

Details of the proposed "O" ring groove design shall accommodate corrosion protection requirements and shall be furnished at the Tender stage for consideration.

Table 3: Schedule of Flange Dimensions & Drilling according to Pressure Rating

PRESSURE RATING (kPa)	PIPE NB (mm)	FLANGE BODY DIMENSIONS (EXCL. THICKNESS; SANS 1123, Ed. 3.1)	DRILLING TABLE (SANS 1123, Ed. 3.1)
1 000	1600 & 1800	1 000/1B	1 000/1B
1 000	< 1600	1 000/3	1 000/3
1 600	ALL	1 600/3	1 600/3
2 500	ALL	2 500/3	2 500/3
4 000	≤ 500	BS 4505 Table 40/3	BS 4505 Table 40/3
4 000	> 500	NWS 1676 Table 40/3	NWS 1676 Table 40/3

(a) Joints rated below 4000 kPa:

The flange body dimensions (excluding thickness) for sizes smaller than 1 600 mm NB shall be as for steel plate flanges for welding as detailed in SANS 1123 Table 1000/3. The minimum flange rating shall be SANS 1123 Table 1000/3 for all working pressures up to 1 000 kPa. The minimum pressure rating for the drilling of flanges shall be according to SANS 1123 Table 1000/3.

The flange body dimensions (excluding thickness) for size 1 600 mm NB to 2 000 mm NB shall be as for integral iron flanges as detailed in SANS 1123 Table 1 000/1B.

Should standard flanges in accordance SANS 1123 Table 1000/3, including flange thicknesses, be offered by the Main Contractor, he shall communicate this in writing to the Engineer for approval prior to any material being purchased. Should thicker flanges be offered (without any cost escalations), the Main Contractor shall ensure that the additional flange thickness be directed away from the pipe's flanged ends. In other words, the Main Contractor shall ensure that the pipe's "flange face-to-face", "face-to-plain end" and/or "flange-to-centreline" dimensions are strictly in accordance with the dimensions and tolerances set out in the drawings.

Blank flanges shall be manufactured in accordance with the drawings. On- and off- Site testing of blank flanges shall follow the same procedures as with pipes and specials.

DLD 5.3 Breastplate, Sealing Interfaces and Guides (Hydromechanical Equipment)

The new breastplate shall be manufactured from stainless steel 316L in accordance with the drawings. The bell mouth section of the intake shall form part the manufactured breastplate. The drawings shall also provide a detail guide to installation of the new breastplate with special attention to adjustment and allowable tolerances for the installation. These tolerances are set forth to ensure that the emergency gate can seal successfully under unbalanced conditions.

The Main Contractor shall also supply new emergency gate guide rails and trash screen guide channels in accordance with the drawings. These guides shall be fastened onto the new breastplate, as well as chemically anchored through new holes onto the existing concrete on the upstream face of the dam wall. Contact between dissimilar materials (stainless steel anchors/fasteners through mild steel equipment) shall be isolated by means of fastener insulating kits where applicable.

DLD 5.4 Valves

DLD 5.4.1 Existing Sleeve Valves

Currently installed on the Left Bank Outlet Works, are six (6) 1000 mm NB hydraulically operated sleeve valves. Refurbishment by a sleeve valve specialist, and in accordance with DWS 2510, is required on five (5) of these sleeve valves. The sleeve valve of Line 3 does not require refurbishment. The scope of refurbishment includes, but not limited to, stripping of the valve, replacement of the seals, repairs of potential defects, conformance to the manufacturer's tolerances, refurbishment of all corrosion protection, re-assembly of the valves, setting of the seals, pressure testing and other work that the Engineer may deem necessary. A full inspection shall be carried out in the presence of the Engineer and the sleeve valve specialist after stripping of the valve to determine the scope of refurbishment. A twelve month guarantee on the product and services surrounding the sleeve valve refurbishment shall be provided by the sleeve valve specialist. Should this entail an additional fee, this shall be indicated in the Bill of Quantities by the Main Contractor. A functional test of the five sleeve valves shall be completed at the workshop, using sleeve valve specialist's hydraulic power pack to actuate the valve during testing.

Complete new valve position indicators shall form part of the supply with the refurbishment of the five sleeve valves mentioned above. A "like-for-like" replacement of the sleeve valve position indicator is required. The current system translates the linear position of the sleeve to a signal by means of a rotary encoder. This signal is relayed to the position indicator located on the NOC. Routing of cables and wires shall be kept in the same configuration as the existing setup. New encoders shall be compatible with the existing power pack read outs. Signal cables shall run in hot dip galvanized conduits, separate from any other electrical wiring.

DLD 5.4.2 Existing Hydraulic Power Pack

Servicing of the hydraulic power pack shall form part of the services provided by the sleeve valve specialist. The hydraulic oil shall be completely drained from the hydraulic oil reservoir and replaced with the required grade of hydraulic oil. Furthermore, the air breather dryer (desiccant breather) shall be replaced with a new unit. A functional test shall be conducted on Site to ensure complete functionality with the five refurbished sleeve valves. Functionality with all six sleeve valves, as well as their respective position indicators, shall be tested on Site.

DLD 5.5 Mono Rail and Chain Hoist – rated at 5 Metric Ton

DLD 5.5.1 Crawl Beams

Mono rail hoist beams shall be designed, manufactured, installed, load tested and certified as specified in the drawings. All mono rails shall be hot dip galvanized in accordance with SANS 121. The crawl beams shall be equipped with removable stops on each end. These shall be removed and re-installed by the Main Contractor after having installed the chain hoist onto the mono rails. The span and positioning of the mono rail hoist beams shall be in accordance with the drawings.

The mono rails shall be retrofitted to the existing concrete forming part of the dam wall by means suitably sized stainless steel chemical anchors. Special consideration shall be given to working and installing chemical anchors in an overhead position. Dissimilar materials shall be insulated in accordance with DWS 9900.

Load capacity display plates shall form part of the supply of mono rail crawl beams. These display plates shall be either riveted or screwed onto each crawl beam using hot dip galvanized mild steel fasteners. Fasteners shall not protrude more than 5 mm from the I-beam web faces on each side of the beam. The display plate material shall be metal vehicle number plate-style with a yellow background and black lettering. The lettering shall be approximately 120 mm high and bold. The display plate shall be positioned such that it is clearly visible during operating conditions. Non-metallic display plates, stickers or painted-on lettering shall not be accepted.

An upstream section of the beam shall be marked as the "storage" position of the hoist. This shall be annotated on a display plate similar to the load capacity display plate.

DLD 5.5.2 Manually Operated Block & Tackle Type Chain Hoists

One manually operated block and tackle type chain hoist, as specified in the drawings, for use on all six (6) hot dip galvanised mild steel crawl beams shall be primarily used during maintenance periods. These units shall comply with SANS 1594.

The chain hoist shall be equipped with a manually operated geared crawl which shall correspond with the hoist capacity. Due to limited head room, the chain hoist shall be the low head room type. The crawl and chain hoist shall be supplied with suitably load rated zinc plated mild steel chains which shall not hang closer than 400 mm to the floor.

Load chains shall, after installation, be lubricated with a dry, chain-type lubricant. The chain hoist shall be equipped with an appropriately sized hot dip galvanized mild steel chain bucket. The bucket shall be designed such that it facilitates easy movement of the load chain and shall be capable of accommodating the full length of load chain supplied. The load chain bucket shall have drainage holes to prevent the accumulation of water therein.

The load capacity of the chain hoist as well as each crawl shall be clearly displayed on each unit. This figure shall correspond to the actual rating of the total hoist system, including all safety mechanisms. All equipment supplied shall conform to the relevant industry and safety standards.

