City of Johannesburg

Johannesburg Water SOC Ltd

Turbine Hall
65 Ntemi Piliso Street
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Johannesburg

Johannesburg Water
PO Box 61542
Marshalltown
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Tel +27(0) 11 688 1400
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YOU ARE HEREBY INVITED TO BID FOR REQUIREMENTS OF JOHANNESBURG WATER

DESCRIPTION: LV CABLING, PANEL REPLACEMENT FOR SCREENS AND COMPACTORS AT NORTHERN WWTW HEAD OF WORKS

RFQ NUMBER:RFQJW025NS26-27
ADVERT DATE: 13 July
CLOSING DATE: 28 July 2026
CLOSING TIME: 16:00
RFQ VALIDITY PERIOD: 60 Days **TOTAL QUOTATION VALUE MUST BE INCLUSIVE OF ALL APPLICABLE TAXES. NB: FAILURE TO INCLUDE ALL APLICABLE TAXES ON QUOTATION WILL LEAD TO DISQUALIFICATION.**
SUBMISSION OF QUOTATIONS: SUBMISSIONS MUST BE MADE ON THE E-TENDER PORTAL (https://www.etenders.gov.za/)
COMPULSORY BRIEFING SESSION - VENUE: NORTHERN WASTEWATER TREATMENT WORKS (DIEPSLOOT) **DATE: 21 July 2026** **TIME: 09h00** NB: All service providers coming to attend site briefing must wear safety shoes and safety reflective jackets

CONTACT PERSON **SUPPLY CHAIN MANAGEMENT** **Name: Nompumezo Sobhekwa** **Tel No: 011 688 1656** **Email: Nompumezo.mramba@jwater.co.za**	**CONTACT PERSON** **END USER DEPARTMENT** **Name: Phakamani Dube** **Tel No: 011 510 2644** **Email: Phakamani.dube@jwater.co.za**

Name of Bidder: .....

Total Amount excl. VAT: .....

VAT Amount: .....

Total Amount Incl. VAT: .....

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THIS BID IS SUBJECT TO THE PREFERENTIAL PROCUREMENT POLICY FRAMEWORK ACT OF 2000 AND THE PREFERENTIAL PROCUREMENT REGULATIONS, 22, THE GENERAL CONDITIONS OF CONTRACT (GCC) AND, IF APPLICABLE, ANY OTHER SPECIAL CONDITIONS OF CONTRACT

QUOTATIONS WILL BE EVALUATED ON THE 80/20 POINT SCORING SYSTEM. 80 POINTS WILL BE ALLOCATED TO PRICE AND THE REMAINING 20 POINTS WILL BE ALLOCATED FOR SPECIFIC GOALS AS PER PPPFA 2022

ALL SUPPLIERS RESPONDING TO QUOTATIONS SHOULD BE REGISTERED ON CENTRAL SUPPLIER DATABASE (CSD)

1. **QUOTATIONS MUST BE ON COMPANY LETTERHEADS**
2. **QUOTATIONS RECEIVED AFTER CLOSIND DATE AND TIME WILL NOT BE ACCEPTED.**
3. **QUOTATIONS WITHOUT BRAND NAMES WHERE REQUIRED WILL NOT BE ACCEPTED**
4. **TOTAL QUOTATION VALUE TO INCLUDE ALL APPLICABLE TAXES.**
5. **SUBMIT A COPY OF A VALID BBBEE CERTIFICATE OR SWORN AFFIDAVIT.**
6. **ENSURE THAT ALL ATTACHED MBD'S ARE DULY COMPLETED AND SIGNED**
7. **SUBMIT A COPY OF VALID LEASE AGREEMENT OR MUNICIPAL ACCOUNT STATEMENT NOT OLDER THAN 3 MONTHS AND NOT IN AREAS FOR MORE THAN 90 DAYS**
8. **ACCEPTANCE OF A QUOTATION WILL BE SUBJECT TO JOHANNESBURG WATER'S SUPPLY CHAIN POLICY**

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Guide: How to submit a response on the E-tender Portal

- Submit on E tender portal, following the below:

1. (https://www.etenders.gov.za/)
2. Search/Click Browse Opportunities by organ of state (Johannesburg Water)/search by RFQ reference number.
3. Click the **+ sign** to expand the tender/ RFQ information.
4. start the e submission process.
5. Supplier login
6. Use your CSD Credentials to Login. Contact CSD on (csd@treasury.gov.za) in case you forgot your login credentials. “My profile should show if you have logged in successfully”.
7. select supplier.
8. check the submission checklist and attached the compulsory documents.
9. confirm and proceed.

If the application is not going through on the E-tender portal Contact:

eTenders Contact Centre
+27(0)12 406 9222 / 012 406-9229 / 012 312-5000
etenders@treasury.gov.za https://etenders.treasury.gov

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Specification:

RFQ Evaluation Criteria

NO.	MANDATORY CRITERIA	YES/NO
1.	BOQ completed in full by the bidder	
2.	The bidder submitted proof of valid registration/letter certificate with minimum CIDB grading of 1 EP. **The certificate/letter must be submitted together with the RFQ.**	
3.	The bidder submitted proof of valid electrical installation registration as an electrical contractor (Installation Electrician) 3phase installation (IE)	
4.	The bidder submitted 1 CV for Artisan with Trade Test	
5.	The bidder submitted proof of at least one completed project whereby the scope of work was to supply/repair, deliver and install MCC or Control Panels, LV cables and cable ladders (completion certificate or reference letter signed by the client: with working contact details of the client, email and telephone numbers)	
6.	The bidder has attended compulsory site briefing	

Technical Specification

SpecE02 Cable Racks 201908
SpecE04 LVDB_MCC 201908
SpecE05 LV Cable 201908

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BILL OF MATERIAL

No.	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
	SECTION A : Material Supply and Delivery				
1	Supply and deliver 3CR12, 3mm thickness, B26 electric orange cable ladders c/w cover 150mm	m	36		
2	Supply and deliver 3CR12, 3mm thickness, B26 electric orange P2000 channel	m	12		
3	Supply and deliver stainless steel fasteners	sum	1		
4	Supply and deliver 6mm2 x 4c Cu swa pvc swa cable	m	300		
5	Supply and deliver 6mm2 lugs	sum	1		
6	Supply and deliver 1.5mm2 x 3c Cu swa pvc swa cable	m	150		
7	Supply and deliver 1.5mm2 lugs	sum	1		
8	Supply and delivery Corrosion Guard Ex E Gland For Swa Envirogland Type - size 0	each	18		
9	Supply and delivery Corrosion Guard Ex E Gland For Swa Envirogland Type - size 1	each	18		
10	Supply and delivery Corrosion Guard Ex E Gland For Swa Envirogland Type - size 2	each	18		
11	Supply and deliver 6mm2 x 4c LV cable joints kits Cast Resin c/w ferrules and tapes (provision)	each	4		
12	Supply and deliver underground warning tape 150mm caution electric cable	m	100		
13	Supply and deliver River sand 35m x 1m x 60mm	m3	2.1		
14	Supply and deliver 32A MCCB 36kA 3P with shunt trip, c/w shaft and door handle	each	3		
15	Supply and deliver ELCOR sensor 250mA	each	3		
16	Supply and deliver EL-SEC X earth fault relay 250mA	each	3		
17	Supply and deliver 2.5mm panel wire (red, black, grey) 20m/colour	m	60		
18	Supply and deliver core markers and steel tag marking	sum	1		
19	Supply and deliver cable tag markers	each	18		
20	Supply and deliver M8 x 60mm stainless steel Rawl Bots (packet of 100)	pkt	1		
21	Supply and deliver fluorescent starter 220-240VAC 4-80W	each	300		
22	Supply and deliver quicktronic fit T8, QT-FIT 2 x 58-70 electronic ballast Osram or equivalent (supply datasheet for if supplying equivalent for compatibility)	each	10		
	Total Section A				
	SECTION B: Labour and site work				
23	Decommissioning of old outdoor control panels including all associated cables and deliver to the works electrical stores	each	5		
24	Install stainless steel 3CR12 B26 electric orange outdoor panel with inner door (4 x M8 bolts per box) (panel supplied by others)	each	6		
25	Install stainless steel 3CR12 B26 electric orange Pedestal for outdoor panel (4 x M10 ralw bolts per pedestal) (pedestal supplied by others)	each	6		
26	Supply and deliver 3CR12, 3mm thickness, B26 electric orange cable ladders c/w cover 150mm	m	36		
27	Supply and deliver 3CR12, 3mm thickness, B26 electric orange P2000 channel	m	12		
28	Install stainless steel fasteners	sum	1		
29	Install 6mm2 x 4c Cu swa pvc swa cable and cable strapping	m	300		
30	Install 6mm lugs	sum	1		
31	Install 1.5mm2 x 3c Cu swa pvc swa cable	m	100		

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32	Install 1.5mm2 lugs	sum	1		
	Install cable glands, Corrosion Guard Ex E Gland for Swa Envirogland Type - size 0-2	each	36		
34	Install 6mm2 x 4c LV cable joints Cast Resin (provision)	each	4		
35	Install underground warning tape 150mm caution electric cable	m	100		
36	Pavement removal 35m x 1m	m2	35		
37	Excavation 600mm x 600mm x 35m	m3	13		
38	Backfilling and compaction 600mm x 600mm x 35m	m3	12.6		
39	Pavement re-instatement 35m x 1m	m2	35		
40	Install River sand 35m x 1m x 60mm	m3	2.1		
41	Install 32A MCCB 36kA 3P with shunt trip, c/w shaft and door handle	each	3		
42	Install ELCOR sensor 250mA	each	3		
43	Install EL-SEC X earth fault relay 250mA	each	3		
44	Install 2.5mm panel wire (red, black, grey) 20m/colour	m	60		
45	Install core markers and steel tags marking	sum	1		
46	Install cable tag markers	each	18		
47	Testing and Commissioning (MCC to Outdoor Control Panel to Motor)	each	6		
48	Quality Control Plan	sum	1		
49	Compliance with OHS requirements (safety file)	sum	1		
	Total Section B				
	SUB-TOTAL (A + B)				
	VAT				
	TOTAL				

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MANDATORY REQUIREMENTS:

1.1 *Full Completion of the Bill of Quantities (BOQ)/ Specification (where applicable)*

1.2 *Attendance of compulsory site briefing (where applicable)*

1.3 *Attachment of datasheet, reference letter, proof of certification, proof of accreditation, functionality requirements (where applicable)*

1.4 *No RFQ will be considered from persons in the service of the state*

1.5 No Bidder who is blacklisted by National Treasury or any National Authority due to non-performance will be considered

1.6 *All Quotes should be on PDF (MS WORD, MS EXCEL, PICTURES ARE NOT ALLOWED) and On Company Letterhead*

1.7 *Submission of a Joint Venture Agreement, where applicable, which has been properly signed by all parties*

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POPIA PRIVACY STATEMENT

Johannesburg Water SOC Limited

In terms of the Protection of Personal Information Act 213 (Act 4 of 2013), also called the POPI Act or POPIA, Johannesburg Water SOC Limited, undertakes all reasonable measures to protect personal information and to keep it private and confidential.

1. Privacy Notice applies to:

Suppliers, vendors, contractors, service providers, etc whether appointed or prospective.

2. Definitions of personal information

According to the Act "personal information" means information relating to an identifiable living, natural person, and where it is applicable, an identifiable, existing juristic person. All addresses including residential, postal and email addresses.

3. About the Public Entity

Johannesburg Water (SOC) Limited, registration number 2000/029271/30

3.1 The information we collect

We collect information directly from you where you provide us with your personal details. Where possible, we will inform you what information you are required to provide to us and what information is optional.

3.2 How Johannesburg Water use your information

We will use your personal information only for the purposes for which it was collected and agreed with you. For example: to gather contact information, to confirm and verify your identity, for the evaluation and adjudication of bids and quotations for tenders, request for quotations, and other personal information for the procurement of goods and services by the Entity.

3.3 Disclosure of information

We may disclose your personal information to our Shareholder, the City of Johannesburg, and other Government agencies such as National Treasury, and the Auditor-General of South Africa. We have agreements in place to ensure that they comply with the privacy requirements as required by the Protection of Personal Information Act.

We may also disclose your information:

- Where we have a duty or a right to disclose in terms of law.
- Where we believe it is necessary to protect our rights.

3.4 Information Security

We are legally obliged to provide adequate protection for the personal information we hold and to stop unauthorised access and use of personal information. We will, on an ongoing basis, continue to review our security controls and related processes to ensure that your personal information remains secure.

When we contract with third parties, we impose appropriate security, privacy and confidentiality obligations on them to ensure that personal information that we remain responsible for is kept secure. We will ensure that anyone with whom we pass your personal information agrees to treat your information with the same level of protection as we are obliged to.

3.5 Your rights: Access to Information

You have the right to request a copy of the personal information we hold about you. To do this, simply contact us at informationofficer@jwater.co.za, and specify what information you require.

3.6 Correction of your personal information

You have the right to ask us to update, correct or delete your personal information. We will require a copy of your identification document to confirm your identity before making changes to personal information we may hold about you. We would appreciate it if you would keep your personal information accurate and up to date.

3.7 How to contact us

If you have any queries about this document; you need further information about our privacy practices; wish to withdraw consent; exercise preferences or access or correct your personal information, please contact us at the numbers listed on our website or send an email to informationofficer@jwater.co.za.

CONSENT TO PROCESS PERSONAL INFORMATION IN TERMS OF THE PROTECTION OF PERSONAL INFORMATION ACT, NO. 4 OF 2013 (POPIA)

The purpose of the Protection of Personal Information Act, no. 4 of 2013 (POPIA), is to protect personal information of individuals and businesses and to give effect to their right of privacy as provided for in the Constitution. By signing this form, you consent to lawful collection, processing, storage and, where necessary, sharing your personal information by Johannesburg Water SOC Ltd. and consent is effective immediately and will remain effective until such consent is withdrawn in terms of POPIA.

1. I …… a natural person "herein referred to as the Data Subject" with ID Number.....hereby give my consent to Johannesburg Water SOC Ltd. "herein referred to as the Responsible Party" to collect, process and distribute my personal information where Johannesburg Water SOC Ltd. is legally required to do so.

2. I understand my right to privacy and the right to have my personal information processed in accordance with the conditions for the lawful processing of personal information.

3. I understand the purposes for which my personal information is required and for which it will be used and consent to third parties accessing my personal information and to Johannesburg Water SOC Ltd. sharing my personal information strictly for reporting purposes.

4. I understand that, should I refuse to provide Johannesburg Water SOC Ltd. with the required consent and/or information, Johannesburg Water SOC Ltd. will be unable to assist me.

5. I declare that all my personal information supplied to Johannesburg Water SOC Ltd. is accurate, up to date, not misleading and that it is complete in all respects and that I will notify Johannesburg Water SOC Ltd. of any changes to my Personal Information should any of these details change.

6. I also understand that I have the right to request that my personal information be corrected or deleted, if it is inaccurate, irrelevant, excessive, out of date, incomplete, misleading, or obtained unlawfully or that the personal information or record be destroyed or deleted if the Responsible Party is no longer authorised to retain it.

Signed at ..... this ..... day of .....20……

…..
Signature of data subject/designated person

……	……	……
Full Name/Dept of Responsible Party	Signature	Date

DATA SUBJECT CONSENT WITHDRAWAL FORM
IN TERMS OF THE PROTECTION OF PERSONAL INFORMATION ACT, NO. 4 OF 2013 (POPIA)

CONSENT

I .....a natural person "herein referred to as the "Data Subject" with identification number …….. hereby withdraw my consent to process my personal information by Johannesburg Water SOC Ltd (Responsible Party). Therefore, Johannesburg Water SOC Ltd. no longer has my consent to process my personal information for the intended purpose

……
……
……..
which was previously granted using the DATA SUBJECT CONSENT FORM.

The withdrawal of consent does not affect the lawfulness of the processing activities up to the date on this form.

Details of Data Subject

Name and surname:	……..
Identification number:	……..
Date of Birth:	……..
Residential address:	……..
	……..
	……..
Contact number(s):	……..
E-mail address:	……..
Relationship to Responsible Party:	……..

