
Section H Detailed Specifications for Refurbishment of Electrical and Control & Instrumentation Works

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Part 1 – Rietspruit Inlet Works Electrical

1 SCOPE OF WORKS

The scope of works for the electrical installation includes the design, supply, delivery, installation, testing, commissioning and maintenance during the defects notification period of the following:

- 1 Power cables to all motors
- 2 Local isolators at all motors and final terminations to motors
- 3 Local Field Control Stations at the motors and cables supplying these
- 4 Small power and lighting installations to the Inlet Works Building

2 ELECTRICITY SUPPLY

The existing electricity supply at the inlet works is 400 V 4 wire.

3 DRAWINGS

The requirements of Standard Specification Section E200.7 regarding the preparation of construction and workshop drawings by the Contractor shall be complied with.

The following Electrical drawings, which are bound separately, shall be read in conjunction with this Detailed Specification.

Drawing No	Title
J39080-2120-07-905-01	Electrical Schematic Diagrams for MCC-IW
J39080-2120-07-910-01	Electrical Schematic Diagrams for DB-BD, DB-IW, DB-LPS, DB-DW, DB-DPS1, DB-UV, DB-CD, DB-WWPS, DB-GH & DB-DPS2
J39080-1120-07-900-20	Typical Schematic Diagrams for Starters

4 MOTOR CONTROL CENTRE (MCC)

4.1 General

Tenderers shall price to design, manufacture, test off-site, deliver to site, install, connect, test and commission a motor control centre. This MCC will be similar to the one shown on Drawing No J39080-2120-07-905-01 but with fewer motor starters.

Quantities of starters to be allowed are as follows:

Starter Type	Quantity
5.5 kW direct-on-line	1
5 kW direct-on-line	1
4 kW direct-on-line	1
2.2 kW direct-on-line	3

1.5 kW direct-on-line	5
0.75 kW direct-on-line	3
3 kW direct-on-line reversing	1
0.75 kW direct-on-line reversing	2

If it is discovered on site that there is an existing MCC on site which can be repaired and re-used then a price will be negotiated for doing this. Wherever possible rates tendered in the bill of quantities will be used for agreeing the price for this work.

MCC Number	Location	Main Equipment Controlled
MCC-IW	Inlet Works	Screening equipment, de-gritting equipment, grit washing equipment, screw compactors, odour control equipment, clarifiers

The motor ratings given on the schematic diagrams are the Engineer's estimates.

The Tenderer shall base his tender on the ratings as shown.

The bill of quantities makes provision for the tenderers to submit rates for various types and ratings of starters.

These rates shall be used for agreeing the final account.

4.2 Standard Specifications

The manufacture of motor control panels, distribution boards (D's) and PLC Panels shall strictly comply with the latest revisions of the following standards whichever are applicable:

SANS 60439-1	LV Switchgear and Controlgear ASSEMBLIES Part One: Type-tested, Partially Type-tested ASSEMBLIES'.
SANS 60439-2	Switchgear and Controlgear Part Two: Busbar Trunking
SANS 1473-1	LV Switchgear and Controlgear ASSEMBLIES Part One: Type-tested, Partially Type-tested and Specially Tested ASSEMBLIES'.
SANS 1765	Switchgear and Controlgear ASSEMBLIES (distribution boards) with a rated short-circuit withstand strength of up to and including 10 kA
SANS 1973-1	Low-voltage switchgear and controlgear ASSEMBLIES Part 1: Type-tested ASSEMBLIES with stated deviations and a rated short-circuit withstand strength above 10 kA

SANS 1973-3	Low-voltage switchgear and controlgear ASSEMBLIES Part 3: Safety of ASSEMBLIES with a rated prospective short-circuit current of up to and including 10 kA
SANS 1973-8	Low-voltage switchgear and controlgear ASSEMBLIES Part 8: Safety of minimally tested ASSEMBLIES (MTA) with a rated short-circuit current above 10 kA and a rated busbar current of up to and including 1 600 A a.c. and d.c.

The form of construction of the MCC shall be 4a.

Separate compartments are to be provided for each motor started as indicated on the general arrangement drawing and separate compartments are to be provided for the power cables from the starters to the motors.