A durable and flexible cover shall also be provided to shroud the chain hoist, protecting the chain hoist from the environment as well as from the spray produced from the downstream sleeve valve. This cover shall be permanently secured to the beam using 3 mm hot dip galvanized wire rope and suitable ferrules. Neither the cover, nor the wire rope, shall hamper movement or operation of the chain hoist.

When inactive, the chain hoist shall be positioned in the "storage" position mentioned in DLD 5.5.2 where the abovementioned cover shall be found. This shall aid in sheltering the chain hoist and the flexible cover from the external weather elements.

DLD 5.6 Removal, Refurbishment and Re-installation of Caisson

Line 3 of the Left Bank Outlet Works currently has a caisson installed which was used to create a dry working area for the works to be carried out there. The Main Contractor is required to safely remove the caisson from Line 3. Thereafter, a condition assessment will be done in the presence of the Engineer or his representative. The outcomes of this assessment will provide a more finite scope of the refurbishment works to be carried out on the caisson. The refurbishment work predicted is, but not limited to: disassembly, reinstating the structural integrity of the caisson, remedial repair work of any structural and corrosion defects and corrosion protection in accordance with DWS 9900 2nd Edition.

Once the caisson is deemed safe by the Engineer, it shall be used on the remaining five (5) intake shafts to facilitate the installation and finer adjustment of the bell mouths and breastplates. The Main Contractor shall assess the lifting and rigging equipment available on Site. This shall be indicated in the Bill of Quantities by the Main Contractor and no subsequent additional claims shall be allowed.

Once all five (5) intake shafts are refurbished in accordance with this Particular Specification, the Main Contractor is required to safely remove, disassemble and deliver the caisson to a location agreed upon with the Engineer or his Area Representative.

The Main Contractor is required to provide any associated dewatering pumps and supplementary equipment to dewater the intended dry area within the caisson, as well as any other additional equipment for Site work.

DLD 5.7 Associated Diving Works

The Main Contractor shall provide in his Bill of Quantities a sum for the diving works associated with the work to be carried out on the upstream face of the dam wall. Special consideration shall be given to the limited visibility and ergonomics of carrying out work below water.

DLD 5.8 Trash Screens

The Main Contractor shall manufacture six (6) sets of trash screens. The new trash screens shall be a dimensional replica of the existing trash screens. The new trash screens shall be fabricated from stainless steel 316L, and in accordance with DWS 1601 – "General Mechanical Specification". Compatibility and functionality with the new trash screen guide channels and existing trash screen grapple shall be ensured. The Main Contractor shall also include in his supply "As-Built" drawings of the manufactured trash screens. These drawings shall comply with Standard Specification DWS 1602 "Preparation of Mechanical and Electrical Engineering Drawings".

DLD 5.9 Grouting

Grouting is required between the existing cast iron equipment found on the Left Bank Outlet Works and the new stainless steel equipment to be installed. The Main Contractor or the relevant Sub-contractor (Specialist Grouting Applicator) shall conduct an inspection of the cast iron pipes during the Site Briefing. Any special surface preparation methods shall be listed and indicated by the Main Contractor or Specialist Grouting Applicator and shall be included in his offer. Appropriate bondage shall be ensured between the grout and the new- and old equipment.

Special consideration shall be given to the high soluble salt content embedded in the cast iron pipes. In addition, space and equipment limitations shall be noted and accounted for by the Main Contractor or the Specialist Grouting Applicator. The strength of the grout shall be equal to or larger than 40 MPa. Voids in the grout shall at all times be kept to a minimum. No water leakage past any grouted areas shall be allowed. The Specialist Grouting Applicator shall provide a method statement for approval for the application of the grouting. "Non-shrink' or "shrink compensating" grout shall be used. The grout type shall be non-corrosive and free from chlorides.

The Specialist Grouting Applicator shall maintain his procedures strictly in accordance with the application guidelines set forth by the grout supplier/manufacturer.

Surface preparation methods shall be communicated to the Engineer in writing prior to work commencing. Any additional fees surrounding the surface preparation shall be covered in the Bill of Quantities.

DLD 5.9.1 Grouting between mild steel- and stainless steel breastplate

Prior to installation of the new (corrosion protected) stainless steel 316L breastplate, the existing mild steel breastplate shall be corrosion protected in accordance with the procedure outlined in Clause DLD 7. Once the new stainless steel breastplate is installed and adjusted to the correct spacing, the Specialist Grouting Applicator shall go forward with the application grout between the old and new breastplate. The Specialist Grouting Applicator shall provide the necessary formwork with sufficient venting to ensure full coverage of the void to be grouted. The Specialist Grouting Applicator shall indicate in his Tender minimum waiting periods for the setting of the grout and after which stress can be applied to the surface.

Strong emphasis is placed on the elimination of voids and/or air pockets within the grout. Methods for eliminating these voids and/or air pockets shall be communicated to the Engineer during the Tender stage. The grout applied shall be suitable for application in narrow and confined spaces (less than 60 mm), as well as being applied to vertical surfaces with a slope of 1:30.

DLD 5.9.2 Grouting between cast iron pipes and stainless steel pipes

Grouting is required between the existing cast iron pipes and the new stainless steel 304L pipes. The grout is required to completely fill the void between the two pipes. Once again, emphasis is placed on the avoidance of air pockets in the grout. The lengths of the pipes, around which grouting is required, are further detailed in the drawings. These lengths range from 5 meter to 12 meter depending on the level of the inlet being grouted. The Specialist Grouting Applicator shall take these lengths into consideration for the application of the grout. No considerable slope is present on any of the inlets on the Left Bank Outlet Works. The circumferential cavity to be grouted is approximated to a radial width of 100 mm.

Should the Specialist Grouting Applicator propose grouting the breastplate cavity and pipe cavity in one phase, this shall be communicated in writing to the Engineer.

DLD 5.9.3 Minor grouting

Additional grouting is required between the existing dam wall concrete and base plates. These base plates include those found downstream of the emergency gate guide rails, downstream of the trash screen guide channels and those below the downstream pipework. The same grouting requirements as outlined above shall apply.

DLD 5.9.4 Grouting plant and equipment

The Specialist Grouting Applicator and Main Contractor shall assess and outline limitations for equipment required to successfully complete the grouting work described above. Any plant and/or equipment required on Site shall be outlined in the Main Contractor's Bill of Quantities.

DLD 6 SITE INSTALLATION AND ERECTION

No mounting/attachment of any temporary equipment onto any existing infrastructure at the dam shall be permitted without the written approval of the Engineer.

DLD 6.1 Pipes and Specials

As far as practicable, all equipment shall be manufactured at the Main Contractor or Sub-contractor's workshop. The Main Contractor shall ensure that all manufactured items are delivered to Site in due time as to eliminate delays with other Sub-contractors on Site.

All plant and equipment required for the successful completion of this project shall be the responsibility of the Main Contractor. Such plant and equipment shall be suitably sized to safely and efficiently carry out the installation/erection, testing and commissioning of the work.

The appointed Main Contractor and his Sub-contractor(s) shall, on Site, comply with the Occupational Health and Safety Act to the satisfaction of the Dam Operator and Site Agent.

The Main Contractor shall be responsible for the complete installation of all pipes and specials covered under this Particular Specification. Installation thereof shall be done in accordance with DWS 1110: CONSTRUCTION OF PIPELINES, AWWA Manual M11 and the installation drawings.

Installation shall include transport from the point of storage at Site to the location of installation of each item, alignment of all pipes and specials according to the drawings, connecting of flanges and couplings, site welding, field testing and making good of corrosion protection, etc.