Signed at _____on this _____day of _____20 ___

_____
Signature of Data Subject

_____
Information Officer/Deputy
Johannesburg Water SOC Ltd.

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ADMINISTRATIVE REQUIREMENTS

PLEASE SUPPLY THE FOLLOWING DOCUMENTS TO ENABLE US TO EVALUATE YOUR SUBMISSION:

Returnable Documents	Description	Yes/No
1	Original Valid Tax Clearance Certificate /valid SARS PIN	**COMPULSORY**
2	A, certified /original/valid, BBBEE certificate /affidavit (Please note that the Sworn Affidavit must be compliant as per B- BBEE Practice Guide 01 of 2018 , NON-COMPLIANT AFFIDAVIT WILL BE SCORED ZERO)	**COMPULSORY**
3	Municipal rates and taxes (Must not be older than 90 days in arrears in line with regulation 38.	**COMPULSORY**
4	Signed Declaration of Interest form (MBD 4)	**COMPULSORY**
5	Declaration of Bidders past supply chain management practices (MBD 8)	**COMPULSORY**
6	Certificate of Independent Proposal Determination (MBD 9)	**COMPULSORY**
7	Proof of CSD registration /MAAA Supplier Number	**COMPULSORY**
8	Preference points claim form in terms of the preferential procurement regulations 2022 (MBD 6.1)	**COMPULSORY**
9	Company registration documents with ID copies of directors / shareholders.	**COMPULSORY**

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MBD 3.1

PRICING SCHEDULE – FIRM PRICES (PURCHASES)

NOTE: **ONLY FIRM PRICES WILL BE ACCEPTED. NON-FIRM PRICES (INCLUDING PRICES SUBJECT TO RATES OF EXCHANGE VARIATIONS) WILL NOT BE CONSIDERED**

IN CASES WHERE DIFFERENT DELIVERY POINTS INFLUENCE THE PRICING, A SEPARATE PRICING SCHEDULE MUST BE SUBMITTED FOR EACH DELIVERY POINT

Name of Bidder…… Bid Number……

Closing Time ……. ….. Closing Date…….

OFFER TO BE VALID FOR **60 DAYS** FROM THE CLOSING DATE OF BID.

ITEM NO.	QUANTITY (QTY)	DESCRIPTION	UOM	UNIT PRICE (P)	TOTAL PRICE (QTY*P)
1	1	SECTION A: Material Supply and Delivery	Sum		
2	1	SECTION B: Labour and site work	Sum		
		SUB-TOTAL			**R**
		VAT AT 15%			**R**
GRAND TOTAL (BID PRICE IN RSA CURRENCY WITH ALL APPLICABLE TAXES INCLUDED)					**R**

I (full name) _____, in my capacity as _____, the duly authorized representative of _____(company name) hereby declares that the offer is in

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accordance with the attached specification, notes to suppliers & accepts all conditions/ clauses contained in the said documents.	
Signature of duly authorized representative	**Date:**

- Required by: ……

- At: ……

……

- Brand and Model ……..

- Country of Origin

……

- Does the offer comply with the specification(s)? *YES/NO

- If not to specification, indicate deviation(s) ……..

- Period required for delivery ……..

*Delivery: Firm/Not firm

- Delivery basis ……

Note: All delivery costs must be included in the bid price for delivery at the prescribed destination.

** “all applicable taxes” includes value- added tax, pay as you earn, income tax, unemployment insurance fund contributions and skills development levies.

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Ms Kethabile Mabe (Company Secretary),
Johannesburg Water SOC Ltd
Registration Number: 2000/029271/30

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MBD 4

DECLARATION OF INTEREST

1. No bid will be accepted from persons in the service of the state[1].

2. Any person, having a kinship with persons in the service of the state, including a blood relationship, may make an offer or offers in terms of this invitation to bid. In view of possible allegations of favouritism, should the resulting bid, or part thereof, be awarded to persons connected with or related to persons in service of the state, it is required that the bidder or their authorised representative declare their position in relation to the evaluating/adjudicating authority.

3 In order to give effect to the above, the following questionnaire must be completed and submitted with the bid.

3.1 Full Name of bidder or his or her representative: .....

3.2 Identity Number:.....

3.3 Position occupied in the Company (director, trustee, hareholder[2]): .....

3.4 Company RegistrationNumber: .....

3.5 Tax Reference Number: .....

3.6 VAT Registration Number: .....

3.7 The names of all directors / trustees / shareholders members, their individual identity numbers and state employee numbers must be indicated in paragraph 4 below.

3.8 Are you presently in the service of the state… ..... **YES / NO**

3.8.1 If yes, furnish particulars.....
.....

[1]MSCM Regulations: "in the service of the state" means to be –
(a) a member of –
(i) any municipal council.
(ii) any provincial legislature; or
(iii) the national Assembly or the national Council of provinces.

(b) a member of the board of directors of any municipal entity.

(c) an official of any municipality or municipal entity.

(d) an employee of any national or provincial department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999 (Act No.1 of 1999);

(e) a member of the accounting authority of any national or provincial public entity; or

(f) an employee of Parliament or provincial legislature.

[2] Shareholder" means a person who owns shares in the company and is actively involved in the management of the company or business and exercises control over the company.

3.9 Have you been in the service of the state for the past twelve months?..... **YES / NO**

3.9.1 If yes, furnish particulars.....

.....

3.10 Do you have any relationship (family, friend, other) with persons in the service of the state and who may be involved with the evaluation and or adjudication of this bid? ..... **YES / NO**

3.10.1 If yes, furnish particulars.....

.....

3.11 Are you, aware of any relationship (family, friend, other) between any other bidder and any persons in the service of the state who may be involved with the evaluation and or adjudication of this bid? ..... **YES / NO**

3.11.1 If yes, furnish particulars.....

.....

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3.12 Are any of the company's directors, trustees, managers, principal shareholders or stakeholders in service of the state? .....**YES / NO**

3.12.1 If yes, furnish particulars.....

.....

3.13 Are any spouse, child or parent of the company's directors' trustees, managers, principle shareholders or stakeholders in service of the state .....**YES/ NO**

3.13.1 If yes, furnish particulars.....

.....

3.14 Do you or any of the directors, trustees, managers, principle shareholders, or stakeholders of this company have any interest in any other related companies or business whether or not they are bidding for this contract .....**YES / NO**

3.14.1 If yes, furnish particulars: .....

.....

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4. Full details of directors / trustees / members / shareholders.

Full Name	Identity Number	State Employee Number

…….. ……..

Signature **Date**

…… ……

Capacity **Name of Bidder**

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MBD 6.1

PREFERENCE POINTS CLAIM FORM IN TERMS OF THE PREFERENTIAL PROCUREMENT REGULATIONS 2022

This preference form must form part of all tenders invited. It contains general information and serves as a claim form for preference points for specific goals.

NB: BEFORE COMPLETING THIS FORM, TENDERERS MUST STUDY THE GENERAL CONDITIONS, DEFINITIONS AND DIRECTIVES APPLICABLE IN RESPECT OF THE TENDER AND PREFERENTIAL PROCUREMENT REGULATIONS, 2022

1. GENERAL CONDITIONS

1.1 The following preference point systems are applicable to invitations to tender:

- the 80/20 system for requirements with a Rand value of up to R50 000 000 (all applicable taxes included); and
- the 90/10 system for requirements with a Rand value above R50 000 000 (all applicable taxes included).

1.2 To be completed by the organ of state

(*delete whichever is not applicable for this tender*).

a) The applicable preference point system for this tender is the 90/10 preference point system.

b) The applicable preference point system for this tender is the 80/20 preference point system.

c) Either the 90/10 or 80/20 preference point system will be applicable in this tender. The lowest/ highest acceptable tender will be used to determine the accurate system once tenders are received.

1.3 Points for this tender (even in the case of a tender for income-generating contracts) shall be awarded for:

(a) Price; and

(b) Specific Goals.

1.4 To be completed by the organ of state:

The maximum points for this tender are allocated as follows:

	POINTS
PRICE	80
SPECIFIC GOALS:	20
Total points for Price and SPECIFIC GOALS	**100**

1.5 Failure on the part of a tenderer to submit proof or documentation required in terms of this tender to claim points for specific goals with the tender, will be interpreted to mean that preference points for specific goals are not claimed.

1.6 The organ of state reserves the right to require of a tenderer, either before a tender is adjudicated or at any time subsequently, to substantiate any claim in regard to preferences, in any manner required by the organ of state.

2. DEFINITIONS

(a) **"tender"** means a written offer in the form determined by an organ of state in response to an invitation to provide goods or services through price quotations, competitive tendering process or any other method envisaged in legislation.

(b) **"price"** means an amount of money tendered for goods or services, and includes all applicable taxes less all unconditional discounts;

(c) **"Rand value"** means the total estimated value of a contract in Rand, calculated at the time of bid invitation, and includes all applicable taxes;

(d) **"tender for income-generating contracts"** means a written offer in the form determined by an organ of state in response to an invitation for the origination of income-generating contracts through any method envisaged in legislation that will result in a legal agreement between the organ of state and a third party that produces revenue for the organ of state, and includes, but is not limited to, leasing and disposal of assets and concession contracts, excluding direct sales and disposal of assets through public auctions; and

(e) **"The Act"** means the Preferential Procurement Policy Framework Act, 2000 (Act No. 5 of 2000).

3. FORMULAE FOR PROCUREMENT OF GOODS AND SERVICES

3.1. POINTS AWARDED FOR PRICE

3.1.1 THE 80/20 OR 90/10 PREFERENCE POINT SYSTEMS

A maximum of 80 or 90 points is allocated for price on the following basis:

80/20 **or** **90/10**

$$Ps = 80\left(1 - \frac{Pt - P\,min}{P\,min}\right) \text{ or } Ps = 90\left(1 - \frac{Pt - P\,min}{P\,min}\right)$$

Where

Ps = Points scored for price of tender under consideration

Pt = Price of tender under consideration

Pmin = Price of lowest acceptable tender

3.2. FORMULAE FOR DISPOSAL OR LEASING OF STATE ASSETS AND INCOME GENERATING PROCUREMENT

3.2.1. POINTS AWARDED FOR PRICE

A maximum of 80 or 90 points is allocated for price on the following basis:

80/20 **or** **90/10**

$$Ps = 80\left(1 + \frac{Pt - P\,max}{P\,max}\right) \text{ or } \quad Ps = 90\left(1 + \frac{Pt - P\,max}{Pmax}\right)$$

Where

Ps	=	Points scored for price of tender under consideration
Pt	=	Price of tender under consideration
Pmax	=	Price of highest acceptable tender

4. POINTS AWARDED FOR SPECIFIC GOALS

4.1. In terms of Regulation 4(2); 5(2); 6(2) and 7(2) of the Preferential Procurement Regulations, preference points must be awarded for specific goals stated in the tender. For the purposes of this tender the tenderer will be allocated points based on the goals stated in table 1 below as may be supported by proof/ documentation stated in the conditions of this tender:

4.2. In cases where organs of state intend to use Regulation 3(2) of the Regulations, which states that, if it is unclear whether the 80/20 or 90/10 preference point system applies, an organ of state must, in the tender documents, stipulate in the case of—

(a) an invitation for tender for income-generating contracts, that either the 80/20 or 90/10 preference point system will apply and that the highest acceptable tender will be used to determine the applicable preference point system: or

(b) any other invitation for tender, that either the 80/20 or 90/10 preference point system

will apply and that the lowest acceptable tender will be used to determine the applicable preference point system,

then the organ of state must indicate the points allocated for specific goals for both the 90/10 and 80/20 preference point system.

Table 1: Specific goals for the tender and points claimed are indicated per the table below.

(Note to organs of state: Where either the 90/10 or 80/20 preference point system is applicable, corresponding points must also be indicated as such.

Note to tenderers: The tenderer must indicate how they claim points for each preference point system.)

The specific goals allocated points in terms of this tender	Number of points allocated (80/20 system) (To be completed by the organ of state)	Number of points claimed (80/20 system) (To be completed by the tenderer)	Proof of documents as per spec
SMME (An EME or QSE) **51% or more black owned by Black People**	80		• Valid BBBEE Certificate issued by SANAS accredited verification agency or DTI /CIPC BBBEE Certificate for Exempted Micro Enterprises or Qualifying Small Enterprise or Affidavit sworn under oath.

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(b) recover costs, losses or damages it has incurred or suffered as a result of that person's conduct.

(c) cancel the contract and claim any damages which it has suffered as a result of having to make less favourable arrangements due to such cancellation.

(d) recommend that the tenderer or contractor, its shareholders and directors, or only the shareholders and directors who acted on a fraudulent basis, be restricted from obtaining business from any organ of state for a period not exceeding 10 years, after the *audi alteram partem* (hear the other side) rule has been applied; and

(e) forward the matter for criminal prosecution, if deemed necessary.

	…… **SIGNATURE(S) OF TENDERER(S)**
SURNAME AND NAME:	……
DATE:	……
ADDRESS:	……
	……
	……
	……

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MBD 8

DECLARATION OF BIDDER'S PAST SUPPLY CHAIN MANAGEMENT PRACTICES

1 This Municipal Bidding Document must form part of all bids invited.

2 It serves as a declaration to be used by municipalities and municipal entities in ensuring that when goods and services are being procured, all reasonable steps are taken to combat the abuse of the supply chain management system.

3 The bid of any bidder may be rejected if that bidder, or any of its directors have:

a. abused the municipality's / municipal entity's supply chain management system or committed any improper conduct in relation to such system.
b. been convicted for fraud or corruption during the past five years.
c. willfully neglected, reneged on or failed to comply with any government, municipal or other public sector contract during the past five years; or
d. been listed in the Register for Tender Defaulters in terms of section 29 of the Prevention and Combating of Corrupt Activities Act (No 12 of 2004).

4 In order to give effect to the above, the following questionnaire must be completed and submitted with the bid.

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4.1	Is the bidder or any of its directors listed on the National Treasury's Database of Restricted Suppliers as companies or persons prohibited from doing business with the public sector? (Companies or persons who are listed on this Database were informed in writing of this restriction by the Accounting Officer/Authority of the institution that imposed the restriction after the *audi alteram partem* rule was applied). **The Database of Restricted Suppliers now resides on the National Treasury's website(www.treasury.gov.za) and can be accessed by clicking on its link at the bottom of the home page.**	Yes ☐	No ☐
4.1.1	If so, furnish particulars:		
4.2	Is the bidder or any of its directors listed on the Register for Tender Defaulters in terms of section 29 of the Prevention and Combating of Corrupt Activities Act (No 12 of 2004)? **The Register for Tender Defaulters can be accessed on the National Treasury's website (www.treasury.gov.za) by clicking on its link at the bottom of the home page.**	Yes ☐	No ☐
4.2.1	If so, furnish particulars:		
4.3	Was the bidder or any of its directors convicted by a court of law (including a court of law outside the Republic of South Africa) for fraud or corruption during the past five years?	Yes ☐	No ☐
4.3.1	If so, furnish particulars:		

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4.4	Does the bidder or any of its directors owe any municipal rates and taxes or municipal charges to the municipality / municipal entity, or to any other municipality / municipal entity, that is in arrears for more than three months?	Yes ☐	No ☐
4.4.1	If so, furnish particulars:		
4.5	Was any contract between the bidder and the municipality / municipal entity or any other organ of state terminated during the past five years on account of failure to perform on or comply with the contract?	Yes ☐	No ☐
4.7.1	If so, furnish particulars:		

CERTIFICATION

I, THE UNDERSIGNED (FULL NAME) ……..……..……

CERTIFY THAT THE INFORMATION FURNISHED ON THIS

DECLARATION FORM TRUE AND CORRECT.

I ACCEPT THAT, IN ADDITION TO CANCELLATION OF A CONTRACT, ACTION MAY BE TAKEN AGAINST ME SHOULD THIS DECLARATION PROVE TO BE FALSE.

……... ……..

Signature **Date**

…… ……..

Position **Name of Bidder**

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MBD 9

CERTIFICATE OF INDEPENDENT BID DETERMINATION

1 This Municipal Bidding Document (MBD) must form part of all bids[1] invited.

2 Section 4 (1) (b) (iii) of the Competition Act No. 89 of 1998, as amended, prohibits an agreement between, or concerted practice by, firms, or a decision by an association of firms, if it is between parties in a horizontal relationship and if it involves collusive bidding (or bid rigging).[2] Collusive bidding is a *pe se* prohibition meaning that it cannot be justified under any grounds.