4.3 Wiring for Instrumentation and control cables

The wiring for instrumentation and control cables shall be kept separate from power cables and busbars up to the point where they enter the compartment where they are to be connected to equipment.

To provide for this separate sheet metal compartments shall be provided in the busbar and cable compartments.

4.4 Pushbuttons and indicating lamps

Pushbuttons shall be instated in the motor starter compartments as follows:

Function	Colour
Emergency Stop	Red
Start	Green
Stop	Red
Reverse (where applicable)	Yellow
Lamp Test	Black

Indicating lamps shall be installed in the motor starter compartments as follows

Function	Colour
Run	Green
Trip	Red
Forward (where applicable)	Green
Reverse (where applicable)	Yellow

4.5 Metering and Indication Instruments

The following shall be provided in each motor starter compartment:

- Ammeter (maximum demand indicating type)
- Voltmeter with 6 way selector switch so that all phase to phase and all phase to neutral voltages can be read
- Running hour meter

The instruments shall be connected to and shall communicate with the SCADA system.

5 FIELD CONTROL STATIONS

A field control station shall be installed next to each motor and shall be provided with the following control push buttons:

- Start
- Stop
- Emergency Stop
- Forward (where required in place of Start)
- Reverse (where required)

Field control stations shall be mounted on galvanized steel stanchions and shall be weatherproof to IP 65.

If there are existing field control stations in place and these are adjudged by the Engineer to be adequate for purpose then these may be re-used

6 LOW VOLTAGE CABLES

Power cables to local isolators and from local isolators to the motors and cables to the field control stations shall be installed on stainless steel cable trays, which shall be installed by the Contractor.

The cables shall be steel wire armoured PVC insulated cables to SANS 1507

Cables to the motors shall be 4 core with one core being used as protective earth.

Each motor supply cable and each cable to a field control station shall be labelled at each end plus

at each draw chamber through which it passes.

The Contractor shall make use of Hellerman Tyton Ovalgrip type marking system with the characters threaded onto Arrow Tag Type 2 which is to be attached to the cables with nylon cable ties or other approved marking system.

A cable schedule is set out below.

Cable No	From	To	Cable or Busbar Type	Estimated Length (m)
6.1	MCC-IW	Fine Screen Wash Water Pump No 1	4 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.2			1.5 mm ² 7 core for field control and emergency stop	24
6.3	MCC-IW	Fine Screen Wash Water Pump No 2	4 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.4			1.5 mm ² 7 core for field control and emergency stop	24
6.5	MCC-IW	Fine Screen Wash Water Pump No 3	4 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.6			1.5 mm ² 7 core for field control and emergency stop	24
6.7	MCC-IW	Screw Conveyor Wash Water Pump No 1	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.8			1.5 mm ² 7 core for field control and emergency stop	24
6.9	MCC-IW	Screw Conveyor Wash Water Pump No 2	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.10			1.5 mm ² 7 core for field control and emergency stop	24
6.11	MCC-IW	Screw Conveyor Wash Water Pump No 3	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.12			1.5 mm ² 7 core for field control and emergency stop	24
6.13	MCC-IW	De-gritter Wash Water Pump No 1	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.14			1.5 mm ² 7 core for field control and emergency stop	24
6.14	MCC-IW	De-gritter Wash Water Pump No 2	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.16			1.5 mm ² 7 core for field control and emergency stop	24
6.17	MCC-IW	De-gritter Wash Water Pump No 3	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.18			1.5 mm ² 7 core for field control and emergency stop	24
6.19	MCC-IW	Fine Screen No 1 Drive Motor	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.20			1.5 mm ² 7 core for field control and emergency stop	24
6.21	MCC-IW	Fine Screen No 1 Brush Drive Motor	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.22			1.5 mm ² 7 core for field control and emergency stop	24