Alignment and reforming of pipe ends at joints for site welding purposes shall be achieved using suitable pipe chain clamps. The *EZPCC/10-72 SS 'E-Z Fit' Pipe Chain Clamp* or equal is recommended. Pipe ends shall be reformed from the inside using suitable spider jacks. Reforming of pipe ends shall not cause any localised denting or bulging of pipes. Stainless steel contact points and chain shall be used on the pipe clamps and spiders to reduce possible contamination on the stainless steel pipes.

Installation procedures shall include transport from the point of storage at Site to the location of installation of each item, alignment of all pipes and specials according to the drawings, connecting of flanges and couplings, site welding, field testing and making good of corrosion protection, etc.

DLD 6.2 Proposed Possible Procedures for Site Works

The Main Contractor is not obliged to strictly follow either procedure described below. Should the Main Contractor propose an alternative method for conducting the Scope of Work covered in this Particular Specification, this shall be communicated to the Engineer in writing for approval prior to work on Site commencing. Should this entail an additional fee, this shall be included in the Bill of Quantities. The Main Contractor shall, during the Tender stage, submit a draft method statement with estimated durations for the installation procedure he proposes. After appointment, the Main Contractor shall submit a detailed method statement explaining the Site works to the Engineer for approval.

DLD 6.2.1 Installation from Upstream Side of the Dam Wall

The caisson shall be safely removed, disassembled and delivered to the Main Contractor's workshop for inspection and determination of the scope of refurbishment. The caisson- and valve refurbishment, manufacturing of pipes, specials, breastplates, valves and lifting equipment shall be carried out in a suitably equipped workshop. During diving operations, no water shall be released from the Left Bank Outlet Works, unless in case of emergency. Flow shall be ceased by closing all six sleeve valves.

As detailed in the drawings, holes shall be drilled and tapped into the existing mild steel breastplate to suit the studs. These studs, together with two nuts and two washers (per stud) shall be used to accurately adjust the flatness of the new breastplate. With the use of specialist divers, the new 1000 mm NB stainless steel pipe lengths shall be lowered and slid into the respective 1295 mm I/D pipe inlets. The new 1000 mm NB bell mouth and breastplate assembly shall also be lowered by the divers and installed in position with the use of the abovementioned studs.

The refurbished caisson shall then be lowered and installed in position. Once successfully installed, the downstream sleeve valve will be partially opened to release the water within the pipe. Dewatering pumps can be used to facilitate the removal of this water and that within the caisson's intended dry working area.

The new breastplate and bell mouth assembly shall be adjusted using the studs and nuts. These nuts shall be tack welded after final checking of the breast plate alignment, using the emergency gate in front of each inlet. Holes on the old breastplate and existing dam wall concrete shall be drilled for the installation of the emergency gate guide rail anchors. These chemical anchors shall be set in accordance with the drawings. The new 1000 mm NB stainless steel pipes can be slid into the correct position and welded onto the new bell mouth. The Main Contractor shall ensure that anchors for the two sets of guides are strictly aligned within the allowable tolerance. Once sufficient 1000 mm NB pipe length protrudes from the downstream face of the concrete dam wall, the excess can be cut in accordance with the drawings. Plain ended pipes shall be welded in accordance with the drawings.

After checking of pipe alignment, the Specialist Grouting Applicator shall commence with applying the grout in the cavities between the old cast iron and new stainless steel equipment. Once the grout is set, the 1000 mm NB flange shall be welded on the downstream plain end of the pipe. Thereafter the accompanying pipe work (or blank flange for upper inlets) shall be installed. The sequence of fastening flange bolts shall be adhered to at all times. The emergency gate guide rails and trash screen guide channels can be mounted onto the new breastplate.

The downstream pipes, valves and specials (including the 100 mm NB drain pipe assembly) can be reinstalled. Minor grouting underneath base plates can be completed next. Upon the approval of the Engineer and commissioning of the now refurbished line, the caisson shall be safely removed and relocated to the next line where the above steps shall be repeated.

Any decommissioned equipment shall be delivered from Site to the Uitkeer workshop.

DLD 6.2.2 Installation from Downstream Side of the Dam Wall

Installation of the pipes and specials can also be carried out from the downstream side of the dam wall. As in the previous proposed procedure for installation, fabrication work on Site shall be minimised. Procedures as stated above for the work surrounding the caisson apply to this procedure as well. Flow is ceased by closing the existing sleeve valves. Thereafter, the monorail lifting beam shall be rigged and installed at the Level A (bottom) inlet. The caisson is then safely lowered and installed on the line intended for refurbishment. Once successfully installed, the water within the caisson and within the inlet is drained using temporary dewatering pumps (to be supplied by the Main Contractor).

Once dry, the existing downstream pipework (i.e. 1295 mm I/D 24 degree bend and 1000 mm NB sleeve valve) can be safely rigged away for storage and refurbishment respectively. The existing 100 mm NB drainage assembly shall be safely stored on Site for reinstallation later on. Holes are then drilled and tapped into the existing mild steel breastplate and the studs screwed in. The new breastplate is then lowered into position and fastened to the studs using two nuts and two washers per stud. These nuts shall be tack welded after final checking of the breast plate alignment, using the emergency gate in front of each inlet. A temporary pulley can be installed on the upstream face of the dam wall, directly above the pipe centreline. Alternatively, it can be mounted on the caisson if deemed safe. This will facilitate easier handling of the new 1000 mm NB pipes whilst being positioned in the existing 1295 mm I/D pipes.

The new stainless steel pipe lengths can be safely rigged into the Level A (bottom) inlet. The first pipe length can be partially slid into the existing mild steel pipe, creating more room downstream for the next pipe length.

This will allow the welding on the inside and outside of the pipe prior to being fully positioned within the 1295 mm I/D pipe. This procedure shall be followed for the remaining pipe lengths until sufficient pipe distance protrude from the downstream face of the dam wall, as indicated in the drawings. The bell mouth section shall then be welded to the first pipe length, creating one continuous item. Remedial corrosion protection in the weld area shall be carried out (in accordance with DWS 9900 Second Edition) prior to being rigged upstream into position.

Once the 1000 mm NB pipe length is welded to the new 1000 mm NB bell mouth, the Specialist Grouting Applicator shall then begin to apply grout between the old and new pipes. This will be done prior to welding the downstream 1000 mm NB flange, allowing more room for bleeding/venting of the grout. Once the grout has set, the previous proposed procedure (see Clause DLD 6.2.1) can be followed for the installation of the remaining pipes, specials, valves and drainage assembly. Precautions and safety measures highlighted in Clause DLD 6.2.1 shall also apply for this proposal.

DLD 7 CORROSION PROTECTION

DLD 7.1 General

All equipment supplied under this Particular Specification shall conform to the latest DWS 9900. This includes, but is not limited to, newly manufactured and refurbished mechanical equipment. All new equipment shall be blast cleaned to Sa3, in accordance DWS 9900 2nd Edition.

DLD 7.2 Proprietary Items

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

DLD 7.3 Coating Systems

Note that outdoor polyurethane shall be ultraviolet resistant. Where not specified, the selection of final colours shall be in accordance with DWS 9900 2nd Edition and confirmed with the Engineer.

DLD 7.3.1 Coating Systems for Existing Equipment

(a) Sleeve Valves

Existing sleeve valves shall be corrosion protected in accordance with DWS 9900 2nd Edition. This includes, but is not limited to, any remedial work to the valve body, surface preparation, coating application techniques, quality requirements, testing procedures and remedial corrosion protection.

(b) Cast iron pipes, specials and breastplate

Existing cast iron pipes, bell mouths and breastplates shall be blast cleaned to Sa 2½, removing any existing lining present. A coating of two pack epoxy (600 µm) shall be applied to the existing breastplate, as well as 500 mm length of pipe downstream of the breastplate.