3 Municipal Supply Regulation 38 (1) prescribes that a supply chain management policy must provide measures for the combating of abuse of the supply chain management system, and must enable the accounting officer, among others, to:

a. take all reasonable steps to prevent such abuse;

b. reject the bid of any bidder if that bidder or any of its directors has abused the supply chain management system of the municipality or municipal entity or has committed any improper conduct in relation to such system; and

c. cancel a contract awarded to a person if the person committed any corrupt or fraudulent act during the bidding process or the execution of the contract.

4 This MBD serves as a certificate of declaration that would be used by institutions to ensure that, when bids are considered, reasonable steps are taken to prevent any form of bid-rigging.

5 In order to give effect to the above, the attached Certificate of Bid Determination (MBD 9) must be completed and submitted with the bid:

[1] Includes price quotations, advertised competitive bids, limited bids and proposals.

[2] Bid rigging (or collusive bidding) occurs when businesses, that would otherwise be expected to compete, secretly conspire to raise prices or lower the quality of goods and / or services for purchasers who wish to acquire goods and / or services through a bidding process. Bid rigging is, therefore, an agreement between competitors not to compete.

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MBD 9

CERTIFICATE OF INDEPENDENT BID DETERMINATION

I, the undersigned, in submitting the accompanying bid:

_____

(Bid Number and Description)

in response to the invitation for the bid made by:

_____

(Name of Municipality / Municipal Entity)

do hereby make the following statements that I certify to be true and complete in every respect:

I certify, on behalf of:_____that:

(Name of Bidder)

1. I have read and I understand the contents of this Certificate.
2. I understand that the accompanying bid will be disqualified if this Certificate is found not to be true and complete in every respect.
3. I am authorized by the bidder to sign this Certificate, and to submit the accompanying bid, on behalf of the bidder.
4. Each person whose signature appears on the accompanying bid has been authorized by the bidder to determine the terms of, and to sign, the bid, on behalf of the bidder.
5. For the purposes of this Certificate and the accompanying bid, I understand that the word "competitor" shall include any individual or organization, other than the bidder, whether or not affiliated with the bidder, who:

    (a) has been requested to submit a bid in response to this bid invitation.
    (b) could potentially submit a bid in response to this bid invitation, based on their qualifications, abilities or experience; and
    (c) provides the same goods and services as the bidder and/or is in the same line of business as the bidder

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6. The bidder has arrived at the accompanying bid independently from, and without consultation, communication, agreement or arrangement with any competitor. However, communication between partners in a joint venture or consortium[3] will not be construed as collusive bidding.
7. In particular, without limiting the generality of paragraphs 6 above, there has been no consultation, communication, agreement or arrangement with any competitor regarding:
    (a) prices.
    (b) geographical area where product or service will be rendered (market allocation)
    (c) methods, factors or formulas used to calculate prices.
    (d) the intention or decision to submit or not to submit, a bid.
    (e) the submission of a bid which does not meet the specifications and conditions of the bid; or
    (f) bidding with the intention not to win the bid.
8. In addition, there have been no consultations, communications, agreements or arrangements with any competitor regarding the quality, quantity, specifications and conditions or delivery particulars of the products or services to which this bid invitation relates.
9. The terms of the accompanying bid have not been, and will not be, disclosed by the bidder, directly or indirectly, to any competitor, prior to the date and time of the official bid opening or of the awarding of the contract.

[3] Joint venture or Consortium means an association of persons for the purpose of combining their expertise, property, capital, efforts, skill and knowledge in an activity for the execution of a contract.

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10. I am aware that, in addition and without prejudice to any other remedy provided to combat any restrictive practices related to bids and contracts, bids that are suspicious will be reported to the Competition Commission for investigation and possible imposition of administrative penalties in terms of section 59 of the Competition Act No 89 of 1998 and or may be reported to the National Prosecuting Authority (NPA) for criminal investigation and or may be restricted from conducting business with the public sector for a period not exceeding ten (10) years in terms of the Prevention and Combating of Corrupt Activities Act No 12 of 2004 or any other applicable legislation.

.....	.....
Signature	Date
.....	.....
Position	Name of Bidder

Johannesburg Water	Document title :	**Minimum SHE Requirements for Construction Related RFQ projects**		
	Revision	00	Author:	OHS: Projects
	Effective Date	January 2017	Pages:	01

1. SCOPE OF WORK

Head of works panels repairs for screens and compactors

2. PURPOSE

The aim of the SHE specification is to ensure that any contractor which is appointed by Johannesburg Water to conduct any work complies with the SHE requirements of the SHE specification and any other legislative requirement applicable to the contract scope.

3. APPLICABILITY

This document is applicable to all contractors and suppliers conducting contractual activities for and on behalf of Johannesburg Water.

4. APPOINTMENTS

The contractor and its appointed sub-contractor must make the relevant legislative and non-statutory appointments, which must be maintained valid for the entire contract duration.

All appointees shall be suitably trained and found to be competent for the responsibilities there are assigned for.

Copies of all relevant appointments and the relevant competence certificates must be kept in the relevant SHE file.

5. INSURANCE

The contractor and all its appointed sub-contractor(s) shall be registered with an appropriate compensation commissioner and have a valid letter of good standing from commissioner. The contractor is responsible for ensuring the Letter of Good Standing is valid for the entire duration of the project/contract. A copy of the letter of Good Standing must be kept in the SHE file.

6. COSTING FOR SHE REQUIREMENTS

The contractor is responsible for ensuring that SHE costing is taken into consideration for the entire project/contract as this will ensure they comply with the SHE legislative requirements

7. INDUCTION

An initial induction shall be done with key personnel to familiarize them with the requirements on site and for compiling the SHE file.

Once labourers are appointed JW will conduct an induction on SHE requirements, and the contractor is also required to conduct their company specific induction

8. SUBMISSION OF SAFETY FILE

- Once appointed the contractor can submit their safety file for approval.
- Approval will be granted when the critical items have been sufficiently addressed.

9. RISK ASSESSMENT

- Every Contractor who has been appointed contractually to conduct work for Johannesburg water shall do compile a baseline risk assessment prior to starting with work, subject to the approval of the Client.
- Thereafter the task based risk assessments will be done daily with every task being done.

10. SAFE WORKING PROCEDURES / METHOD STATEMENTS

The following method statements / safe working procedures must be compiled:

- Incident investigation, emergency plan, waste management plan, PPE procedure, hand tool procedure, hazardous chemical substance procedure.
- Method statement for the entire works

11.ELECTRICAL CONTRACTOR & RESPONSIBLITIES

- No person may do electrical installation work as an electrical contractor unless that person has been registered as an electrical contractor in terms of the Regulation.
- The principal contractor who does electrical installation work as an electrical contractor shall register annually in the form of Annexure 3 with the chief inspector or a person appointed by the chief inspector. An application for registration shall be accompanied by a prescribed fee.
- An electrical contractor shall be responsible for the safety, safe use and maintenance of the electrical installation he or she uses or leases.

12.CERTIFICATE OF COMPLIANCE

- A registered person may issue a certificate of compliance accompanied by the required test report only after having satisfied himself or herself by means of an inspection and test that a new electrical installation complies with the provisions of regulation 5(1) and was carried out under his or her general control; or an electrical installation which existed prior to the publication of the current edition of the health and safety standard incorporated into these Regulations in terms of regulation 5(1), complies with the general safety principles of such standard; or the existing part of the electrical installation complies with the general safety principles of such standard and is reasonably safe, and the extensions or alterations effected comply with the provisions of regulation 5(1) and were carried out under his or her general control.
- Any person who undertakes to do electrical installation work shall ensure that a valid certificate of compliance is issued for that work and no person may amend a certificate of compliance.

13.WORKING AT HEIGHTS

- A competent person must compile a fall protection plan for all tasks which will be done at elevated position.
- The requirements as per the Construction regulations for working at heights shall be always complied with by the contractor.
- The fall protection plan shall be specific to the work that will be conducted at elevated position and proper provision must be made for rescue of employees at heights.
- Fall protection plan must include fall risk assessment detailing proper controls to be implemented.
- All employees who their duties entail working at heights must be declared medically fit by an Occupational Health Practitioner for working at heights.
- Employees who will be working at heights must be trained by a competent service provider for working at heights and must be trained on use of fall prevention/arrest devices to be used at heights.
- Employees working at height must be trained on the latest approved fall protection plan before work commences at height.

14. WORKING IN CONFINED SPACES

- An employer/contractor shall take steps to ensure that a confined space is entered by an employee or other person only after the air therein has been tested and evaluated by a person who is competent to pronounce on the safety thereof, and who has certified in writing that the confined space is safe and will remain safe while any person is in the confined space, taking into account the nature and duration of the work to be performed therein.

15. MEDICAL SCREENING REQUIREMENTS

- The contractor shall ensure that a medical surveillance programme is implemented for all employees.
- The medical examination shall be conducted in line with the employee job profile/job description.
- A valid medical fitness certificate must be submitted together with the SHE File for approval for all employees who will be doing work for Johannesburg Water.
- Any employee(s) who are declared conditionally fit must be provided with employment which does not aggravate their medical condition as to endanger themselves or other employees.
- The following tests shall be done:
    - Audiograms.
    - A cardio-respiratory examination
    - Lung function tests.
    - Eye/ sight tests.
    - A general physical examination.
    - A review of previous medical history.
    - Blood pressure tests
    - Glucose tests
    - Vaccinations (Hepatitis A & Typhoid)

16.TOOLBOX TALKS

- The contractor shall ensure they conduct toolbox talks with their employees on a weekly basis and records of these must be kept in the SHE file.
- The objective of toolbox talks should be to communicate relevant site information to assist in improvement of occupational health and safety performance.
- Employees must acknowledge the receipt of toolbox talks and this record must also be kept in the SHE file.

17 .PERSONAL PROTECTIVE EQUIPMENT (PPE)

- Contractor must issue their employees SABS approved PPE. A copy of the PPE issue register signed by the employee issued with the PPE must be kept in the SHE file.
- Contractor supervisor are required to conduct continuous inspections of the PPE issued to their employees to ensure that they are still in good condition to be used by the employee or they still comply with manufacture requirements.
- The contractor is responsible for ensuring that employees are trained on the safe use of the PPE issued to them, how to maintain it and the limitations of the PPE.
- NO SHORTS OR DRESSES WILL BE ALLOWED ON SITE

18. WORKPLACE SIGNAGE

- Appropriate symbolic signage must be displayed where it is required by legislation.
- Appropriate warning, mandatory and information signs must be placed where required.
- All signs must comply to SANS/SABS requirements.
- Contractors shall use mandatory and prescribed symbolic safety signs at their lay down and site areas.

19.INCIDENT REPORTING AND INVESTIGATION

- All incidents shall be reported to the Client before the end of the shift or within 24hrs of occurrence.
- Section 24 incidents shall be reported to DOL using the prescribed format.
- The contractor shall develop an incident management procedure and communicate with all employees.

20.NOTIFICATION OF CONSTRUCTION WORK

- The contractor shall notify the DOL in the prescribed format of the intended work prior to work.

21.COMPLIANCE MONITORING

- Weekly inspections and monthly audits will be conducted on site.

22.PROJECT COMPLETION

- Upon completion of the project the SHE file shall be returned to the Client for retention and close out

Johannesburg Water	Document title :	**Minimum SHE Requirements for Construction Related RFQ projects**		
	Revision	00	Author:	OHS: Projects
	Effective Date	January 2017	Pages:	01

Project details						
Project Scope: Head of works panels repairs for screens and compactors **Depot / Site / Department: Northernworks** **Estimated duration: TBC**						
Documents required						
Letter of Good Standing	**Yes**	X	**No**		**N/A**	
SHE plan	**Yes**	X	**No**		**N/A**	
Risk Assessment	**Yes**	X	**No**		**N/A**	
Safe working Procedures	**Yes**	X	**No**		**N/A**	
Notification of Construction work	**Yes**	X	**No**		**N/A**	
Inspection registers	**Yes**	X	**No**		**N/A**	
Items required before starting						
Medicals	**Yes**	x	**No**		**N/A**	
Vaccinations	**Yes**	x	**No**		**N/A**	
PPE (boots, hard hats, overall)	**Yes**	X	**No**		**N/A**	
Induction	**Yes**	X	**No**		**N/A**	
Approval from OHS	**Yes**	X	**No**		**N/A**	
APPOINTMENTS AND COMPETENCIES						
Construction Supervisor						
Appointment	**Yes**	X	**No**		**N/A**	
CV (and/ certificates)	**Yes**	X	**No**		**N/A**	
Safety Officer						
Appointment	**Yes**	x	**No**	X	**N/A**	
CV (and/ certificates)	**Yes**	x	**No**	X	**N/A**	
NB* Other appointments will be based on the number of employees on site as required by law.						

RETURNABLE ANNEXURE A: ACKNOWLEDGEMENT OF SHE SPECIFICATION & ANNEXURES

CONTRACTOR:	

I, the undersigned, hereby acknowledge that I have obtained copies of the following listed documentation and confirm that I fully understand the contents thereof and the consequences of non-compliance. The Contractor furthermore reiterates its commitment to compliance of the requirements contained within the following provided documentation:

- Johannesburg Water SOC Ltd, Safety, Health & Environmental (SHE) Specification, Annexure 1: Baseline risk assessment conducted for or on behalf of Johannesburg Water SOC Ltd;

Signed at …… on this …….. Day of …… 20……...

CONTRACT MANAGER			
NAME	DESIGNATION	DATE	SIGNATURE
CONTRACT SUPERVISOR			
NAME	DESIGNATION	DATE	SIGNATURE
WITNESS (1)			
NAME	DESIGNATION	DATE	SIGNATURE
WITNESS (2)			
NAME	DESIGNATION	DATE	SIGNATURE

JOHANNESBURG WATER (SOC) Ltd.

BULK WASTEWATER

PARTICULAR SPECIFICATION

E02 : ELECTRICAL CABLE RACKS

Johannesburg Water (SOC) Ltd.
PO Box 61542
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Revision 5

August 2019

City of Johannesburg
Johannesburg Water (Pty) Ltd

DOCUMENT CONTROL SHEET

Document Title: **Particular Specification – E02 : Electrical Cable Racks**

JW Reference: **BWW523C**

Document Ref. No: **E02**

DOCUMENT APPROVAL

RECORD OF REVISIONS

Date	Revision	Author	Comments
5	2019-08-20	B Pieterse	Review of Electrical Standards, plus New Design Guidance
4	2014-06-03		Review of Mechanical / Electrical and Control / Instrumentation Standards, plus New Design Guidance
3	2012-05-30		Review of Mechanical / Electrical and Control / Instrumentation Standards, plus New Design Guidance
2	2010-05-03		Review Electrical Standards
1	2009-05-12		Review of Mechanical / Electrical and Control / Instrumentation Standards, plus New Design Guidance

PARTICULAR SPECIFICATION: VOLUME E02: ELECTRICAL CABLE RACKS

CONTENTS

E02.1 SCOPE

This specification covers the supply, delivery and installation of cable ladders for industrial installations. Only cable ladders are to be supplied. Cable trays shall not be acceptable. Cable ladders are not recommended for large cables and open ground as they expose the cable to theft.

E02.1.1 Statutory Documents and Standards

Cable ladders shall be manufactured in accordance with the requirements of the latest editions of the following standards:

(a) SANS 10044	:	Welding
(b) SANS 10064	:	Preparation of steel surfaces for coating
(c) SANS 1274	:	Coatings applied by the powder process
(d) SANS 10162-1	:	The structural use of steel Part 1: Limit-states design of hot-rolled steelwork
(e) SANS 10162-2	:	The structural use of steel Part 2: Limit-states design of cold-formed steelwork
(f) SANS 10162-4	:	The structural use of steel Part 4: The design of cold-formed stainless steel structural members
(g) SANS 10142-1	:	The wiring of premises Part 1 – Low voltage Installations

E02.1.2 Particular Specifications to be read in conjunction with this specifications

This specification shall be read in conjunction with the following specifications:-

(a) E06	:	ELECTRICAL MEDIUM AND LOW VOLTAGE CABLE INSTALLATION

E02.2 CABLE LADDER MATERIAL

All cable ladders shall, unless otherwise specified, be heavy-duty cable ladder standard pattern.