6.23	MCC-IW	Fine Screen No 2 Drive Motor	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.24			1.5 mm ² 7 core for field control and emergency stop	24
6.25	MCC-IW	Fine Screen No 2 Brush Drive Motor	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.26			1.5 mm ² 7 core for field control and emergency stop	24
6.27	MCC-IW	Fine Screen No 3 Drive Motor	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.28			1.5 mm ² 7 core for field control and emergency stop	24
6.29	MCC-IW	Fine Screen No 3 Brush Drive Motor	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.30			1.5 mm ² 7 core for field control and emergency stop	24
6.31	MCC-IW	Fine Screen No 4 Drive Motor	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.32			1.5 mm ² 7 core for field control and emergency stop	24
6.33	MCC-IW	Fine Screen No 4 Brush Drive Motor	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.34			1.5 mm ² 7 core for field control and emergency stop	24
6.35	MCC-IW	Fine Screen No 5 Drive Motor	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.36			1.5 mm ² 7 core for field control and emergency stop	24
6.37	MCC-IW	Fine Screen No 5 Brush Drive Motor	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.38			1.5 mm ² 7 core for field control and emergency stop	24
6.39	MCC-IW	Fine Screen No 6 Drive Motor	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.40			1.5 mm ² 7 core for field control and emergency stop	24
6.41	MCC-IW	Fine Screen No 6 Brush Drive Motor	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.42			1.5 mm ² 7 core for field control and emergency stop	24
6.43	MCC-IW	Coarse Screen No 1 Drive Motor	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.44			1.5 mm ² 7 core for field control and emergency stop	24
6.45	MCC-IW	Coarse Screen No 2 Drive Motor	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.46			1.5 mm ² 7 core for field control and emergency stop	24
6.47	MCC-IW	Coarse Screen No 3 Drive Motor	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.48			1.5 mm ² 7 core for field control and emergency stop	24
6.49	MCC-IW	Coarse Screen No 4 Drive Motor	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.50			1.5 mm ² 7 core for field control and emergency stop	24

6.51	MCC-IW	Coarse Screen No 5 Drive Motor	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.52			1.5 mm ² 7 core for field control and emergency stop	24
6.53	MCC-IW	Coarse Screen No 6 Drive Motor	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.54			1.5 mm ² 7 core for field control and emergency stop	24
6.55	MCC-IW	Grit Washer 1 Agitator Drive	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.56			1.5 mm ² 7 core for field control and emergency stop	24
6.57	MCC-IW	Grit Washer 1 Discharge Screw Drive	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.58			1.5 mm ² 7 core for field control and emergency stop	24
6.59	MCC-IW	Grit Washer 2 Agitator Drive	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.60			1.5 mm ² 7 core for field control and emergency stop	24
6.61	MCC-IW	Grit Washer 2 Discharge Screw Drive	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.62			1.5 mm ² 7 core for field control and emergency stop	24
6.63	MCC-IW	Grit Washer 3 Agitator Drive	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.64			1.5 mm ² 7 core for field control and emergency stop	24
6.65	MCC-IW	Grit Washer 3 Discharge Screw Drive	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.66			1.5 mm ² 7 core for field control and emergency stop	24
6.67	MCC-IW	Grit Washer 4 Agitator Drive	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.68			1.5 mm ² 7 core for field control and emergency stop	24
6.69	MCC-IW	Grit Washer 4 Discharge Screw Drive	1.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.70			1.5 mm ² 7 core for field control and emergency stop	24
6.71	MCC-IW	Screw Compactor 1 Screw Drive	2.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.72			1.5 mm ² 7 core for field control and emergency stop	24
6.73	MCC-IW	Screw Compactor 1 Washer Impeller Drive	4 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.74			1.5 mm ² 7 core for field control and emergency stop	24
6.75	MCC-IW	Screw Compactor 2 Screw Drive	2.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.76			1.5 mm ² 7 core for field control and emergency stop	24
6.77	MCC-IW	Screw Compactor 2 Washer Impeller Drive	4 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.78			1.5 mm ² 7 core for field control and emergency stop	24