DLD 7.3.2 Coating Systems for Outlet Pipes, Specials and Bell Mouths

See Notes under Clause DLD 7.3.8.

Refer to the Standard Specification DWS 9900 – CORROSION PROTECTION for the updated corrosion systems. The following tables provide minimum Dry Film Thicknesses (DFTs) of the corrosion protection systems required:

(a) Encased in Concrete

ENVIRONMENT	MATERIAL	SURFACE	SYSTEM	MINIMUM DFT (µm)
Encased in concrete	SS 304 or SS 316 (See note 6)	Lining	1. Two pack Epoxy	250
			2. FBE	200
		Coating	1. Two pack Epoxy plus sealant of Polyurethane or Polysulphide – See note 2 of Clause DLD 7.3.8.	150
			2. FBE plus sealant of Polyurethane or Polysulphide –See note 2 of Clause DLD 7.3.8	100

(b) In water

ENVIRONMENT	MATERIAL	SURFACE	SYSTEM	MINIMUM DFT (µm)
In water & severe corrosion conditions	SS 304 See note 6 of Clause DLD 7.3.8.	Lining	1. Two pack Epoxy	250
			2. FBE	200
		Coating	1. Two pack Epoxy	250
			2. FBE	200

(c) Dry

ENVIRONMENT	MATERIAL	SURFACE	SYSTEM	MINIMUM DFT (µm)
Encased in concrete	SS 304 or SS 316 (See note 6)	Lining	1. Two pack Epoxy	250
			2. FBE	200
		Coating	1. Two pack Epoxy plus Top coat of Re-coatable polyurethane	300 50
			2. FBE plus Top coat of Re-coatable polyurethane	200 50

(d) Coating at Joints

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Flange faces	MS	Two pack Epoxy or FBE	60 - 90
Coupling or flanged joints buried in soil or in wet chambers	MS SS 304 SS 316	Coating system for pipe plus Petrolatum wrapping system - refer Section 18 of DWS 9900 2nd Edition.	
Welded joints buried in soil or encased in concrete	MS SS 304 SS 316	As specified for lining and coating	

(e) Stainless Steel Items

SURACES	COATING	MINIMUM DFT (µm)
Stainless steel components (Dissimilar materials in submerged conditions)	Two pack Epoxy or FBE to a smooth, glossy and uniform finish	250
3CR12 steel components (All submerged conditions)	Two pack Epoxy or FBE	600 325
Stainless steel components (Dry or compatible metal conditions)	Pickle and passivate – See note 4 of Clause DLD 7.3.8.	
3CR12 steel components (Dry conditions only)	Pickle and passivate – See note 4 of Clause DLD 7.3.8.	

DLD 7.3.3 Valves

(a) Valves

ENVIRONMENT	MATERIAL	SURFACE	SYSTEM	MINIMUM DFT (µm)
Wet	MS SG	Lining	1. Two pack Epoxy	600
			2. FBE	325
	SS 316	Lining	1. Two pack Epoxy	250
			2. FBE	200
			3. Pickle & passivate - See note 4 of Clause DLD 7.3.8.	
Dry	MS SG	Coating	1. Two pack Epoxy plus top coat of Re-coatable Polyurethane	300 50
			2. FBE plus top coat of Re-coatable Polyurethane	200 50
Wet	MS SG	Coating	1. Two pack Epoxy plus top coat of Re-coatable Polyurethane – where specified	600 50
			2. FBE plus top coat of Re-coatable Polyurethane	325 50
	SS 316	Coating	1. Two pack Epoxy plus top coat of Re-coatable Polyurethane – where specified	250 50
			2. FBE plus top coat of Re-coatable Polyurethane – where specified	200 50
			3. Pickle & passivate - See note 4 of Clause DLD 7.3.8.	

DLD 7.3.4 Breastplates, trash screens, guide rails and guide channels

a) Breastplate – Item 1

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Wet	SS 316	Glass flake Epoxy	600

b) Trash Screens

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Dry/Wet	316L	Pickle and passivate - See note 4 of Clause DLD 7.3.8	

c) Guide Channels

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Dry/Wet	316L	Pickle and passivate - See note 4 of Clause DLD 7.3.8	

d) Guide Rails

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Dry/Wet	MS	Multi-purpose Epoxy: - Bottom and Sides - Rolling/sliding surface	 400 60-90
		Glass Flake Epoxy: - Bottom and Sides - Rolling/sliding surface	 400 60-90

DLD 7.3.5 Monorails

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Outdoor	MS	HDG – Heavy duty coatings plus Epoxy primer for galvanized surfaces plus Re-coatable polyurethane	105 / 80 40-80 50

DLD 7.3.6 Chains and Ropes

Load and Operating Chains

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Dry/Wet	MS	Zn electroplating plus lubricating rust protector	20 Cover surface

DLD 7.3.7 Fasteners

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Fasteners and washers - Dry	MS	HDG plus threads coated with Molybdenum Disulphide lubricant or wax	45
	SS 304	Threads coated with Molybdenum Disulphide lubricant or Nickel Anti-seize compound	Uniform cover
Fasteners and washers - Wet/Submerged	SS 316	1. Pickle and passivate - See note 4 of Clause DLD 7.3.8. plus threads coated with Molybdenum Disulphide lubricant or Nickel Anti-seize compound	Uniform cover
		2. FBE coated (thread surfaces excluded) plus threads coated with Molybdenum Disulphide lubricant or Nickel Anti-seize compound.	50
Fasteners for flanges	MS	HDG plus complete fastener system coated with an approved spray type lubricant (Molybdenum disulphide). Nuts to be covered with UV Resistant polyethylene nut caps filled with corrosion inhibitor grease.	45

DLD 7.3.8 Notes

The following items shall be approved by the Corrosion Engineer:

1. Hot-dip galvanizing
   - Only for pipes up to 200 mm diameter maximum and flow less than 2 m/s.
   - Pipes shall not be embedded in concrete.
   - Water analysis shall be provided.
   - Pipes over 200 mm diameter to be coated with a duplex system.
2. Sealant
   - Interfaces of different environments shall be sealed with a Polyurethane or Polysulphide flexible sealant to be applied in accordance with the manufacturer's data sheets.
3. Un-coated stainless steel
   - Only to be used if no galvanic reaction and anaerobic conditions are found.
4. Pickle and passivate
   - If not in contact with less noble material.
   - If exposed to anaerobic conditions seal-coat all crevices with solvent free Epoxy.
   - Shall be done by the dipping process.
5. Galvanic cells
   - Where a galvanic cell is situated within a water path <150mm and concrete cover <75 mm, both the MS,

			3Cr12 or SS shall be coated.
6.	Anaerobic conditions	-	SS grade 316L shall be used under anaerobic and aggressive water conditions.
7.	Polyurethane for	-	Re-coatable Polyurethane where required colour coding for colour coding. Only UV resistant Polyurethane shall be used.
8.	Primers	-	Primers shall only be used in special cases i.e. over-coating of galvanized surfaces.
9.	3CR12	-	In view of superior corrosion resistance, coated 3CR12 material is preferred.
10.	Mild steel	-	Mild steel may only be used where the pipe lining can be refurbished in situ.
11.	Items subjected to	-	Items to be manufactured out of stainless steel or coated high temperatures with heat resistant paint.
12.	Epoxy primer	-	Epoxy primer may not be required if appropriate two pack Epoxy / Re-coatable Polyurethane is being used.

DLD 8 TESTS

DLD 8.1 General

The above requirements form part of the scope of work of this Particular Specification and shall be provided as part of the rates by the Main Contractor.
The results of all off-site (factory and other locations) and Site tests, carried out by the Main Contractor or his Sub-contractors in accordance with the requirements of this Particular Specification, shall be recorded, certified and submitted to the Engineer in the format specified/agreed.