Cable ladders used inside Elutriation Terrace pump stations or in areas within 50m or less of Ferric Chloride, Hypochlorite or Chlorine shall be manufactured from corrosion resistant GRP (Glass Reinforced Polyester) in which vinylester resin is used. All GRP cable ladders shall consist of a 75 mm high side rail. The minimum thickness of the material that the cable rack is to be manufactured from, shall at least be 4mm. Cross rungs shall be spaced at maximum intervals of 300 mm (centre-to-centre). All screws, bolts and nuts shall be hexagonal to ISO Metric commercial standards. All bolts, nuts, spring washers, etc. shall be 316 grade stainless steel for all applications, except for Ferric Chloride areas, where 304 grade stainless steel must be used. Racks for instrumentation and control cabling shall contain pigmentation to produce an electric orange rack. A sample of the rack material must be approved by the engineer before manufacturing commences. Sections of rack, bends, t-pieces etc. shall be joined together with the correct dowels and resins as specified by the supplier. Wherever racking is drilled or cut, the exposed areas of GRP must be sealed with the same resin to ensure that the material does not fray. Channels or other sections used for securing of cable ladders should as far as possible be made from the same GRP material. Where this is not possible, 316 grade stainless steel support systems shall be used for all applications, except for Ferric Chloride areas, where 304 grade stainless steel must be used.

Cable ladders used inside de-watering buildings shall be metal cable ladders, manufactured from corrosion resistant, powder coated, 3CR12 grade stainless steel. All cable ladders shall consist of at least 75 mm high side rail. The minimum sheet thickness of the material that the cable rack

is to be manufactured from shall at least be 2mm. Cross rungs shall be spaced at maximum intervals of 300 mm (centre-to-centre). All screws, bolts and nuts shall be hexagonal to ISO Metric commercial standards. All bolts, nuts, spring washers, etc. shall be 316 grade stainless steel. Metal racks for instrumentation and control cabling shall be powder coated electric orange. If GRP ladder racking (as described in item 6.5.2 above) is cheaper than 3CR12 grade ladder racking, the GRP racking should be used inside de-watering buildings as well.

Cable ladders used for all applications other than those mentioned above shall be heavy-duty metal cable ladders, manufactured from 3CR12 grade, powder coated, stainless steel. All metal cable ladders shall consist of at least 75 mm high side rail. The minimum sheet thickness of the material that the cable rack is to be manufactured from shall at least be 3mm. Cross rungs shall be spaced at maximum intervals of 300 mm (centre-to-centre). All screws, bolts and nuts shall be hexagonal to ISO Metric commercial standards. All bolts, nuts, spring washers, etc. shall be 316 grade stainless steel. Racks for instrumentation and control cabling shall be powder coated electric orange.

E02.3 CABLE LADDER ACCESSORIES

E02.3.1 General

Cable ladder accessories shall be considered to be horizontal bends, vertical bends, internal bends, external bends, Tee-pieces, cross-pieces, reducers (transition pieces), support struts and fasteners. The accessories shall have dimensions that correspond to the dimensions of the linear sections to which they are connected. The radii of all bends shall be 1 m minimum.

The inside dimensions of horizontal angles or connections shall be large enough to ensure that the allowable bending radius of the cables are not exceeded. Sharp angles shall be 45º metered.

E02.4 INSTALLATION

Cable ladders shall be installed within accessible civil constructed cable ducts. These ducts may form part of the scope of works or may be existing.

Cable ladders are required to be installed within the cable ducts in the motor control centre rooms, on site electrical reticulation, and on access platforms to the mechanical equipment.

Cable ladders shall be installed within accessible cable ducts and shall be supported by a strut channel section securely fixed to the wall. The corrosion protection shall be of the same system as that of the cable ladder. Only vertical installation of cable ladder will be allowed in cable ducts. All cable must be installed on cable ladders and no loose cables will be accepted.

Cable ladders shall be supported with the struts, channels, brackets, clamps, cantilever arms and nuts/bolts/washers. Unless otherwise agreed, drilling into or welding onto metal columns, trusses and other metal building structures are not allowed and suitable clamps must be used to fix the cable ladders to the building structure.

The platform mounted cable ladder reticulation shall be installed at minimum of 150 mm from the supporting concrete structure.

Crevice corrosion of the metal elements in contact with concrete surface shall be eliminated by means of a suitable layer of non-shrink grouting.

Unless otherwise agreed, all screws, bolts and nuts shall be hexagonal to ISO Metric commercial standards. All bolts, nuts, spring washers, etc. shall be stainless steel 316.

All cable ladders shall be spliced with splice sets. The corrosion protection of splices shall be of the same system as that of the cable ladder.

All cable racks not installed in closed ducts or inside buildings will be installed with flat (vertical installation) or peaked covers (horizontal installation). The corrosion protection of covers shall be of the same system as that of the cable ladder.

All cable ducting must be covered with anti-theft covers. All exposed cable on cable ladders must

be covered with anti-theft covers.

All overhead cable ladders crossing a walkway must be at least 2000mm above floor level.

Structural designs must be done for any cable bridges. Support material must be corrosion protected to the same standard as the cable ladder. The design must be approved by the Engineer.

E02.5 EARTH BONDING OF CABLE RACKING

All cable rack joints must be equipotential bonded. Both the ends of cable racking must be bonded to an equipotential bonding bar. Where cable racks enter a lighting protected structure, the bonding conductor must be connected to the rack as close as possible to the point of entrance. All bonding conductors must be equal to 6 sq. mm copper PVC insulated wire.

The bonding conductor cable will be a composite stranded cable made up of tinned copper wires and galvanised steel wires that are braided-interwoven to form the cable. The complex braided and interwoven wires of steel and copper make it very difficult to separate and is unattractive and uneconomical to copper thieves and scrap dealers. The conductor must be insulated in clear PVC.

E02.6 CORROSION PROTECTION

All cable ladders and the cable ladder accessories shall be coated as specified below.

The preparation of the metal surfaces of the cable ladders and cable ladder accessories shall be in accordance with the latest edition of SANS 10064, prior to the application of protective coating.

Corrosion protection shall conform to the coating system stated below:

E02.6.1 Powder Coating Systems

All cable ladder shall be coated in the colour B26 – orange

E02.6.1.1 Paint System 1: Powder Coating, seven (7) stage zinc phosphate treatment, pure epoxy primer, polyester finishing coat, thickness 140 µm.

Paint System	Host Material	Preparation	Primer Coat	Finishing Coat	Dry film Thickness
			(70 µm)	(70 µm)	(µm)
No 1	304 L SS	7 stage zinc phosphate pre-treatment	Epoxy	Epoxy	140

E02.6.1.2 Upon the completion of the corrosion protection specified, the Contractor shall be required to perform the following quality control testing procedures:-

- Impact testing in accordance with SABS 6: Part J,
- Cross hatch adhesion test
- Bend test

E02.6.1.3 The corrosion protection shall form part of the quality control system as approved by the Engineer and the Tenderer shall submit a certificate of compliance upon the delivery of all cable rack supplied. The tenderer will supply a sample of all cable rack to Johannesburg Water for testing purposes.

E02.6.1.4 Epoxy Powder Coat Products

Item	Product type	Powder – Lak
1	Epoxy primer	23-007
2	Pure Epoxy / Polyester finishing coat	Series 3000

E02.7 INSPECTION

After installation, a visual inspection should be conducted with the Engineer. The contractor must compile a butt list with all items not to the satisfaction of the Engineer.

E02.8 MEASUREMENT AND PAYMENT

Item	Unit
Supply and deliver cable ladder	m

The unit of measurement shall be per linear length in meter of cable ladder supplied and delivered. Separate items shall be scheduled to include for each size of cable ladder required under the Contract.

The tendered rates shall include for the manufacture, supply, delivery, handling and inspection of the complete cable ladder.

Item	Unit
Install cable ladder	m

The unit of measurement shall be per linear meter of cable ladder installed. Separate items will be scheduled in the Schedule of Quantities differentiating each size of cable ladder installed under the Contract.

The tendered rates shall include for all labour, handling, the cutting at points of change in direction, jointing, etc, for the complete installation and inspection of the cable ladders installed under the Contract.

Item **Unit**

Supply and deliver horizontal bends ..... No

The unit of measurement shall be the number of horizontal bends supplied and delivered. Separate items shall be scheduled to include for each size of horizontal bend required under the Contract.

The tendered rates shall include for the manufacture, supply, delivery, handling and inspection of the complete horizontal bends.

Item **Unit**

Install horizontal bends ..... No

The unit of measurement shall be the number of horizontal bends installed. Separate items will be scheduled in the Schedule of Quantities differentiating each size horizontal bend installed under the Contract.

The tendered rates shall include for all labour, handling, the cutting at points of change in direction, jointing, etc, for the complete installation and inspection of the horizontal bends installed under the Contract.

Item **Unit**

Supply and deliver vertical bends ..... No

The unit of measurement shall be the number of vertical bends supplied and delivered. Separate items shall be scheduled to include for each size of vertical bend required under the Contract.

The tendered rates shall include for the manufacture, supply, delivery, handling and inspection of the complete vertical bends.

Item **Unit**

Install vertical bends ..... No

The unit of measurement shall be the number of vertical bends installed. Separate items will be scheduled in the Schedule of Quantities differentiating each size of vertical bend installed under the Contract.

The tendered rates shall include for all labour, handling, the cutting at points of change in direction, jointing, etc, for the complete installation and inspection of the vertical bends installed under the Contract.

Item **Unit**

Supply and deliver internal bends ..... No

The unit of measurement shall be the number of internal bends supplied and delivered. Separate items shall be scheduled to include for each size of internal bend required under the Contract.

The tendered rates shall include for the manufacture, supply, delivery, handling and inspection of the complete internal bends.

Item **Unit**

Install internal bends ..... No

The unit of measurement shall be the number of internal bends installed. Separate items will be scheduled in the Schedule of Quantities differentiating each size of internal bend installed under the Contract.

The tendered rates shall include for all labour, handling, the cutting at points of change in direction, jointing, etc, for the complete installation and inspection of the internal bends installed under the Contract.

Item **Unit**

Supply and deliver external bends ..... No

The unit of measurement shall be the number of external bends supplied and delivered. Separate

items shall be scheduled to include for each size of external bend required under the Contract.

The tendered rates shall include for the manufacture, supply, delivery, handling and inspection of the complete external bends.

Item	**Unit**
Install external bends	No

The unit of measurement shall be the number of external bends installed. Separate items will be scheduled in the Schedule of Quantities differentiating each size of external bend installed under the Contract.

The tendered rates shall include for all labour, handling, the cutting at points of change in direction, jointing, etc, for the complete installation and inspection of the external bends installed under the Contract.

Item	**Unit**
Supply and deliver Tee-pieces	No

The unit of measurement shall be the number of Tee-pieces supplied and delivered. Separate items shall be scheduled to include for each size of Tee-piece required under the Contract.

The tendered rates shall include for the manufacture, supply, delivery, handling and inspection of the complete Tee-pieces.

Item	**Unit**
Install Tee-pieces	No

The unit of measurement shall be the number of Tee-pieces installed. Separate items will be scheduled in the Schedule of Quantities differentiating each size of Tee-pieces installed under the Contract.

The tendered rates shall include for all labour, handling, the cutting at points of change in direction, jointing, etc, for the complete installation and inspection of the Tee-pieces installed under the Contract.

Item **Unit**

Supply and deliver cross-pieces ..... No

The unit of measurement shall be the number of cross-pieces supplied and delivered. Separate items shall be scheduled to include for each size of cross-piece required under the Contract.

The tendered rates shall include for the manufacture, supply, delivery, handling and inspection of the complete cross-pieces.

Item **Unit**

Install deliver cross-pieces ..... No

The unit of measurement shall be the number of cross-pieces installed. Separate items will be scheduled in the Schedule of Quantities differentiating each size of cross-pieces installed under the Contract.

The tendered rates shall include for all labour, handling, the cutting at points of change in direction, jointing, etc, for the complete installation and inspection of the cross-pieces installed under the Contract.

Item **Unit**

Supply and deliver reducers (transition-pieces) ..... No

The unit of measurement shall be the number of transition pieces supplied and delivered. Separate items shall be scheduled to include for each size of transition-piece required under the Contract.

The tendered rates shall include for the manufacture, supply, delivery, handling and inspection of the complete transition-pieces.

Item Unit

Install reducers (transition-pieces) ..... No

The unit of measurement shall be the number of transition-pieces installed. Separate items will be scheduled in the Schedule of Quantities differentiating each size of transition-pieces installed under the Contract.

The tendered rates shall include for all labour, handling, the cutting at points of change in direction, jointing, etc, for the complete installation and inspection of the transition-pieces installed under the Contract.

Item **Unit**

Supply and deliver cable ladder support struts material **m**

The unit of measurement shall be per linear meter of material supplied and delivered. Separate items will be scheduled in the Schedule of Quantities differentiating each size of cable ladder support struts supplied and delivered under the Contract.

The tendered rates shall include for the manufacture, supply, delivery, handling and inspection of the cable ladder support struts material.

Item **Unit**

Install cable ladder support struts **m**

The unit of measurement shall be per linear meter of material supplied and installed. Separate items will be scheduled in the Schedule of Quantities differentiating each cable ladder support struts installed under the Contract.

The tendered rates shall include for all labour, handling, cutting, welding, painting, drilling and mounting, etc., for the complete installation and inspection of the cable ladders support struts installed under the Contract.

JOHANNESBURG WATER (SOC) Ltd.

BULK WASTEWATER

PARTICULAR SPECIFICATION

E04 : ELECTRICAL LOW VOLTAGE DISTRIBUTION BOARDS AND MOTOR CONTROL CENTRES

Johannesburg Water (SOC) Ltd.
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Revision 6

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City of Johannesburg
Johannesburg Water (SOC) Ltd

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Date	Revision	Author	Comments
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PARTICULAR SPECIFICATION: VOLUME E04: ELECTRICAL LOW VOLTAGE DISTRIBUTION BOARDS AND MOTOR CONTROL CENTRES

CONTENTS

E04.1 INTRODUCTION

This specification is for the supply of low voltage (400V) distribution switchboards.

E04.2 SCOPE

E04.2.1 General

The scope of work includes the furnishing of all labour, material and services for the design, supply, manufacture, testing and inspection at works, delivery to site, off-loading and rectification of defects developing during the warranty period for equipment as specified below.

E04.2.2 Work to be Included

The work includes, but shall not be limited to the items listed below.-

(a) All work in E04.2.1 above.

(b) Documentation, as called for in the vendor QA and document requirement list and drawings and data.

(c) The supply of one complete set of any special tools required per switchboard that will be required for operation or maintenance purposes, including three spare sets of each type of fuse.

(d) Recommended spares for one year's operating period and the prices of it.

(e) Technical assistance if requested during checking for operational readiness.