6.79	MCC-IW	Screw Compactor 3 Screw Drive	2.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.80			1.5 mm ² 7 core for field control and emergency stop	24
6.81	MCC-IW	Screw Compactor 3 Washer Impeller Drive	4 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.82			1.5 mm ² 7 core for field control and emergency stop	24
6.83	MCC-IW	Screw Compactor 4 Screw Drive	2.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.84			1.5 mm ² 7 core for field control and emergency stop	24
6.85	MCC-IW	Screw Compactor 4 Washer Impeller Drive	4 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.86			1.5 mm ² 7 core for field control and emergency stop	24
6.87	MCC-IW	Screw Compactor 5 Screw Drive	2.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.88			1.5 mm ² 7 core for field control and emergency stop	24
6.89	MCC-IW	Screw Compactor 5 Washer Impeller Drive	4 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.90			1.5 mm ² 7 core for field control and emergency stop	24
6.91	MCC-IW	Vortex de-gritter 1 Grit discharge drive	4 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.92			1.5 mm ² 7 core for field control and emergency stop	24
6.93	MCC-IW	Vortex de-gritter 2 Grit discharge drive	4 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.94			1.5 mm ² 7 core for field control and emergency stop	24
6.95	MCC-IW	Vortex de-gritter 3 Grit discharge drive	4 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.96			1.5 mm ² 7 core for field control and emergency stop	24
6.97	MCC-IW	Vortex de-gritter 4 Grit discharge drive	4 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.98			1.5 mm ² 7 core for field control and emergency stop	24
6.99	MCC-IW	Vortex de-gritter 5 Grit discharge drive	4 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.100			1.5 mm ² 7 core for field control and emergency stop	24
6.101	MCC-IW	Vortex de-gritter 1 Paddle drive	2.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.102			1.5 mm ² 7 core for field control and emergency stop	24
6.103	MCC-IW	Vortex de-gritter 2 Paddle drive	2.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.104			1.5 mm ² 7 core for field control and emergency stop	24
6.105	MCC-IW	Vortex de-gritter 3 Paddle drive	2.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.106			1.5 mm ² 7 core for field control and emergency stop	24
6.107	MCC-IW	Vortex de-gritter 4 Paddle drive	2.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.108			1.5 mm ² 7 core for field control and emergency stop	24
6.109	MCC-IW	Vortex de-gritter 5 Paddle drive	2.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24

6.110			1.5 mm ² 7 core for field control and emergency stop	24
6.111	MCC-IW	Fan No 1	2.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.112			1.5 mm ² 7 core for field control and emergency stop	24
6.113	MCC-IW	Fan No 2	2.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.114			1.5 mm ² 7 core for field control and emergency stop	24
6.115	MCC-IW	Fan No 3	2.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.116			1.5 mm ² 7 core for field control and emergency stop	24
6.117	MCC-IW	Fan No 4	2.5 mm ² PVC/PVC/SWA/PVC 4 core cable	24
6.118			1.5 mm ² 7 core for field control and emergency stop	24

7 LOCAL ISOLATORS

A suitably sized three pole local isolator shall be installed close to each motor. The isolator shall be mounted on a galvanized steel stanchion to be manufactured by the Contractor. Where practical the field control station and isolator may be mounted on the same stanchion.

8 ELECTRICAL BUILDING SERVICES

The extent of the small power and lighting installations to the building including the specifications for light fittings shall be shown on drawings. Tenderers shall base their tenders on the quantities given in the Bill of Quantities and these quantities shall be re-measured on site.

A schematic diagram for the Distribution Board (DB) for the small power and lighting has been included in the tender package.

In practice it will probably be cost effective for this DB to be incorporated into the MCC; however for tender purposes the tenderers shall price as if the DB is separate from the MCC and fed from it by a cable.

Tenderers shall base their prices on the supply of a surface mounted DB.

9 SITE LIGHTING

Based on the South African national Standard SANS 10389-2:2007: Exterior Lighting Part2:Exterior Security Lighting the site is identified as a high risk area. Site lighting shall be installed to achieve illuminance levels as follows:

Minimum Average Illuminance (Lux)	Minimum Illuminance (Lux)	Uniformity (Minimum)
10	2	0.2

The Contractor shall submit a proposal for a site lighting system to achieve this.

This proposal shall be supported by calculations and an illumination simulation to demonstrate compliance and the Contractor shall provide workshop drawings, construction drawings and as built drawings as for all other aspects of the contract.

For the purpose of tendering Tenderers shall base their price on the quantities given in the Bill of Quantities