DLD 8.2 Visual Inspection of Pipes and Specials

All finished pipes and specials shall be visually examined and shall be free of injurious defects as defined in API 5L Section 9.10 (44th Edition, October 2007). In addition, fillet welds and welds on specials shall be inspected by the application of a penetrant-dye, in accordance with API 1104, on the inside and outside over 100% of any specific weld bead to determine if any cracks are present. This procedure shall also apply to all pipe to pipe flange welds, as well as butt welded pipe “cans”.

DLD 8.3 Testing of Pipes and Specials

DLD 8.3.1 Hydraulic Pressure Testing

In addition to the requirements of SANS 719, the following requirements shall apply to the testing and inspection of pipes and specials:

(a) Hydraulic pressure tests (pressure resistance and leak test) shall be carried out on all pipes and specials in order to test the integrity of the material used and of welds. These tests shall take place prior to corrosion protection and grout application. The hydraulic test pressure applicable to all pipes and specials shall be equivalent to 1,5 times the relevant pressure rating, e.g. 900 kPa for 600kPa rated pipes. This is in accordance with the formula in SANS 719 sub-clause 5.2.4 using the pressure bearing wall thickness (i.e. 3,6 mm for 8 mm wall thickness on 1000 mm NB pipes obtained from the Barlow Formula). This test pressure shall be maintained for 30 minutes after which visual inspection of all welded seams shall be performed while maintaining the test pressure. The duration of the hydraulic pressure tests may be reduced by the Engineer.

Pipes purchased which have a valid pressure test certificate, may be used without retesting, provided no reworking of the pipe has taken place.

(b) The pressure shall be applied gradually by approved means and maintained without variation sufficiently long for the duration of the inspection. Should leaks appear from any part or any defects of any nature be discovered, the pipe shall be emptied and the defects repaired. The pipe shall then

be retested. Should a pipe, after repair, fail to pass the second hydraulic test, the Engineer my order its rejection.

(c) Where possible, specials shall be hydraulically pressure tested in the same way as specified for pipes. Specials and pipe sections that cannot be practically hydraulically pressure tested, shall be subjected to 100% radiographic (or ultrasonic) testing of all the welds not subjected to the hydraulic pressure test of the original pipe.

(d) Specials manufactured completely or partially from plate that has not been subjected to a hydraulic pressure test as described above, shall be hydraulically pressure tested as specified for pipes.

(e) Specials manufactured completely or partially from plate that has not been subjected to a hydraulic pressure test as described above and that can for practical reasons not be subjected to a hydraulic pressure test, shall be subjected to a 100% radiographic test on all welds. Such items shall however be kept to the minimum

(f) Circumferential and longitudinal butt welds (only in the event of no hydraulic pressure test being conducted): 100% of the length of all circumferential butt welds shall be subjected to 100% radiographic test, provided when consistently acceptable results are obtained, the number of welds to be so tested may be reduced by the Engineer.

(g) Site welds: All site welds shall be subjected to 100% Magnetic Particle Inspection (MPI) or ultrasonic testing (UT). The welds subject to MPI or UT are, but not limited to, circumferential internal weld between pipe lengths, circumferential internal weld between pipe lengths and bell mouth, circumferential internal- and external welding of the site welded 1000 mm NB flange. In the event of remedial welding completed, the Engineer may request 100% radiographic (or ultrasonic) testing of the remedial weld bead.

(h) The test pressure over any length or section of pipe work being tested, taking possible difference in elevation into account, shall be such that the test pressure at any point along that section does not exceed 900 kPa. Any such conditions shall only be carried out with the written approval of the Engineer.

(i) The integrity of welds on items hydraulically tested in the workshop shall not be questioned during radiographic testing of site welds.

Note that the maximum static pressure between the lowest pipe inlet and non-overspill crest (NOC) of the dam is approximately 130 kPa.

All hydraulic pressure tests on pipes and specials shall be conducted in the Manufacturer's Workshop and before the application of any corrosion protection.

Periodic factory inspection, verification and witnessing of tests and inspection of test records may be carried out by the Engineer or an independent Inspectorate appointed by the Engineer.

Tests and inspections shall be carried out at the Manufacturer's Works at the expense of the Main Contractor who shall provide all necessary testing facilities, labour instruments, equipment and samples that might be required, free of charge. The Engineer or his representatives shall be afforded every facility during the course of manufacture and testing to enable witnessing and inspections to be carried out effectively.

All test samples shall be selected by the Engineer or his representatives and all instruments used for testing purposes shall be approved by the Engineer or his representatives. If in the opinion of the Engineer or his representatives any instrument should require calibration, such instruments shall be calibrated at the expense of the Main Contractor by such body as may be approved by the Engineer.

No mechanical re-working or straining of pipes and specials shall be allowed after testing and inspection.

DLD 8.3.2 Workshop Testing

All equipment supplied under this Particular Specification shall as far as practicable be completely assembled for functional tests and inspection at the Main Contractor's workshop. The drawings have accounted for distance pipe pieces for the sake of pressure testing. Any additional equipment required to facilitate the successful testing at the Main Contractor's workshop, shall be accounted for in the Bill of Quantities.

Full mechanical- (including welding preparation and welding) and corrosion protection inspection of the items shall be carried out at the Main Contractor's Works in the presence of an Inspector appointed by the Engineer. Workmanship and dimensional correctness shall be checked prior to corrosion protection procedures.

DLD 8.3.3 Hydrostatic Field Testing

After complete installation, the Main Contractor shall be responsible to carry out a hydraulic pressure test of the complete pipe system (including all valves) to ensure that all joints and connections are leak free. This test and allowable leakage shall comply with AWWA M11 Chapter 12, over a test period of minimum two hours after the test pressure has been maintained for a minimum of 24 hours. This test will be conducted at the dam's static pressure at the time of completion.

DLD 8.3.4 Repair of Injurious Defects

Injurious defects found by non-destructive testing of welds, visual examination, hydrostatic testing or determined by any other means to exceed the limitations in API 5L Section 9.10 (44th Edition, October 2007) and API 1104 Section 9 (20th Edition, November 2005) shall be repaired in accordance with API 1104 Section 10 (20th Edition, November 2005) but subject always to the requirements of this Particular Specification.

The total length of all repairs shall be subjected to hydraulic pressure testing to 900 kPa. Where hydraulic pressure testing is not possible, radiographic tests shall be performed on the total length of all repairs in accordance with Section 9.3 of API 1104..

DLD 8.4 Testing of Valves

The refurbished 1000 mm NB sleeve valves shall be tested for compliance with this Particular Specification as well as any other Specification referred to herein.

Full mechanical (including welding preparation and welding) and corrosion protection inspection of the items shall be carried out at the Manufacturer's Works in the presence of an Inspector appointed by the Engineer. Workmanship and dimensional correctness shall be confirmed prior to corrosion protection procedures. All equipment shall be completely assembled for functional tests and inspection at the Manufacturer's Works. Each valve supplied shall be operated in both opening and closing directions and through its full travel by means of the specific operating actuator for that valve. For this purpose and for correct reinstallation of actuators on Site, each actuator shall be linked to its specific valve through the valve's unique identification number. The refurbished hydraulic power pack shall be used during all such functional tests of the sleeve valves.

The following shall be regarded as minimum hold points (as listed on the *Quality Control Plan for Manufacture*) by the Engineer and shall be carried out in his presence:

- Inspection after stripping of valve and assessment of power pack (see Clause DLD 5.4.1.)
- Point 12: Hydrostatic test of valve components (uncoated)
- Point 18: Hydrostatic test of assembled valve
- Point 20: Final inspection and functional test

The Engineer may, in his own discretion, require the Mechanical Sub-contractor to obtain the services of an accredited and approved independent third party Inspectorate to verify any of the above points, should he not be able to attend these tests in person. Any such inspectorate shall report to the Engineer in writing the outcome of his inspection.