E04.3 STANDARDS

In general, work and materials shall be in accordance with the latest practice and in particular in accordance with the latest revision of the following specifications, and any amendments thereto, the SANS specification taking precedence:

(a) SANS 10142-1	:	The wiring of premises Part 1: Low-voltage installations
(b) SANS 60439-1	:	Low-voltage switchgear and controlgear assemblies Part 1: Type-tested and partially type-tested assemblies
(c) SANS 60439-2	:	Low-voltage switchgear and controlgear assemblies Part 2: Particular requirements for busbar trunking systems (busways)
(d) SANS 60439-3	:	Low-voltage switchgear and controlgear assemblies Part 3: Particular requirements for low-voltage switchgear and controlgear assemblies intended to be installed in places where unskilled persons have access for their use - Distribution boards
(e) 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
(f) SANS 60947-1	:	Low-voltage Switchgear and Control gear Part 1: General rules
(g) SANS 60947-2	:	Low-voltage Switchgear and Control gear Part 2: Circuit-breakers
(h) SANS 60947-3	:	Low-voltage Switchgear and Control gear Part 3 Switches, disconnectors, switch-disconnectors and fuse-combination units
(i) SANS 60947-4.1	:	Low-voltage Switchgear and Control gear Part 4-1: Contactors and motor-starters - Electromechanical contactors and motor-starters
(j) SANS 60947-4.2	:	Low-voltage Switchgear and Control gear Part 4-2: Contactors and motor-starters - AC semiconductor motor controllers and starters
(k) SANS 60947-4-3	:	Low-voltage Switchgear and Control gear Part 4-3: Contactors and motor-starters - AC semiconductor controllers and contactors

for non-motor loads

(l) SANS 60947-5-1	:	Low-voltage Switchgear and Control gear Part 5-1: Control circuit devices and switching elements - Electromechanical control circuit devices
(m) SANS 62262	:	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)
(n) SANS 60529	:	Degrees of protection provided by enclosures (IP code)
(o) IEC 60228	:	Conductors of insulated cables
(p) BSS 3858	:	Binding and identification sleeves for use on electric cables and wires
(q) SANS 1507-1	:	Electric cables with extruded solid dielectric insulation for fixed installations (300/500 V to 1 900/3 300 V) Part 1: General
(r) SANS 1507-2	:	Electric cables with extruded solid dielectric insulation for fixed installations (300/500 V to 1 900/3 300 V) Part 2: Wiring cables
(s) SANS 1574-1	:	Electric Cables – Flexible Cords and Flexible Cables Part 1: General
(t) SANS 1574-3	:	Electric Cables – Flexible Cords and Flexible Cables Part 3: PVC-insulated cables for industrial use
(u) SANS 1619	:	Small power distribution units (ready-boards) for single-phase 230 V service connections
(v) SANS 61643-11	:	Low-voltage surge protective devices Part 11: Surge protective devices connected to low-voltage power systems - Requirements and test methods
(w) SANS 61643-12	:	Low-voltage surge protective devices Part 12: Surge protective devices connected to low-voltage power distribution systems - Selection and application principles
(x) SANS 61238-1	:	Compression and mechanical connectors for power cables for rated voltages up to 30 kV (Um = 36 kV) Part 1: Test methods and requirements
(y) SANS 60730-2-7	:	Automatic electrical controls for household and similar use Part 2-7: Particular requirements for timers and time switches
(z) SANS 62053-61	:	Electricity metering equipment (a.c.) - Particular requirements Part 61: Power consumption and voltage requirements)
(aa)BSS 1322	:	Aminoplastic Moulding Materials
(bb)SANS 60076-1	:	Power transformers, Part 1: General
(cc) SANS 1091	:	National colour standard
(dd)SANS 61869-1	:	Instrument transformers Part 1: General requirements
(ee)SANS 61869-2	:	Instrument transformers Part 2: Additional requirements for current transformers
(ff) SANS 61869-3	:	Instrument transformers Part 3: Additional requirements for inductive voltage transformers
(gg)IEC 60051/BS 89	:	Direct acting indicating analogue electrical measuring instruments and their accessories. Specification for special requirements for ammeters and voltmeters
(hh)BS EN 60255	:	Measuring relays and protection equipment. Common requirements
(ii) SANS 156	:	Moulded-case circuit-breakers
(jj) SANS 1195	:	Busbars
(kk) BS159	:	High-voltage busbars and busbar connections

E04.3.1 Particular specifications to read in conjunction with this specification

This specification shall be read in conjunction with the following specifications:-
E26: ELECTRICAL COLOUR CODING OF EQUIPMENT
G02: PARTICULAR SPECIFICATION FOR CORROSION PROTECTION
E06: ELECTRICAL MEDIUM AND LOW VOLTAGE CABLE INSTALLATION
E08: WIRING

E04.3.2 Mandatory Requirements

All equipment and services shall comply with the mandatory requirements of:

(a) Occupational Health and Safety Act 85 of 1993 (as amended).

E04.4 SYSTEM DETAIL

Busbar voltage	400V ±10% as per system voltage on the site
Frequency	50 Hz
Phase rotation	R-Y-B-R
Phases	3Ph+N, with Protective Earth (PE)
Earthing system	TN-S

E04.5 GENERAL REQUIREMENTS

This section will be applicable to the following equipment:

(a) Motor Control Centres (MCC).

(b) Main Distribution Boards (MDB).

(c) Auxiliary Distribution Boards (ADB).

The following is described in separate sections:

(a) Flush Mounted Distribution Boards.

(b) Surface Mounted Distribution Boards

(c) LV Kiosks (Switch Cubicles)

E04.5.1 Manufacturing and Construction Details

E04.5.1.1 General

(a) Electrical panels will be floor standing unless specified differently.

(b) All floor-standing switchboards will be positioned above a cable trench with bottom entry cables.

(c) Electrical switchboards positioned inside Electrical Distribution/MCC rooms shall be manufactured with 2mm thick mild steel.

(d) Electrical switchboards positioned outside Electrical Distribution/MCC rooms shall be manufactured from 2mm thick stainless steel (3CR12) as a minimum. Heaters will be installed in the switchboards to prevent condensation.

(e) In special applications, the Electrical switchboards will be manufactured to the Engineers specification.

(f) All switchboards shall be of ample size to accommodate all the specified switchgear and provide space for future switchgear. For every 4 (or part of 4) circuit breakers of a kind on a switchboard, space for an additional circuit breaker of similar size shall be allowed unless future space requirements are clearly specified.

(g) All specified external dimensions for switchboards shall be strictly adhered to.

(h) The Contractor or Manufacturer shall obtain the opinion of the Engineer before manufacturing any switchboard.

(i) The Contractor shall ascertain the exact position of switchboards and shall arrange timeously for the installation of cable sleeves, openings in the structure, flush draw trays behind switchboards and supports over cable trenches.

(j) In general, flush and surface mounted switchboards shall be mounted 2000mm above finished floor level - measured to the top of the switchboard. The upper ends of switchboards may not be higher than 2100mm above finished floor level.

(k) Unless otherwise agreed or stated in this Specification, all screws, bolts and nuts shall be hexagonal to ISO metric commercial standards and shall be rustproof. Loose ‘bolts and nuts' shall not be used on steelwork. Blind threaded fastening system bushings or equivalent shall be used for thread sizes M5 and above. Studs projecting from the exterior surfaces of the board shall have chrome or cadmium plated dome nuts. Self-tapping screws shall not be utilised for any purpose on any equipment.

(l) The short-circuit current levels as indicated on drawings shall be deemed the maximum fault current occurring at the panel under symmetrical short circuit conditions on the line side of the final limiting device in a circuit. The duration of the maximum short circuit currents shall be deemed a minimum of one second. Evidence (in the form of certificates from testing authorities recognised by Johannesburg Water) of the ability of the 400V switchboards offered to withstand satisfactorily the prospective fault conditions shall be furnished with the tender.

(m) Switchboards shall be designed to confine internal arcing faults and to direct arcs and gases arising from these away from the operator.

(n) The general structure of the panel shall be designed and fabricated to ensure that no excessive vibration caused by the operation of any component is transmitted to any other components, thereby causing spurious tripping of any device.

(o) Measures shall be taken to prevent electrolytic corrosion where dissimilar metals are in contact with each other.

(p) Bolts shall be of the correct size for the holes provided and shall be fitted with matching sizes of washers and lock washers. Where removable covers are provided with bolt fastening, the nuts shall be either welded in position or securely fixed by means of a mechanical fixing device. Self-tapping screws, captive head nuts or cage nuts are not acceptable.

E04.5.1.2 Panel Subdivision

(a) The Electrical panel will be constructed as one or more fully interchangeable modular, rigid, free standing columns, bolted together to form an extensible, composite, vermin proof unit of uniform appearance.

(b) Panels shall be designed to permit the addition of identical columns.

(c) Columns widths will be 600, 700, 800, 900 or 1000 mm for design flexibility. Columns will be 600 or 800mm deep. Increase in depth of certain sections of panels for high current ratings shall be subject to the Engineer's approval.

(d) The overall height of the column may not be more than 2300mm.

(e) Each column shall be divided horizontally into buckets.

(f) Panels will be split into transportable section with lengths not exceeding 3000mm for ease of transportation.

(g) A channel iron frame (minimum 100mm x 50mm) shall be provided under each panel

section of transportable length, which shall be so constructed that it can be used for lifting the transportable section without distortion taking place.

(h) All panel section of transportable length shall be fitted with lifting lugs and shall have sufficient strength to withstand all stresses occurring during transportation, installation and operation without distortion or damage.

E04.5.1.3 Internal Form of Separation

(a) The minimum internal Forms of Separation for any Electrical switchboards shall be Form 3b, as described below:

i. Separation of busbars from all functional units;

ii. Separation of all functional units from one another;

iii. Separation of terminals for external conductors from the functional units, but not from those of other functional units;

iv. The power cable connections are disposed in the same compartment;

v. Maintenance services require extra care, as placed in the same compartment the connections of other units might be powered;

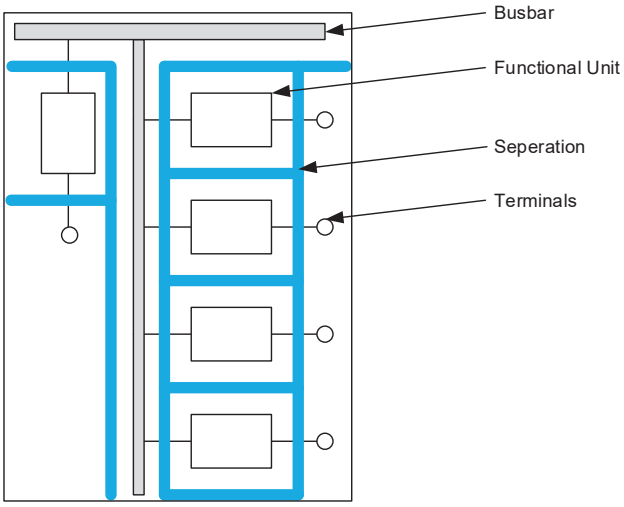

Figure 1: Form 3B

E04.5.1.4 Buckets

(a) Buckets will be equipped and wired as per the drawings issued by the Engineer.

(b) The buckets will be sized to accommodate all components with ease.

(c) Buckets will be fixed pattern with components permanently mounted to the chassis plate of the bucket.

(d) All bucket design and construction shall be based on natural cooling by convection or radiation. Attention shall be given to ventilation to prevent the accumulation of heat in buckets where power electronic drives (soft starters and VSD's) or other heat generating equipment (i.e. control transformers) are contained. Extraction ventilation fans should be installed in these cases to remove heat from the cubicle. The filtered extraction fan should be placed as high as possible in the compartment door with a filtered air inlet opening as low as possible in the compartment door. The fan and opening must be sized to ensure all generated heat is extracted from the bucket. Natural convection cooling will not be accepted.

(e) Spare buckets shall be equipped generally as detailed on the drawings issued by the

Engineer, and shall include all circuit breakers, busbars, wiring, instruments, etc., with the exception that, in the case of withdrawable circuit breakers, only the breaker cradle shall be furnished.

E04.5.1.5 Doors

(a) Buckets shall have doors suitably constructed to ensure rigidity and shall be a neat fit in the framework and around the circuit breaker escutcheon plate.

(b) Doors shall be fitted with robust steel or brass hinges with at least two 6mm square recessed quick close/open latches. Hinges shall be provided at 500mm intervals per door with a minimum of two hinges per door. Each door shall be fitted with an equal number of hinges and latches. At least one of these latches shall be lockable with a padlock.

(c) Doors and covers shall be provided with a high-density neoprene gasket to form a firm seal. The neoprene seal shall be a nominal 5mm thick compressed to 3mm on closing of the door. The entire switchboard shall be effectively dust and splash proof to IP 54.

(d) All hinged doors shall be fitted with a robust mechanism to latch and hold the door in the wide-open position, to minimise inadvertent contact with live parts during maintenance operations.

(e) All hinged doors shall open to a minimum of 135° from the closed position, to facilitate easy access for maintenance.

(f) Doors should be the same width as the MCC column. A single door shall not exceed the width of 800mm. Where the column width exceeds 800mm, two doors must be installed.

(g) The Bucket door shall be interlocked with the circuit breakers to prevent opening of the door when the circuit breaker is in the "ON" position. A non-apparent door interlock defeat shall be provided for the opening of the door with the circuit breaker in the “ON” position for testing and maintenance. In addition, there shall be provision for attaching a padlock to the operating handle in the “OFF” position that prevent the circuit breaker from being operated. Should more than one padlock be fitted, a safety lockout hasp must be used.

(h) All access doors are to be effectively and permanently earthed to the main panel enclosure, by means of a suitable braided copper earth strap, not less than 6mm^2, crimped with properly sized lugs and bolted at each end to the door and enclosure.

(i) All equipment mounted on bucket door will be flush mounted.

E04.5.1.6 Busbar Compartments

(a) The Busbar compartment shall contain the three phases and the neutral busbars, duly marked L1, L2, L3 and N or identifiable by colour coding Red, White, Blue and Black.

(b) The protective earth busbar shall be located in a separate compartment, and shall be duly marked PE.

(c) Provision shall be made for expansion or contraction of the busbars and the housing due to loadings, temperature changes and short circuit conditions. The busbars shall allow for expansion on both the left and right-hand side.

(d) The busbar compartment shall have bolted covers on the front of the panel for access to the busbars, insulators and joints. Removable covers shall be provided with captive screws.

(e) All busbars and droppers shall be securely supported by heavy, high di-electric, non-hygroscopic material with bracing to withstand stresses due to short circuits of one second duration and at least equal to the interrupting rating of the circuit breaker protecting the busbars.

(f) Busbar standoff insulators and support will be injection moulded (Polyamide 66 fibreglass reinforced (30%) (Halogen free)). Threaded inserts will be galvanized steel.

(g) The Busbar shall be supported by insulators made of flameproof and leakage-proof

material. Busbars, insulators and supports shall be braced to withstand the mechanical and thermal effects of fault currents.

(h) Busbar insulators shall be mounted in such a way that they can be easily removed and replaced.

(i) In addition to any support/bracing required by the electrical conditions, the busbars shall also have sufficient support to prevent stresses being transmitted to the circuit breakers or any components by cable terminations. Particular attention must be paid to the termination arrangements of any multiple incoming three-core cables to ensure adequate glanding space.

(j) The following minimum air clearances shall be observed for busbars and other current carrying or live parts:

i. Phase – Earth : 30mm

ii. Phase – Phase : 45mm

Where these clearances cannot be attained, suitable insulating barriers shall be employed In addition, all busbar work (including connections to, from and between equipment) shall have applied solid insulation suitable for the rated voltages. GPO-3 (Glass Polymer laminate) insulation shall be used wherever possible. GPO-3 is constructed with fiberglass-reinforced thermoset polyesters. It must feature a combination of beneficial electrical and mechanical properties. These attributes include Dielectric strength, flame resistance, arc and track resistance, high-flex strength and high-impact strength. They maintain stability, will not melt under heat and have excellent overall electrical properties.

(k) The busbar compartment shall be constructed to ensure that fire or other faults cannot spread between the various sections. All insulation used on electrical conductors/connections and wiring shall be flame retardant types, constructed of low toxicity materials.

(l) The busbar compartment must have suitable sealing arrangement at each end as well as between the busbar compartment and buckets.

E04.5.1.7 Cable termination points

(a) Suitable termination points shall be provided to enable any multiple three-core cables to be terminated without cross-overs of different phases and with minimum lengths of cable "tails".

(b) All cable termination points and associated connections shall be suitably braced to withstand the available fault currents without damage. If necessary cable support clamps shall be provided for the individual cable tails after the cable gland.

E04.5.1.8 Cable Gland Plates

(a) Sectionalised removable gland plates shall be fitted and shall be fixed by means of captive nuts or screws and so located that ample space is available for the satisfactory entry and termination of cables

(b) Cable entry shall be at the bottom of the board.

(c) All gland plates are to be connected to the main panel earth bar via suitably sized copper conductors and unused sections shall be left blank.

(d) Gland plates for three-core cable of cross-sectional area 70mm^2 and above shall be minimum 5mm thickness.

(e) Mild steel gland plates shall be galvanised.

(f) Where single core cables are used, gland plates are to be of non-magnetic material or slit to mitigate effect of eddy currents.

(g) The cable gland compartments shall have removable covers attached with standard 6mm

square recessed quick close/open latches.

E04.5.1.9 Labelling and markings

(a) The panel shall be provided with an identity label, engraved with 30mm high black on white characters and shall be mounted on top of the switchgear.