All of the above requirements form part of this Contract and shall be provided as part of the rates by the Mechanical Sub-contractor.

DLD 8.5 Testing of Lifting Equipment

All Lifting Equipment supplied under this Project Specification shall be completely assembled for functional tests and inspection at the Manufacturer's Works.

Full mechanical- (including welding preparation and welding) and corrosion protection inspection of the items shall be carried out at the Manufacturer's Works in the presence of an Inspector appointed by the Engineer. Workmanship and dimensional correctness shall be checked prior to corrosion protection procedures.

Each mono rail beam with chain hoist shall be tested and certified at the Main Contractor's Works at the specified working load plus a 25% overload in accordance with BS 2853 and in the presence of the Engineer. This load test shall be carried out in the Main Contractor's Works by his staff and with the calibrated load he provides.

After complete installation at Site, the Main Contractor shall be responsible to carry out a load test on all lifting equipment supplied at the specified working load plus a 25% overload. The Main Contractor shall arrange such tests to be witnessed by the Engineer.

The Manufacturer shall provide for each mono rail beam with chain hoist a Certificate of Examination and Load Testing in accordance with the requirements of an accredited Lifting Machineries Inspector that shall be signed by the Engineer or his representative who witnessed the test.

The above requirements form part of this Contract and shall be provided as part of the rates by the Main Contractor.

DLD 9 MARKING

All pipes and specials shall be clearly marked by welding alongside a longitudinal or spiral weld on one end of the pipe (at least 300 mm away from the end) with the following data: Item number and specific range designation number. These numbers shall in return reference to the documentation that consists of the following information:

(a) Grade and thickness of material;

(b) Item number of the pipe or special;

(c) Nominal diameter (mm);

(d) Work pressure (kPa).

(e) Hydraulic test pressure (kPa)

The applicable drilling table shall be stamped or welded on the periphery of all flanges. The minimum height of welded-on lettering shall be 30 mm. Hard stamping shall be legible after coating.

DLD 10 STORAGE, HANDLING AND TRANSPORT

After testing, final inspection and approval, the pipes and specials shall be securely packed to prevent any damage in transit. In order to protect the internal coating system, the ends of the pipes and specials shall be securely blanked off by sturdy blanks.

The ends of all pipes and specials shall be protected against denting. Pipes shall be transported and stacked in a manner such as to prevent deformation of the pipe body in excess of 2 percent of diameter. Dents causing a protrusion in excess of 3 mm into the interior of the pipe shall result in the pipe being rejected. Otherwise, General Mechanical Specification DWS 1601 “General Mechanical Specification” as well as the appended Storage Specification – shall apply.

DLD 11 DOCUMENTATION

The Main Contractor shall supply the following duly completed and signed documentation in triplicate and in a format agreed with the Engineer.

DLD 11.1 Documentation Prior to Installation

Installation of the monorail beams as described in Clause DLD 5.5 shall only be allowed after acceptance by the Engineer of following documentation:

- Copy of registration certificate of Lifting Machinery Entity (LME);
- Copy of Lifting Machinery Inspector (LMI) Certificate for Installer;
- Design drawings (assembly / installation) signed by competent design engineer;
- Signed off manufacturing QCP’s (crane manufactured in terms of design drawings and all relevant regulations and specifications);
- Factory Load Test Certificates;
- Operating and Maintenance Manuals containing copies of all the above documentation and as otherwise specified in DWS 1601 – “General Mechanical Specification”.
- Installation Method Statement;

DLD 11.2 Documentation After Installation

The Main Contractor shall provide the Engineer within four weeks of completion of installation with the following documentation, as applicable, for all the equipment supplied under this Contract:

- Site Load Test Certificates
- Electrical Certificate of Compliance for all electrically operated equipment and the installation thereof;
- Copies of all the above documentation for inclusion into the final version of the Operating and Maintenance Manuals.

DLD 12 TOLERANCES

The Main Contractor shall refer to the tolerances specified in Clause DLD 5.2 and as indicated in the drawings.

DLD 13 TESTS ON COMPLETION

Tests on Completion of the Works and pipelines shall be carried out in accordance with Clause DLD 8. These tests shall take place as shown in the Main Contractor's Construction Programme. The Main Contractor shall submit to the Engineer for approval a method statement for this procedure and shall be responsible to provide for all the requirements and to carry out the approved procedure.

DLD 14 MEASUREMENT AND PAYMENT

DLD 14.1 Basic Principles

Notwithstanding the breakdown as indicated in the Bill of Quantities, all the work and requirements of any nature as specified in this Particular Specification shall be covered by the Main Contractor in the pricing as reflected in the Bill of Quantities. No additional cost for any work or requirement in this Particular Specification shall be allowed. All items covered by this Particular Specification shall be measured as final fabricated units meeting the functional requirements of the relevant specifications.

DLD 14.2 General

Items are provided for the Bidder to price for:

- Procurement, Manufacture, Hydraulic Pressure Testing and Supply of the pipes and specials
- Refurbishment, Procurement, Manufacture and Supervised Site installation and testing of Valves
- Design, Procurement, Manufacturing and Supply of Lifting Equipment
- Removal, refurbishment, re-installation of caisson.
- Corrosion Protection of all the Mechanical Equipment covered in this Particular Specification
- Transport and Delivery to- and from Site and/or Main Contractor's Site store.
- Installation of Mechanical Equipment covered in this Particular Specification
- Procurement, Supply and application of Grout
- Test on Completion and Commissioning
- Reinstatement of Guarantee of Mechanical Equipment

DLD 14.3 Procurement, Manufacture and Supply of Pipes, Specials & Hydromechanical Equipment

UNIT: SUM

Separate items are provided in the Bill of Quantities for the procurement of materials, manufacture and supply of the Pipes, Specials and Hydromechanical Equipment as listed in the Bill of Quantities:

Measurements shall be made on the basis of the equipment or associated items procured, manufactured and supplied.

The rates tendered against the items in the Bill of Quantities shall include full compensation for the procurement, manufacture and supply, including supply of raw materials and bought-out items; fabrication / manufacture / assembly; quality assurance and quality control; inspection and testing (including attendance on inspection / tests witnessed by the Engineer); type and routine tests; trial erection and dismantling and any other work as specified. Payment will only be effected after full compliance of the items with this Particular Specification has been certified by the Engineer and once the data book has been received.

DLD 14.4 Refurbishment of Valves, Hydraulic Power Pack and Position Indicators

UNIT: SUM

The rates tendered against the items in the Bill of Quantities shall include for full compensation of all costs incurred in the refurbishment, inspection and testing of the specified valves, hydraulic power pack, new valve position indicators, jointing material and fasteners, associated operating or control equipment, Operating and Maintenance Manuals and record drawings. Payment will be made per unit. No separate payment will be made for Tender, manufacturing and Site construction drawings. Payment will only be effected after full compliance of the items with the Particular Specification has been certified by the Engineer.

DLD 14.5 Design, Procurement, Manufacture and Supply of Lifting Equipment

UNIT: SUM

Separate items are provided in the Bill of Quantities for the design, manufacture and supply of the following lifting equipment:

6 off 5 metric Ton rated mono rail lifting beams, together with one 5 metric Ton rated manually operated low headroom chain hoist and with manually operated geared crawls as described in DLD 5.5.

Measurement shall be made on the basis of the equipment or associated items designed, procured, manufactured and supplied, complete with Operating and Maintenance Manuals and all other pre-installation documentation as specified.