(b) Each buckets shall be labelled on the left top door corner with the reference letter(s) of that compartment, using durable designation label with 30mm high black letters on a white background. The labels shall have two designation letters, the first referring the column, numbered from A, left to right and the second referring to the bucket, numbered from 1 top to bottom.

(c) All buckets shall be clearly labelled with suitable inscriptions indicating their function. All labels shall have black characters at least 6mm high on white background.

(d) Incomers shall be labelled "Incomer from ……..." as indicated on the drawings issued by the Engineer, using engraved black characters at least 6mm high on white background.

(e) Standby bus coupler (where applicable) shall be labelled "Standby Bus Coupler", using engraved black characters at least 6mm high on white background.

(f) All removable covers protecting live equipment shall be fitted with warning labels as well as ID tags to ensure the covers are replaced in the original position after removal. Warning labels shall be engraved white characters 6mm high on a red background.

(g) All electrical components/equipment shall be labelled (with designations corresponding to those of the Engineer's schematic diagrams) to facilitate recognition.

(h) The labels for equipment mounted on doors shall be identified with white trifoliate labels having black lettering engraved on them, with a maximum height of 3mm letters.

(i) The equipment labels shall be secured by means of high quality double-sided tape.

(j) The labels for all equipment, installed behind panels, shall be fixed to the chassis close to the equipment.

(k) If this equipment is positioned too close to each other to accommodate descriptive engraved labels, the equipment may be identified by a code or number label, which shall be fixed close to the equipment. The code or number shall be identified on a legend board, which shall be installed on the switchboard behind a protective cover.

(l) The types of labels for equipment behind the doors or covers shall be subject to the Engineer's approval.

(m) Danger labels shall be white lettering 6mm high engraved on a red background.

(n) All labels and label brackets shall be affixed by machine screws. Adhesive labels are not acceptable.

(o) Over and above labelling requirements of this specification, the labelling requirements of SANS 10142-1 must be met.

E04.5.1.10 Insulation Materials

(a) Any insulation, filling putty, etc., used shall be selected such that it can withstand without harmful effect (mechanically or electrically), all temperatures encountered within the MCC.

E04.5.2 Electrical Details

E04.5.2.1 Busbars and Connections

(a) Busbars and connections shall generally comply with SANS 1195 for air clearances. Notwithstanding the contents of the above-mentioned specifications, all solid copper work shall be made of hard drawn high conductivity copper of constant cross-section throughout

their lengths with a maximum design current density of 1,66A/mm².

(b) The Phase and Neutral busbars shall be manufactured with flat copper bars with a standard rectangular conductor profile, of the same cross-section over the whole width of the panel.

(c) Busbar droppers shall be manufactured with flat copper bars with a standard rectangular conductor profile, of the same cross-section over the whole length of the dropper. The use of flexible conductors as droppers from the main busbars to circuit breakers shall not be permitted.

(d) All busbar joints shall be silver plated or tinplated. High pressure bolted lap joints shall be used and all bolts shall be of the high tensile type.

(e) All fixed busbar joints (separation links) between adjacent sections shall be maintenance-free.

E04.5.2.2 Earth Bar

(a) A protective earth bar shall extend the whole length of each Electrical panel and shall be duly marked PE. The earth bar shall at least, be bolted to the switchgear housing at each column.

(b) Stranded clear insulated aluminium earth wire (equal to 70mm^2 copper wire) with crimp type terminals shall be provided at both ends of the protective earth bar for connection to the substation earth bar/earthing system.

E04.5.2.3 Control Wiring

(a) Each Electrical panel shall be equipped and completely wired at the factory and, only after satisfactory testing, be split, if necessary, for transportation.

(b) Control and instrumentation wiring shall be silicone insulated throughout and of flexible, stranded, annealed, untinned copper construction. All wiring shall comply with the table below. Conductors shall comply with SANS 1411, Part 1, Table 4, Class 5.

CT Wiring	-	2.5mm^2 phase coloured, common return black insulated, earth green/yellow
General Control Wiring	-	(AC) 1.0mm^2 grey
	-	(DC) 2.5mm^2 (positive – red, negative – black)
Control Neutral	-	(AC) 1.0mm^2 (same size as phase wiring) – black
LED’s and PLC Inputs	-	(AC) 0.75mm^2 grey
	-	(DC) 0.75mm^2 (positive – red, negative – black)

(c) Notwithstanding the above-mentioned requirements, the vendor shall ensure wire size used is amply rated for the applicable current, under ambient conditions.

(d) All control/instrument panel wiring shall terminate by means of suitably sized compression crimp lugs on screw-type terminals. Terminals of the pressure pad type are not accepted. The minimum voltage rating of the control wiring shall be 600/1000V grade to SANS 1507 and SANS 1411 Parts 1 and 3.

(e) Wiring shall be run in plastic trunking. Only where a space problem exists will loomed wiring be acceptable.

Note: Stick-on harness holders are not acceptable.

(f) Conductors passing through holes in compartments shall be protected by means of neoprene grommets. Bevelling of sheet steel will not be accepted as a substitute.

(g) Conductors shall be general-purpose 600/1000V grade PVC-insulated copper wire to SANS 1507 and SANS 1574. Aluminium conductors are not acceptable.

(h) Single or solid conductor wire shall not be used.

(i) Joints or splices in any wiring are not acceptable.

(j) Panel and equipment terminals, labels, etc., shall be accessible after the wiring has been completed.

(k) Connections to equipment on swing doors shall be arranged to give a twisting motion and not a bending motion to the conductor.

(l) Single pole and double pole moulded-case circuit breakers shall be wired in a way that the supply to the switchboard is equally balanced.

(m) Stripping of insulation shall not result in damage to the conductors. The stripping tools used shall be of the type, which permits the length of strip to be pre-set. Control wiring shall be terminated with pre-insulated, crimped or compression type lugs. Crimping tools shall be of the type, which will not release the termination during normal operation until the conductor crimp has been correctly formed. Any damaged wiring will be rejected.

(n) Lugs shall be of the hooked blade type when used in conjunction with screw clamp spring loaded insertion type terminals, ring tongue type when used with stud or direct screw mounted connections and wire pin when used with pinch screw type connections such as indicating lamp fittings.

(o) Not more than two conductors shall be connected to any side of a terminal.

(p) Each terminal strip shall be provided with not less than 10% spare terminals, with a minimum of two, unless otherwise approved.

E04.5.2.4 Power Wiring and Cable Terminations

(a) Power wiring on the "live" side of the circuit breakers (from the busbar dropper to the circuit breaker terminals) shall be as short as possible, sized to carry the maximum current continuously of the frame size of the respective circuit breaker and shall be a flexible copper conductor. The flexible connection shall be provided on all such connections and shall be designed to prevent the transmission of any forces that may arise between the busbar droppers and the circuit breaker. In terms of SANS 60439, this connection is deemed a fault free zone and the design and use of the flexibles shall in no manner compromise this zone.

(b) Power wiring on the "load" side of the circuit breaker terminals to cable termination terminal shall be as short as possible, sized to carry the maximum current continuously of the frame size of the respective breaker and shall be a flexible conductor. The flexible connection shall be provided on all such connections and shall be designed to prevent the transmission of any forces that may arise between the circuit breaker and the cable termination terminal. In terms of SANS 60439, this connection is deemed a fault free zone and the design and use of the flexibles shall in no manner compromise this zone.

(c) Terminals that are on the live side of fuses and isolating switches shall be completely shrouded to prevent accidental contact.

(d) Power circuit wiring and connections in a switchboard shall be rated to the full frame size rating of the associated equipment, i.e. fused switch, contactor, circuit breaker, etc., and not to the circuit or fuse rating.

(e) Power wires shall bear the colour along their entire length of the phase to which they are connected.

(f) Neutral connections shall have the same rating as the phase connections unless otherwise

approved.

(g) Power wiring terminations shall use an appropriate crimped accessory (the pressed tubular type of accessories). Stamped, folded, split-barrel type accessories are not acceptable.

(h) Terminations for power wiring and cabling shall be provided with pressure type clamping connections or bolted connections capable of accepting crimped or compression type lugs on conductors.

(i) In addition, hexagonal die type hydraulic crimping shall be used for all wiring greater than 16mm² in size.

(j) Cables shall be made off directly onto circuit breakers, switches, contractors, thermal-overloads, etc. Terminals or solid copper terminating conductors shall be provided where necessary. Provision shall be made for bracing and fixing of the cable leads to prevent vibration.

(k) A predrilled solid copper bar shall be provided for terminating all external power cables above 70mm, or where three or more cables in parallel are specified. The arrangement shall be suitable for accepting cable lugs of conductors up to 630mm².

E04.5.2.5 Wire Numbering

(a) Each end of every wire shall be marked with a wire number by means of plastic cable ferrules (black lettering on a white or yellow base).

(b) All wires shall be identified on both ends with a wire marker. The wire marker shall consist of a transparent flexible tube that slides over the wire with a wire identification label (black letters on a rigid white PVC tag) which slides into a label pocket on the tube. The tube must be correctly sized for the wire diameter.

(c) Split or open type marking ferrules shall not be used.

(d) Cable/wire marking ferrules shall correlate to the appropriate schematic or wiring diagrams.

(e) For all control wires without lug terminations, the numbered ferrule must not fall off when disconnecting the wire and in this regard, the use of one strand of wire to retain the ferrule is acceptable.

(f) All cables shall be identified on both ends with a cable marker. The cable marker shall consist of printed stainless steel band fixed to the cable with stainless steel strapping.

E04.5.2.6 Terminals and Connections

(a) All terminals will be of the screw-type. Terminals of the pressure pad type are not accepted Minimum rating for terminal blocks shall be 40A. Terminal strips/blocks shall be marked with designations corresponding with the suppliers/buyers drawings. Generally, terminal numbers shall be the same as the relevant wire number. No more than two wires may be connected to any one side of a terminal. Ten percent (10%) additional spare terminals shall be furnished.

(b) Terminals are to be provided for all door-mounted components, diodes, etc.

(c) Power connections on any equipment shall not use "Philips/Star" type screw/socket heads. Hexagon socket head cap screws (Allen type socket heads) are preferred.

(d) Where a large number of control terminals are mounted in close proximity, the terminals shall be in vertical rows with a minimum of 125mm below rows. Spare terminals shall be mounted at the bottom of the row unless the cabling drawing shows otherwise.

(e) Terminals shall be provided for all cores of external control cable as indicated on the drawings whether internally connected or not.

E04.5.2.7 Air Circuit Breakers (ACBs)

(a) ACBs shall be of the withdrawable type with self-aligning disconnecting devices with the disconnecting fingers preferably mounted on the breaker for ease of maintenance. The draw out mechanism shall hold the circuit breaker rigidly in the fully connected, test and fully disconnected positions.

(b) Safety shutters shall be provided to shield the fixed part automatically when the draw out parts removed preventing access to the conductors (main and auxiliary circuits). These shutters shall be clearly labelled indicating busbar and cable sections and in addition “live” section shall be labelled “400V – LIVE”. ACBs shall be equipped with inter-phase barriers.

(c) Each Incoming ACB from a transformer and each Bus Section ACB shall be equipped with a protection unit incorporating:

i. Overload protection (IDMT)

ii. Thermal overload protection

iii. Instantaneous short-circuit protection

All protection devices will be delivered with protection settings adjusted to the minimum level. The protection unit shall be fitted with a transparent cover that can be sealed in the closed position to prevent tampering with the settings.

(d) The Contractor shall take particular care to ensure that the ACB protection is correctly co-ordinated with the upstream and downstream protective devices.

(e) Current and time delay set points on ACBs shall be accessible from the front of the ACB without removing the ACB from its cradle and shall only be adjustable when the cubicle door is open.

(f) Interlocks shall be provided to ensure the following:

i. That the main circuit breaker cannot be removed from or to the fully connected position unless the ACB is open;

ii. That the compartment doors cannot be opened should any accessible portion of the ACB frame be energised;

iii. That the ACB cannot be closed unless in the fully connected, test or fully disconnected positions.

(g) Mechanical restrictions shall be provided to inhibit mismatch of ACBs of different ratings.

(h) Provision shall be made for the padlocking of any ACB in any one of the fully connected, test or fully open positions. In addition, all ACBs shall have padlocking facility to prevent the close push button being operated when padlocked.

(i) ACBs employed as incomers and bus-section switches shall incorporate captive key interlocks to prevent paralleling of incoming supplies. Locks with captive keys must be built into the ACB’s to prevent both Incomers and the Bus-coupler circuit breakers in the “ON” position at the same time. Padlocks will not be accepted for this application.

(j) The ACBs supplied shall be three pole, magnetic operated. The mechanism shall be of the stored energy type having hand charged spring with mechanical and electrical releases for closing.

E04.5.2.8 Moulded Case Circuit Breakers (MCCBs)

(a) MCCBs shall be of the manually operated type with thermal and instantaneous magnetic protection. Trip functions shall be resettable via the MCCB switching handle.

(b) Each MCCB shall be fitted with a vari-depth operating handle.

(c) Flash barriers shall be furnished to increase creepage distance between phases and shall be furnished on all circuit breaker cradles between the phases on both sides of the MCCB.

(d) The thermal trip elements of each MCCB shall be calibrated for the maximum ambient

temperature at 40°C.

(e) Current ratings of MCCBs shall be detailed in the Single Line Diagram drawings.

(f) MCCBs shall be selected according to rating and the fault level as specified by the Engineer.

(g) The name of the MCCB manufacturer shall be furnished by the tenderer at tender stage.

(h) Each MCCB shall be provided with suitable insulation between the terminals of the MCCB and the back plate/chassis onto which the MCCB is mounted, such that any loose nut, screw, etc., which may fall between the MCCB terminals and back plate cannot cause a short circuit.

(i) Where interlocking is called for between the MCCBs this shall be effected using captive keys in the breaker or a mechanical interlock.

(j) All outgoing circuits shall be equipped with individual core balance earth leakage units arranged to shunt trip each respective outgoing circuit.

(k) Outgoing circuits rated 125A and above shall have IDMT 375 mA earth leakage units EPC type Elsec T. Outgoing circuits rated 100A and below shall have instantaneous 250 mA earth leakage units - EPC type Elsec – X. All earth leakages must be of the manual reset type.

(l) All circuit breakers, except bus couplers, shall be connected with the switched side to the load, i.e. with reference to power flow incoming to "LINE" and outgoing to "LOAD".

(m) The incoming terminals/shutters of all 400V circuit breakers shall be effectively shrouded and marked "400V LIVE" with white characters on a red ground.

E04.5.2.9 Miniature circuit breakers (MCBs)

(a) Miniature circuit breakers (MCBs) shall be confined to auxiliary circuits such as control and indication in which the prospective short-circuit current will not exceed 5kA (3ph at 440Vac), or 7.5kA (1p at 24Vdc). They shall be of the thermal and magnetic trip free type. Where the prospective short-circuit current exceeds the above values, cascaded circuit breakers should be used. All cascaded circuits must be marked with the wording "Warning: This is a cascaded system. Never replace any circuit breaker in the system with another circuit breaker that is not identical in manufacturer, type and rating."

(b) Auxiliary contacts on MCBs

i. Provide the position (open/closed/tripped) remote indication functions of the associated MCB.

ii. Clip on (no tool required) to the left-hand side of the MCB. The type that connects to the MCB operating lever is preferred.

iii. Shall be of good quality and will not interfere with the operation or tripping of the MCB.

E04.5.2.10 Surge Arrestors

(a) All Electrical switchboards shall have a surge arrestor fitted to each phase on the incoming circuit breaker. The surge arrestors shall be fitted to the LIVE side of the circuit breaker.

E04.5.2.11 Instruments and Meters

(a) Incoming CBs shall be equipped with the following as a minimum requirement:

i. A single 96mm x 96mm 5A secondary, combined maximum demand and instantaneous ammeter. The maximum demand portion shall have a thermal movement with 15-minute time lag and drag pointer having a reset facility. It shall have a built-in saturation transformer for increased overload capacity to 90 times

rated current for one second;

ii. A 96mm x 96mm voltmeter connected to measure phase-to-phase voltage and phase to neutral voltage via a multi-position selector switch and a set of fuses suitably rated for voltage and short circuit current;

E04.5.2.12 Current Transformers

(a) All current transformers shall conform to SANS 61869-2. For protection purposes, class 10P CT's are to be used and for indicating purposes class 1 CT's are to be used and for metering purposes class 0.5 CT's are to be used. In general, current transformer mechanical and thermal ratings shall be co-ordinated with the short circuit ratings of the equipment.

E04.5.2.13 Fuses

(a) Fuse protection shall be used in cases were capacitive loads are switched i.e. Power factor correction or static capacitors panels.

(b) Fuses shall not be used for purposes other than voltmeter or kWh meter protection, unless specifically authorised. All short circuit protection shall be provided by means of circuit breakers and fast blow fuses for protecting the incoming side of the devices. In cases where the fault current level is excessively high, HRC fuses in conjunction with CB's should be considered to reduce the fault level and afford better protection for electrical personnel.

E04.5.2.14 Limit Switches

(a) Limit switches shall be metal encapsulated precision switches with robust and compact explosion-proof structures.

(b) Cables shall be equipped with a strain-relief device and safely cast into the enclosure. Switches shall have bottom, side or lateral cable outlets as per the requirement of the application. The integrated basic switch shall have a single-pole changeover contact with a high switching accuracy and a precise repeatability of the switching point.

(c) It shall have high vibration resistance and long mechanical life. It shall have a high protection class that would allow the switch to be used in all processes of Johannesburg Water wastewater treatment plants.

E04.5.3 Mounting of Equipment

E04.5.3.1 Clearance and Access

(a) A minimum clearance of 50mm shall be maintained between items of equipment and the side of the compartment.

(b) Where extra equipment is specified after the design has been finalised, this clearance requirement may be altered subject to the Engineer's approval.

(c) No piece of equipment shall be mounted in any position where it is not visible and accessible to a viewer looking into the compartment through the door opening.

E04.5.3.2 Mounting of Circuit Breakers

(a) All moulded case circuit breakers shall be flush mounted with only toggles protruding.

(b) Miniature circuit breakers may be installed in clip-in trays mounted on the frame.

(c) Special provision shall be made for large main switches.

(d) Circuit breakers shall be installed so that the toggles are in the up position when "ON" and down when "OFF".

E04.5.3.3 Mounting of Contactors

(a) Contactors shall only protrude through the panel in special cases. Plastic covers or other coverings will not be required.

E04.5.3.4 Instrumentation

(a) All metering instruments shall be mounted flush in the front panel unless otherwise specified.

(b) In certain instances it may be required that instruments be mounted flush in the door. In these instances, the back of metres shall be covered by removable covers of isolating material fixed to the door to protect the terminals of instruments and to prevent accidental contact.

(c) Equipment mounted normally on the surface, e.g. time switches and relays shall be mounted behind the front panel. In these cases, hinged access panels shall be provided in the front panel.

E04.5.3.5 Fuse-Links and Carriers

(a) Fuses shall be of the high rupturing capacity type and shall be mounted on insulated draw-out carriers, which shall hold the fuses positively and remain firmly fixed after withdrawal. In all cases, the top terminal shall be the live terminal. This applies also for MCB's.

(b) DC circuits shall have fuses in the positive and negative leads.

(c) Fuses shall be so positioned that they are readily accessible to a person standing on the floor.

(d) Fuses for instrumentation shall be mounted on the outside of the compartment door adjacent to or below the instrument.

(e) Fuses shall be provided with labels giving their rating and duty.

(f) Solid link holders shall be coloured white.

(g) One spare fuse of each type and size used in each board shall be fitted on clip holders on the inside of the front panel.

E04.5.3.6 Control Equipment

(a) All equipment performing control functions, e.g. control relays, transducers, and time relays not requiring adjustment, shall be mounted behind the front panel.

E04.5.3.7 Current Transformers

(a) Current transformers shall be accessible and easily removable.

(b) Secondary windings of current transformers shall be earthed at one point only. Each group of current transformers, i.e. protection, metering, etc., shall be earthed directly to the protective conductor (earth bar).

(c) Current transformers shall be naturally air-cooled, and shall be able to withstand the maximum fault current for the duration of time taken by the functional unit to clear, with protective devices set at the maximum time delay settings.

E04.6 MOTOR CONTROL CENTRE

A Motor Control Centre (MCC) is an assembly of one or more enclosed sections having a common

power bus and principally containing motor control units that serves to govern in some predetermined manner the performance of an electric motor. Motor control centres are in modern practice a factory assembly of several motor starters. A motor control centre can include variable frequency drives, programmable controllers, metering apparatus etc. Motor Control Centre is used for controlling of various motors of a particular plant.

E04.6.1 MCC Buckets

(a) The following types of motor starters will be used:

i. Direct-on-line (DOL) type motor starting;

ii. Star/Delta (S/D) type motor starting;

iii. Forward/Reverse type motor starting;

iv. Soft starting (SS) type motor starting;

v. Variable Speed Drive (VSD) type motor starting.

(b) The main contactors on Star/Delta and Forward/Reverse type starters will be mechanically interlocked. The type of motor starting required shall be project specific and shall be indicated in the MCC schedule/s to be issued by the Engineer.

(c) All the protection devices, i.e. overloads, circuit breakers, motor thermistors, motor heaters, gearbox oil flow switches etc. on mechanical equipment shall be hard wired onto the individual motor starter circuits.

(d) Only one motor will be controlled from any MCC bucket.

E04.6.2 Busbars

(a) Main busbars in MCCs shall be rated for 2000 amps as a minimum.

(b) Busbar droppers in MCCs shall be rated for the maximum possible current (determined by the breaker frame size) in that section with a minimum rating of 1000 amps.

E04.6.3 Earth bar

(a) The earth bar shall be rectangular, with a minimum cross sectional area of 400mm² (10mm x 40mm).

E04.6.4 Power wiring

(a) The minimum MCC power wiring size shall be 25mm².

E04.6.5 Circuit Breakers

(a) Air circuit breaker (ACBs) will be used for Incomer circuit breakers on MCCs.

(b) Bus coupler circuit breakers on MCCs will use an air circuit breaker (ACBs).

(c) Moulded Case circuit breakers (MCCBs) will be used for outgoing feeders on MCCs up to a maximum rating of 800 amps.

E04.6.6 Instruments and Meters

(a) Incoming CBs shall be equipped with an power meter capable of providing multiple parameters of the connection including kWh, kVArh, kW, kVAr, PF, MD, etc. and provide a pulsed output and Ethernet connectivity.

(b) Each bucket shall be equipped with a suitably sized 5A current transformer (CT) operated

96mm x 96mm 90° movement suppressed maximum demand ammeter having an overload rating of 40 times the rated current for one second. The CT primary current rating will match (equal) the outgoing feeder circuit breaker current rating. The CT secondary current rating will be 5A.

E04.7 MAIN DISTRIBUTION BOARD

A Main Distribution Board is a panel from where electrical energy is taken out to distribute power to various consumer points. It has a single incoming power sources from a distribution transformer and includes feeder circuit breakers and protection devices to the consumers.

E04.7.1 Busbars

(a) Main busbars in MDBs shall be rated for 2000 amps as a minimum.

(b) Busbar droppers in MDBs shall be rated for the maximum possible current (determined by the breaker frame size) in that section with a minimum rating of 1000 amps.

E04.7.2 Earth bar

(a) The earth bar shall be rectangular, with a minimum cross sectional area of 400mm² (10mm x 40mm).

E04.7.3 Power wiring

(a) The minimum MDB power wiring size shall be 25mm².

E04.7.4 Circuit Breakers

(a) Air circuit breakers (ACBs) shall be used as Incomer circuit breakers on MDBs.

(b) Moulded Case circuit breakers (MCCBs) will be used for outgoing feeders on MDBs up to a maximum rating of 800 amps.

E04.7.5 Instruments and Meters

(a) Incoming CBs shall be equipped with an power meter capable of providing multiple parameters of the connection including kWh, kVArh, kW, kVAr, PF, MD, etc. and provide a pulsed output and Ethernet connectivity.

(b) Feeder CBs shall be equipped with an power meter capable of providing multiple parameters of the connection including kWh, kVArh, kW, kVAr, PF, MD, etc. and provide a pulsed output and Ethernet connectivity.

E04.8 AUXILIARY DISTRIBUTION BOARD

An Auxiliary Distribution Board is a panel from where electrical energy is taken out to distribute power to various consumer points. It has a single incoming power sources from a Main Distribution Board and includes feeder circuit breakers and protection devices to the consumers.

E04.8.1 Busbars

(a) Main busbars in ADBs shall be rated for 1000 amps as a minimum unless otherwise specified/approved by the engineer.

(b) Busbar droppers in ADBs shall be rated for the maximum possible current (determined by

the breaker frame size) in that section with a minimum rating of 600 amps unless otherwise specified/approved by the engineer.

E04.8.2 Earth bar

(a) The earth bar shall be rectangular, with a minimum cross sectional area of 250mm² (10mm x 25mm) unless otherwise specified/approved by the engineer.

E04.8.3 Power wiring

(a) The minimum ADB power wiring size shall be 16mm² unless otherwise specified/approved by the engineer.

E04.8.4 Circuit Breakers

(a) Air circuit breakers (ACBs) shall be used as Incomer circuit breakers on ADBs unless otherwise specified/approved by the engineer.

(b) Moulded Case circuit breakers (MCCBs) will be used for outgoing feeders on ADBs up to a maximum rating of 800 amps.

E04.8.5 Instruments and Meters

(a) Incoming CBs shall be equipped with an power meter capable of providing multiple parameters of the connection including kWh, kVArh, kW, kVAr, PF, MD, etc. and provide a pulsed output and Ethernet connectivity.

(b) Feeder CBs shall be equipped with a suitably sized 5A current transformer operated 96mm x 96mm 90° movement suppressed maximum demand ammeter having an overload rating of 40 times the rated current for one second. The CT primary current rating will match (equal) the outgoing feeder circuit breaker current rating. The CT secondary current rating will be 5A.

E04.9 FLUSH MOUNTED DISTRIBUTION BOARD

E04.9.1 Internal for of Separation

(a) The internal for of separation will be specified by the Engineer.

E04.9.2 Bonding Tray

(a) Bonding trays for flush mounted switchboards shall be of rigidly constructed 1,6mm thick galvanised steel, braced and reinforced.

(b) Formed gussets shall be provided at the corners. All the tray joints shall be properly welded or securely bolted with a brass or cadmium plated steel earth connecting stud and nut.

E04.9.3 Expanded Metal

(a) Where switchboards are to be built into 116mm thick walls, expanded metal shall be spot welded to the rear of the bonding trays.

(b) The expanded metal shall protrude at least 150mm on each side to prevent plaster from cracking.

E04.9.4 Knock-Outs

(a) Ample knockouts shall be provided in the top and bottom ends of each switchboard tray to allow for the installation of conduits for the specified and future circuits.

(b) Knockouts shall be allowed for any size of specified conduit.

(c) Provision shall however be made for termination of at least 2 x 25mm diameter conduits at top and 2 x 25mm diameter conduits at the bottom of each tray.

E04.9.5 Architrave Frame

(a) The architrave frame shall be of 2,0mm thick sheet steel with bevelled edges.

(b) The architrave frame shall accommodate the chassis, panels and doors.

(c) The architrave shall overlap the bonding tray by at least 25mm on each side.

(d) The architrave frame shall be fixed to the tray in such a fashion to allow for depth adjustment and irregularities of the wall.

E04.9.6 Extension Frames

(a) Semi-flush mounted switchboards shall be equipped with extension frames.

(b) Generally, the frame depths shall be 50mm but may be altered to suit each application.

E04.9.7 Chassis

(a) The chassis for mounting of switchgear and equipment shall be of rigid construction and shall be fixed securely to the architrave frame or bonding tray by means of bolts screwed into tapped holes or bolts and nuts. Self-tapping screws are not acceptable.

(b) The chassis position shall be adjustable in the horizontal plane.

E04.9.8 Panel (Faceplate)

(a) A suitably stiffened panel manufactured of 2,0mm thick sheet steel shall be installed in the architrave frame for flush mounting of switchgear.

(b) The panels shall have machined punched slots for housing the specified and future switchgear, instruments, fuse holders, isolating switches, indicator lamps, etc. In exceptional cases, contractors will be allowed to protrude through the panel.

(c) Blanking plates shall be provided in positions where future switchgear will be installed.

(d) The distance between the inside of the closed doors and the panels shall be not less than 40mm.

(e) No equipment may be mounted on the panel (faceplate) unless it is permanently hinged to the switchboard frame.

E04.9.9 Fixing of Panels

(a) The panel for each switchboard shall be secured to the architrave frame by means of captive fasteners. Alternatively, the panel may be secured to the architrave frame by means of two pins at the bottom and a latch or lock at the top of the panel. Self-tapping screws or dome nuts will not be allowed.

(b) Where it is required that equipment be mounted on the panel, the panel shall be securely hinged to the switchboard frame.

E04.9.10 Panel Handles

(a) Two chromium plated handles shall be provided on each front cover.

(b) The handles shall be mounted at the top and bottom of each panel.

E04.9.11 Hinged Panels

(a) Where hinged panels are specified, the hinges shall be fixed to the architrave frame and the panel shall be secured by means of studs and hexagonal chromium plated nuts or by means of a suitable lock or latch, which can be operated with a screwdriver.

(b) The panel shall be removable when it is in the open position.

E04.10 SURFACE MOUNTED DISTRIBUTION BOARD

This section refers to surface mounted sub-switchboards and not to floor standing main switchboards in substations or sub-main switchboards.

E04.10.1 Internal for of Separation

(a) The internal for of separation will be specified by the Engineer.

E04.10.2 Switchboard Tray

(a) Surface mounted switchboards shall be equipped with a 1,6mm sheet steel reinforced tray.

(b) Securing lugs shall be provided to fix the tray to walls or any other structure.

(c) A solid brass or cadmium plated steel earth connection stud and nut shall be provided.

E04.10.3 Construction

(a) All joints shall be welded or securely bolted.

(b) The tray shall be square and neatly finished without protrusions.

(c) The front tray sides shall be rounded with an edge of at least 20mm to accommodate flush doors.

(d) The requirements for chassis, panels and doors shall be as specified for flush mounted switchboards.

(e) The doors shall be hinged and shall fit flush in the frame in the closed position.

(f) Knockouts shall not be provided unless specifically called for.

E04.11 LV KIOSKS (SWITCH CUBICLES)

LV kiosks shall be of sufficient size to accommodate all the specified equipment.

E04.11.1 Framework

LV kiosks shall be manufactured of mild steel sheet metal with a minimum thickness of 2mm or cold rolled 3CR12 sheet metal with a minimum thickness of 1,6mm. Fibre re-inforced or other corrosion proof material (e.g. glass fibre) may also be used if adequately reinforced.

E04.11.2 Ventilation

Two ventilation slots or grilles, approximately 150 x 125mm and covered on the inside with copper mesh, shall be provided on opposite sides of the cubicle.

E04.11.3 Doors

Doors shall be provided in the front and back panels and shall swivel through 180º. Rigid padlocks and base plates for security latches shall be provided on the doors. Openings for security latches shall be blanked with chromed brass discs.

E04.11.4 Warning Sign

Warning and danger signs shall be mounted on each door in compliance with the requirements.

E04.11.5 Base

The kiosk shall be mounted on a well-finished concrete base, with minimum height of 150mm above ground level in the case of mild steel and any of the other specified acceptable materials. The kiosk can be made for direct mounting into the ground in which case it shall be equipped with a base, forming part of the structure, for this purpose. The switch cubicle shall protrude at least 10mm past the edges of the base to prevent water collecting on the base.

E04.12 STANDBY SUPPLIES

(a) Where standby power from a diesel-generator set or other source is available and has to be connected to some of the equipment on a panel, the panel shall be divided into electrically separate sections with sheet metal division plates to isolate power and mains power sections. The section doors must be appropriately colour coded to provide visual distinguishing.

(b) A means shall be provided to isolate both the standby and mains power supplies simultaneously. For this purpose, either a 6-pole rotary switch or mechanically and electrically interlocked circuit breakers or contactors may be used. Electrical interlocking alone is not sufficient. Rotary switches may only be used on panels where the fault level does not exceed 10kA.

(c) A separate 3-pole circuit breaker shall be provided as main switch for both the standby power section and the mains power section in addition to the isolator of (b) above.