The rates tendered against the items in the Bill of Quantities shall include full compensation for the specifications; schematic diagrams; layout drawings; operating and maintenance manuals; programmes of work (manufacture and on-site); design, manufacture and supply, including supply of raw materials and bought-out items; fabrication / manufacture / assembly; quality assurance and quality control; inspection and testing (including attendance on inspection / tests witnessed by the Engineer); type and routine tests; any special tools required for general maintenance, all lubrication required for operation of the equipment, trial erection and dismantling and any other work as specified.

DLD 14.6 Removal, Refurbishment and Installation of Caisson

UNIT: SUM

Separate items are provided in the Bill of Quantities for the removal, refurbishment and re-installation of the caisson as listed in the Bill of Quantities.

The rates tendered against the items in the Bill of Quantities shall include full compensations for all costs incurred in the removal, disassembly, delivery to Main Contractor's workshop, refurbishment, corrosion protection, workshop inspection, delivery to Site, installation, multiple relocation, associated diving works, final removal and delivery to DWS Storage.

Payment will only be effected after full compliance of the items with this Particular Specification has been certified by the Engineer.

DLD 14.7 Corrosion Protection of Mechanical Equipment

UNIT: SUM

Separate items are provided in the Bill of Quantities for the corrosion protection of the following equipment as listed in the Bill of Quantities:

a) Pipes and Specials

b) Hydromechanical Equipment

c) Valves

d) Lifting Equipment

Measurements shall be made on the basis of the equipment or associated items corrosion protected.

The rates tendered against the items in the Bill of Quantities shall include full compensation of all costs incurred in the preparation for corrosion protection, procurement of raw materials and bought-out items, application; quality assurance and quality control; inspection and testing (including attendance on inspection / tests witnessed by the Engineer); type and routine tests and any other work as specified. Payment will be made per unit. Payment under this Clause DLD 14.7 will only be effected after full compliance of the items with this Particular Specification has been certified by the Engineer. The rate tendered for transport of valves and the hydraulic power pack, shall include transport of the items from Darlington Dam to the workshop of the sleeve valve specialist and back to the dam.

DLD 14.8 Delivery to Site

UNIT: SUM

Separate items are provided in the Bill of Quantities for the transport and delivery of the following mechanical equipment as listed in the Bill of Quantities.

a) Pipes and Specials

b) Hydromechanical Equipment

c) Valves and Hydraulic Power Pack

d) Lifting Equipment

Measurement shall be made on the basis of the Plant or associated items transported and delivered to Site.

The rates tendered against the items in the Bill of Quantities shall include full compensation for the preparation and packing for transport; transport from place of manufacture to the Site; insurance, harbour duties, etc. during transport; loading and unloading; inspection during loading and unloading and storage under appropriate conditions at Site.

The rate tendered for transport of valves and hydraulic power pack, shall include transport of these items from Site to the workshop of the sleeve valve specialist and back to Site.

DLD 14.9 Installation of Mechanical Equipment

UNIT: NO

Separate items are provided in the Bill of Quantities for the installation of the following mechanical items:

a) Pipes and Specials

b) Hydromechanical Equipment

c) Valves and Hydraulic Power Pack

d) Lifting Equipment

Measurement shall be made on the basis of equipment or associated items installed and tested for full operation. This rate for the installation of the Mechanical Equipment listed above shall be per refurbishment of one line, which will be completed 5 times to refurbish 5 lines of the Left Bank Outlet Works.

The rates tendered against the items in the Bill of Quantities shall include full compensation for the installation, including the provision of all labour, equipment, transport, materials and temporary works necessary to install the complete works; on-site quality assurance and quality control, inspection and testing (including attendance at tests witnessed by the Engineer); the installation of all auxiliary equipment, electrical panels, cabling, etc., to complete a workable installation; supply of all consumables (electricity, fuel, oil and lubricants, etc.) necessary for the operation of the installation until taking over by the Employer; the putting into service of the complete installation and any other work as specified.

The rate shall also include for all testing and the provision of equipment therefore including all disruptions to installation caused by such testing.

DLD 14.10 Delivery to Storage

UNIT: SUM

Separate items are provided in the Bill of Quantities for the transport and delivery of all decommissioned Mechanical Equipment (as stated in the drawings) to the Uitkeer Workshop as listed in the Bill of Quantities.

Measurement shall be made on the basis of the Plant or associated items transported and delivered the assigned storage location.

The rates tendered shall include full compensation for the preparation and packing for transport; transport from place of manufacture to the Site; insurance, harbour duties, etc. during transport; loading and unloading; inspection during loading and unloading and storage at Uitkeer Workshop.

DLD 14.11 Provisional Sum

UNIT: SUM

A Separate item shall be provided as a provisional sum for the works to the value of R 10 000 000, 00. The Main Contractor shall not be entitled to this sum. It shall only be utilised with written confirmation by the Engineer and will not be used for any omissions in the items quoted by the Main Contractor.

APPENDIX A:
SUNDAYS RIVER IRRIGATION BOARD
DARLINGTON DAM

TENDER: W_____

PARTICULAR SPECIFICATION
DLD:
TECHNICAL SCHEDULES

- **TECHNICAL SCHEDULE FOR CORROSION PROTECTION**
- **TEST CERTIFICATES FOR COATING MATERIAL**
- **QUALITY CONTROL PLAN FOR CORROSION PROTECTION**
- **COATING APPLICATION RECORD**
- **SURFACE PROFILE AND DRY FILM THICKNESS READINGS**

DEPARTMENT OF WATER AND SANITATION

TENDER: W _____

TECHNICAL SCHEDULE FOR CORROSION PROTECTION

(Failure to fully complete this schedule may result in the quote being disregarded.)

Applicator proposed	Name:		
	Contact person:		
	Tel.:		
	Address:		
Value corrosion protection (the lot)	R		
List of products offered:	Coat/Stage	Product (Append pamphlets)	Code
	Primer System (if needed)		
Vinyl Enamel	Top coat		
Pickling paste	Surface prep.		
Passivating paste	Surface prep.		
Blasting Media: For stainless steel	Surface prep.		
For steel	Surface prep.		
Remarks/Deviations			
Name of Contractor:			
	Signature:		
	Date:		

Name of Contractor
(Blockletters)_____

Signature of Contractor: _____

Tel: _____ Fax: _____

Date: _____

DEPARTMENT OF WATER AND SANITATION

TENDER: W_____

TEST CERTIFICATES FOR COATING MATERIAL

The Manufacturer's test certificate shall contain the following information to be supplied with each batch of product delivered to the Contractor:

TABLE 1: SINGLE-PACK MATERIAL

Date:			
Product:			
Reference no.:			
Batch no.:			
Colour:			
Quantity made:			
Shelf life:			
Volume solids:			
Item	**Method**	**Parameter**	**Results**
Fineness of grind:	SANS 178		
Viscosity:	SANS 5153		
Mass/l:	SANS 5050 / 2811-1		
Non-volatile mass,%:	SANS 5193 / SANS 3251		
Surface dry:	SANS 5148		
Hard dry:	SANS 5148		
Volume solids:	ISO 3233		

DEPARTMENT OF WATER AND SANITATION

TENDER: W _____

TEST CERTIFICATES FOR COATING MATERIAL

TABLE 2: TWO-PACK MATERIAL

Date:			
Product no.:			
Reference no.:			
Batch no.:			
Colour:			
Quantity made:			
Shelf life (base):			
Shelf life (curing agent):			
Mixed volume solids:			
Mixing ratio (by volume):			
Item	**Method**	**Parameter**	**Results**
Fineness of grind:	SANS 178		
Viscosity:	SANS 5153		
Mass/l:	SANS 5050 / 2811-1		
Non-volatile mass,%:	SANS 5193 / SANS 3251		
Surface dry:	SANS 5148		
Hard dry:	SANS 5148		
Volume solids:	ISO 3233		
Fineness of grind:	SANS 178		
Viscosity:	SANS 5153		
Mass/l:	SANS 5050 / 2811-1		
Non-volatile mass,%:	SANS 5193 / SANS 3251		
Surface dry:	SANS 5148		

QUALITY CONTROL PLAN FOR CORROSION PROTECTION			
PROJECT:			QCP NO. REVISION: COMPILED BY: DATE:
EQUIPMENT:		SECTION:	
DRAWING NO.:	QTY:	FACTORY ID NO.:	
CLIENT:		CONTACT NO.:	ORDER NO.:
CONTRACTOR:		CONTACT PERSON:	
APPLICATOR:		CONTACT PERSON:	

APPROVALS

CONTRACTOR	**ENGINEER**	**DWAF QC**	**END USER**
NAME: SIGNATUR E: DATE:	NAME: SIGNATUR E: DATE:	NAME: SIGNATURE : DATE:	NAME: SIGNATUR E: DATE:

LEGEND

H - HOLD POINT	W - WITNESS POINT	S – SURVEILLANCE	R – REVIEW

INSPECTION CODE

1 – APPROVAL	3 - TESTING	5 - REPORT REQUIRED	
2 – MATERIAL CERTIFICATE	4 - VISUAL	6 - RECORD REVIEW	

QUALITY CONTROL

	OPERATION	INSP. CODE	INSPECTION INTERVENTIONS				ACCEPTANCE CRITERIA
			CONTRACTOR	ENGINEER	DWAF QC	END USER	
	Documentation approval						
6	Quality Control Plan	1					
1.2	Corrosion protection programme	1					
1.3	Coating material	1					Data sheets
1.4	Pickling and passivation material	1					Data sheets
1.5	Rough blast material	1					Data sheets
1.6	Final blast material	1					Data sheets
2	**Pre-preparation**						
2.1	Dress protrusions and pits	4					Smooth surface
2.2	Radius sharp edges	3					mm minimum radius
2.3	Repair blowholes in castings	4					To be approved by Engineer
2.4	Fettle welds	4					Smooth contour
2.5	Remove weld spatter, burrs, laminations, scabs and scale	4					
3	**Degreasing**						
3.1	Remove oil/grease contamination	3					
4	**Rough blast cleaning**	4					
5	**Measurement of soluble salts**						**Wet surface** / **Dry surface**
5.1	Wax at any point	3					100 mg/m^2 / 500 mg/m^2
5.2	Average over 250 cm^2	3					<100 mg/m^2 / 100 mg/m^2
5.3	Wet cleaning/Re-blasting						Clean soft water
6	**Final blast cleaning**						
6.1	Blasting material	2					
6.2	Cleanliness: Wet surface	4					Sa
6.3	Cleanliness: Dry surface	4					Sa
6.4	Surface profile	3					50-100 μm
6.5	Residual dust and debris	3					0,3%
7	**Application of first coat**						
7.1	Dry Film Thickness (DFT)	3					μm
8	**Application of second coat**						
8.1	Dry Film Thickness (DFT)	3					μm
9	**Application of third coat**						
9.1	Dry Film Thickness (DFT)	3					μm
10	**Completed system**						
10.1	Visual appearance	4					
10.2	Dry Film Thickness (DFT) - Wet surface	3					μm minimum
10.3	Dry Film Thickness (DFT) - Dry surface	3					μm minimum
10.4	Dry Film Thickness (DFT) - flange/ mating surfaces	3					μm minimum
10.5	Electrical Insulation Defect	3					Wet surface
10.6	Adhesion test	3					Where required
11	**Application of third coat**						
11.1	Degreasing	4					
11.2	Pickling	4					
11.3	Passivation	4					

COATING APPLICATION RECORD

1. Pre-preparation												
Dress protrusions & pits:												
Radius sharp edges:												
Repair blowholes in castings:												
Fettle welds:												
Remove weld spatter, burrs, laminations, scale & scabs:												
Primary cleaning:												
2. Degreasing												
Material reference				Batch number:								
"Water break free" test												
3. Rough blast cleaning												
Date of rough blast cleaning				Blasting material:								
4. Measurement of soluble salts												
Maximum at any point mg/m²				Average over 250 cm² mg/m²								
Maximum at any point – final reading mg/m²				Average over 250 cm² - final reading mg/m²								
Wet cleaning/Re-blasting				Blasting material:								
5. Final blast cleaning												
Blasting material:				Cleanliness - wet surface: Sa								
Material certificate No.:				Cleanliness - dry surface: Sa								
Material pH	Hardness		Moh's scale	Residual dust & debris: %								
Surface profile:	Maximum:		µm	Minimumµm			Average µm					
Date of final blast cleaning:				Time completed:								
6. Ambient conditions	**First coat**			**Second coat**			**Third coat**			**Final coat**		
Time	08:00	12:00	16:00	08:00	12:00	16:00	08:00	12:00	16:00	08:00	12:00	16:00
Rain: Yes/No												
Ambient temperature °C												
Substrate temperature °C												
Relative Humidity %												
Dew point °C												
7. Application of coats	**First coat**			**Second coat**			**Third coat**			**Final coat**		
Base : Material reference												
: Batch number												
Activator : Material reference												
: Batch number												
Thinner/solvent : Type												
: Batch number												
Application equipment:												
Colour:												
Surface preparation:												
Areas stripe coated:												
Date of application:												
Time application started:												
Time application completed:												
Wet film thickness:												
Wet surface DFT: Min / Ave	µm		µm	µm		µm	µm		µm	µm		µm
No-off readings												
Dry surface DFT: Min / Ave	µm		µm	µm		µm	µm		µm	µm		µm
No-off readings												
Flange/mating surface DFT:Min/Max	µm		µm	µm		µm	µm		µm	µm		µm
No-off readings												
8. Completed system												
Visual appearance:												
Electrical Insulation Defect at V												
Adhesion test:												
Cure test:												
9. Stainless steel – uncoated components												
Degreasing												
Date of degreasing	Material reference:			Batch No.								
10. Pickling and passivation												
Date of pickling	Material reference:			Batch No.								
Date of passivation:	Material reference:			Batch No.								

SURFACE PROFILE AND DRY FILM THICKNESS READINGS

PROJECT:			
EQUIPMENT:		SECTION:	
DRAWING NO.:	QTY:	FACTORY ID NO.:	
CLIENT:		CONTRACT NO.:	ORDER NO.:
CONTRACTOR:		CONTACT PERSON:	
APPLICATOR:		CONTACT PERSON:	

SURFACE PROFILE

DATE:

WET SURFACE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE
TOP														
MIDDLE														
BOTTOM														

DRY SURFACE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE
TOP														
MIDDLE														
BOTTOM														

DFT FIRST COAT

DATE:

WET SURFACE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE
TOP														
MIDDLE BOTTOM														

DRY SURFACE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE
TOP														
MIDDLE														
BOTTOM														

DFT SECOND COAT

DATE:

WET SURFACE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE
TOP														
MIDDLE														
BOTTOM														

DRY SURFACE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE
TOP														
MIDDLE														
BOTTOM														

DFT THIRD COAT

DATE:

WET SURFACE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE
TOP														
MIDDLE														
BOTTOM														

DRY SURFACE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE
TOP														
MIDDLE														
BOTTOM														

DFT FINAL COAT

DATE:

WET SURFACE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE
TOP MIDDLE														
BOTTOM														

DRY SURFACE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE
TOP														
MIDDLE														
BOTTOM														

FLANGE FACES

DATE:

FLANGE SIZE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE

COMMENTS:

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