Where a 6-pole rotary switch is used as isolator for the incoming supplies, this switch may be located in the standby section of the switchboard in which case the rotary switch can also serve as the isolator for the standby section. This arrangement is acceptable where the equipment on the mains power section of the switchboard can be turned off whenever it is necessary to work on the standby section of the switchboards.

(d) The main switches to the standby and mains power sections shall be interlocked with the doors providing access to those sections to ensure that the door can only be opened when the switches are in the OFF position.

E04.13 ELECTRICAL SUBSTATION FIRE PROTECTION SYSTEM

It is the duty of the Contractor to appoint a trained and competent fire engineering company to design, supply, install, commission, and test and certify a fire protection system for each electrical substation building forming part of the contract.

Each fire protection system will consist out of a fire detection and an extinguishing system as described below. Both systems will be of the highest quality and latest technology, supplied by a reputable manufacturer. The contractor will submit written proof that local support is available to maintain the system and to supply spare parts as required.

E04.13.1 Fire Detection System

The fire detection system must:

(a) Utilise a sub-micron combustion particle detector that detects a fire at its initial stage, before the presence of smoke. This allows preventative action can be taken before any catastrophic event occurs.

(b) Utilise detectors suitable for dusty plant environments and must be impervious to false alarms caused by dust particles in substation buildings with sheet metal roofs where no ceilings are present.

(c) Cover the substation building, all electrical cabinets and all cable trenches.

(d) Only when there is a second alarm from a second detector the system will trigger the gas.

(e) Double Knock system (Trigger an alarm on the first detector activation and trigger the operation of a fire extinguishing system on a second detector activation).

(f) Alert a control and alarm signalling system in case of a fire or a system fault.

(g) Be designed and installed to conform to SANS/ISO 10139 and SANS 369 Parts 1 and 2.

E04.13.2 Fire Extinguishing System

The fire extinguishing system must:

(a) Utilise an automatic system to flood the substation building with a concentration of a gaseous extinguishing agent to extinguishing a fire burning in Class A, B, and C hazards by lowering the oxygen content below the level that supports combustion as quickly as possible.

(b) Utilise a non-toxic, human friendly extinguishing agent. The use of an extinguishing agent that does not support human life must be approved in writing by the Engineer. In this case, other safety measures such as a lockout system should be integrated to ensure safe entrance into the protected substation.

(c) Utilise an efficient extinguishing agent that is electrically non-conductive and that will not adversely affect the protected electrical equipment. No powder or other residue should remain after actuation of the system.

(d) Audible and visual warnings must alert personnel to vacate the protected substation area before discharging the agent.

(e) Utilise a colourless, odourless environment friendly extinguishing agent that is sustainable against impending global warming regulations.

(f) Utilise an extinguishing agent that has a low refill cost.

(g) Should be fully approved by the local authority to an internationally accepted engineering standard.

E04.13.3 Other measures

(a) All points where cable or other services enter the substation building must be properly sealed with a fire rated medium of at least one-hour or as per local standards and regulations.

(b) All ventilation and air conditioning devices must be tripped in the event of first detection of a fire.

(c) All ventilation openings and doors in the substation building should be sealed in the event of first detection of a fire.

(d) A room integrity test needs to be carried out to validate the hold-time for the extinguishing agent as per the room’s natural leakage.

(e) All detection, alarm and extinguishing circuits are to be monitored for system faults.

(f) The substation fire protection system should operate a local audible and visual alarm system and report to a central 24-hour manned operations or security room.

(g) A local handheld fire extinguisher should also be installed within the substation as per local regulations. The type and number should conform to local standards and regulations.

E04.13.4 System Maintenance

(a) The contractor will include a fire protection system maintenance contract for a period of one year after commissioning. A trained and competent fire engineering company must do the maintenance.

(b) Thereafter a trained and competent fire engineering company should be contracted to inspect the system on a three-month basis. It should check that the system is operational in terms of its design and take corrective action in the event of a fault.

(c) The Client should visually check the system once a month for any faults reported on the control panel and anything that might appear out of the ordinary. The Client should immediately report to a competent fire engineering contracting company of any concerns or faults to ensure immediate rectification.

(d) A mandatory annual room integrity test should be carried out as per SANS 1520 Part 1.

(e) Should any physical alterations be made to a substation, a review on the fire protection system must be done to see if its performance has been compromised and appropriate actions should be made to ensure the integrity of the system.

E04.14 QA REQUIREMENTS

The vendor / contractor will be responsible for the following.

TABLE OF CONTENTS			
SECTION	**DESCRIPTION**	**REQUIRED (YES OR NO)**	**WHEN REQUIRED**
DRAWINGS & DESIGN	DESIGN CALCULATIONS		
	GA DRAWINGS	YES	ORDER + 3 WEEKS
(2 SETS OF EACH)	DETAIL DRAWINGS	YES	CONSTRUCTION
	AS BUILT DRAWINGS	YES	COMPLETION
	BROCHURES	YES	CONSTRUCTION
	SKETCHES		
	SCHEMATIC DIAGRAMS	YES	ORDER + 3 WEEKS
	RISK ASSESSMENT BY VENDOR	YES	CONSTRUCTION
	DATA SHEETS	YES	TENDER
	DESIGN CRITERIA	YES	CONSTRUCTION
QUALITY CONTROL DOCUMENTS	QUALITY CONTROL PLAN	YES	ORDER + 3 WEEKS
	MANUFACTURING PROGRAM	YES	ORDER + 3 WEEKS
(2 SETS OF			

EACH)			
MATERIAL CERTIFICATES		YES	MANUFACTURE
CERTIFICATES OF INSPECTION TESTING AND ACCEPTANCE	PRESSURE TEST CERTIFICATE	YES	DATA BOOK
	ELECTRICAL HAZARD CERTIFICATE		
	ELECTRICAL TEST CERTIFICATES	YES	DATA BOOK
	INSTRUMENT CALIBRATION CERTS.		
	VENDORS CERTIFICATE OF CONFORMANCE	YES	COMMISSIONING
	NON-CONFORMITY / CONCESSION REPORTS	YES	COMMISSIONING
MANUALS	OPERATING / MAINTENANCE MANUAL	YES	COMPLETION
	DATA BOOK	YES	DELIVERY – 1 WEEK
	DRAWINGS	YES	COMPLETION
	WARRANTY/GUARANTEES CERTIFICATES	YES	COMPLETION

E04.15 DRAWINGS AND DATA

(a) The vendor / contractor will supply shop drawings to the Engineer prior to manufacturing.

(b) No switchboard manufacturing may start if the drawings are not approved by the Engineer in writing. Should the vendor / contractor start manufacturing without approved shop drawings, any changes required by the Engineer will be for the vendor / contractor's account.

(c) The following will be included in the shop drawings as a minimum:

i. General arrangement drawings

ii. Schematic diagrams

iii. Equipment lists, including the make, catalogue number and capacity of all equipment such as isolators, circuit breakers, fuses, contractors, etc.

iv. All labelling information on a separate sheet.

(d) The approval of the shop drawings shall not relieve the Contractor of his responsibility to the Client to supply the switchboards according to the requirements of this specification or to the requirements of the Detailed Technical Specification.

(e) The vendor / contractor will supply three hard copies and one soft copy of the equipment data book including all items as specified in the Vendor QA and document requirement list.

(f) Data books will be supplied to Johannesburg Water within 7 days from delivery of equipment. Johannesburg Water will review the data books within 14 days from issue and notify the Vendor of its acceptance or rejection of it.

(g) All drawings and documentation shall be in accordance with Johannesburg Water specifications bound in book format.

(h) A complete set of "As Built" drawings of all switchboards shall be submitted to the Engineer immediately after completion of the installation. The following information shall be presented:

i. Items (i) and (iv) of the previous paragraph.

ii. Terminal strip numbers, numbers and colours of conductors connected to the terminal strips and numbers and colours of the conductors utilised for the internal wiring.

iii. A separate schedule of all equipment.

(i) Where "As Built" drawings are modified during the execution of the contract, the Contractor shall at his own expense modify or replace such drawings. Accurate drawings of the equipment shall be forwarded to the Engineer.

E04.16 PAINTING AND PROTECTIVE COATING

E04.16.1 Powder Coating Systems

(a) Paint system 1: Powder Coating, seven Stage zinc, Phosphate pre-treatment, pure epoxy primer, Polyester finishing coat, and thickness 140 µm.

Paint System	Host Material	Preparation	Primer (70µm)	Finishing Coat (70µm)	Thickness µm
No 1	Mild Steel	7 stage phosphate pre–treatment	Epoxy	Epoxy	140

(b) On completion of the paint job, the powder manufacturer must carry out the following tests on the test panels:

i. SABS 6J impact test

ii. Cross hatch adhesion test

iii. Bend test

(c) The powder manufacturer must issue a Certificate of Compliance for each paint job, which should be included in the contract documentation.

(d) The preferred corrosion protection systems are applied onto cold rolled mild steel plate with a thickness of 2.0mm.

E04.16.2 Epoxy Powder Coat Products

Item	Product Type	Powder - Lak
1	Epoxy Primer	23-007
2	Pure Epoxy / Polyester Finishing Coat.	Series 3000

E04.16.3 General

(a) All chassis plates shall be painted white.

(b) All mild steel gland plates shall be galvanised for improved cable earthing.

(c) All panel doors on equipment supplied from a normal supply must be painted Electric Orange (B26).

(d) All panel doors on equipment supplied from an emergency supply must be painted Signal Red (A11).

(e) All panel doors on equipment supplied from an UPS supply must be painted Dark Violet (F06).

(f) Specific external colours will be provided by Johannesburg Water.

(g) Before the installation is handed over, the Contractor shall ensure that all paint surfaces are clean and undamaged.

E04.17 PERFORMANCE AND GUARANTEE

(a) The performance of the items supplied in terms of this specification, as defined by the order, shall be warranted by the Vendor and, if specified, be tested in accordance therewith.

(b) The vendor shall not be specifically required to conduct a performance test on site.

(c) A minimum warranty period of 12 months is required.

E04.18 INSPECTION AND TESTING

E04.18.1 Factory Acceptance Test

(a) The Johannesburg Water Representative shall have access, at all reasonable times, to those parts of the manufacturing facilities engaged in the manufacturing of items in terms of this specification. He is authorised to witness any stage of manufacture, tests and inspect documentation.

(b) The Johannesburg Water Representative is authorised to reject any items not manufactured to the requirements of the specification.

(c) All equipment shall be inspected at the vendor's works prior to delivery, to ensure compliance with the specification.

(d) No unit shall be considered complete until acceptance by Johannesburg Water.

(e) The minimum testing / pre delivery checklist shall be as follows:

i. The Johannesburg Water representative must carry out a clause-by-clause check of each switchboard, prior to delivery.

ii. This switchboard checklist is intended to assist this process but does not relieve him/her of the responsibility described above.

DETAILED INSPECTION ROUTINE

Order No. : _____

Supplier/Vendor : _____

Project : _____

Motor Control Centre Designation : _____

Inspected by : _____

Date : _____

		Comments
Overall Appearance		
□		
□	**Paint work : Compliance with Annexure A5**	
□	**Paint thickness**	
□	**Door fittings good**	
□	**Dust sealing effective (neoprene seals)**	
□	**Board fully assembled**	
□	**Overall height less than specified height**	
□	**Channel iron base frame (less than 3000m)**	
□	**Lifting lugs provided**	
□	**Equipment supplied in accordance with specification (contractors, overloads, circuit breakers, relays, etc.)**	

		Comments
Busbars		
☐	**Correct cross-section**	
☐	**Correct phasing with incomer/feeders**	
☐	**Rigidly supported/braced**	
☐	**Properly insulated**	
☐	**Joints tightened**	
☐	**Transport section joints supplied (Fishplates, nuts and bolts, control wiring and terminals, etc.)**	
☐	**Droppers from main bars to circuit breakers adequately rated, braced, insulated**	
☐	**Nothing unnecessary mounted on bus bars**	
☐	**Main earth bar, min 70mm²**	
☐	**Control busbars generally as above, separate from power busbars**	
☐	**Air clearances adequate throughout**	
Single Line Diagram Check		
☐	**As per approved single line diagram**	
Outgoing Circuit		
☐	**Correct size/rating for MCCB's**	
☐	**Correct size/rating for ACB's**	
☐	**Correct earth leakage relays**	
☐	**Correct current transformer and associated ammeters**	
☐	**Correct overload relays**	
☐	**Correct setting on overload relays**	
☐	**Reasonable provision for cable termination power and control mounting of equipment**	
☐	**Correct conductor sizing, power and control, and correct colouring**	
☐	**Correct indicator lights and colours**	
☐	**Air clearances correct throughout**	
Incoming Circuits		
☐	**Correct size/rating of ACB's**	
☐	**Correct metering and proper mounting**	
☐	**Connection of power factor meter**	
☐	**Fuses on volt meter, where applicable**	
☐	**Reasonable provision for termination of incoming cable/gland plate**	
☐	**Air clearances correct throughout**	
	Incomer status signal to PLC	
	Interlocks	
Pressure and Injection Tests		
☐	**Primary injection test for correct operation of all protection and overload relays**	
Operational Test		
☐	**Mechanical operation of all circuit breakers, preferably with doors closed**	
☐	**Shunt trip of all circuit breakers**	
☐	**Operation of overload relay**	
☐	**Correct operation of all interlocks**	
☐	**Correct operation of indicator lights**	

		Comments
□	**Correct operation of earth fault/overload alarm system, including general alarm panel**	
	Correct signals to PLC terminals	
	Correct interlocks	
	Door interlocks	
General Checks		
□	**Marking of control wires and power conductors**	
□	**Main Motor Control Centre label**	
□	**Cubicle labels fitted – designation and cubicle number**	
□	**Component labels fitted**	
□	**Warning labels on all removable covers giving access to live 400V conductors**	
□	**Labels for indicator lights, pushbuttons, etc.**	
□	**Terminal strip labels**	
□	**Incoming side of circuit breakers label**	
□	**Incoming circuit label – "FROM _____"**	
□	**No 'Philips' (star) screws**	
□	**No self-tapping screws**	
□	**Grommets fitted on all open holes**	
□	**Correct paint specification**	
□	**All documentation submitted**	
□	**Arc venting arrangements satisfactory**	
□	**Door latches fitted**	

(f) Specific testing and inspection requirements relating to switchgear boards are as follows:

i. Prior to shipment, the switchgear boards shall be completely assembled, wired, adjusted and tested by the supplier in the presence of the engineer and the client representative.

ii. Testing shall include primary injection tests of all current transformers, pressure tests to prove quality of insulation, functional tests of all mechanical and electrical components and electrical circuitry and any other tests required to ensure compliance with this specification.

iii. The supplier shall give one week's notice of readiness for final tests to the Johannesburg Water representative. The vendor shall ensure that the equipment is ready for final testing before requesting the presence of the Johannesburg Water representative at such a test. Repeat inspections necessitated by the lack of readiness of the equipment may be charged to the vendor at the discretion of the Johannesburg Water representative.

E04.18.2 Site Acceptance Test and Commissioning

(a) A Site Acceptance Test (SAT) must be conducted at the place of installation prior to switching the DB on. The test shall include (as a minimum) the following:

i. A visual inspection to ensure all the design specifications are adhered to;

ii. Insulation resistance test;

iii. Function testing of all components.

iv. All switchboards must be thermal imaged a minimum of 1 week after being put on service. The image must be taken in normal operating conditions. The image must be analysed for hot spots and must be part of the Operations and Maintenance

Manuals presented at the end of the project.

E04.19 MEASUREMENT AND PAYMENT

Item Unit

Supply and deliver Switchboards or Motor Control Centres ..... No

The unit of measurement shall be the number of MCC's or boards supplied and delivered.

The tendered rate shall include full compensation for the manufacture, supply, testing and delivery of the boards as specified in the detailed specification.

Item Unit

Install Switchboards or Motor Control Centres ..... No

The unit of measurement shall be the number of MCC's or boards installed.

The tendered rates shall include full compensation for the installation of the specified boards, including all required installation material to install the MCC or board in the required position including a heavy-duty strut, mounted 400mm below the gland plate. All incoming and outgoing cables shall be attached to this strut by means of K-clamps or approved equivalent clamps.

Item Unit

Commission Switchboards or Motor Control Centres ..... No

The unit of measurement shall be the number of MCC's or boards.

The tendered rates shall include full compensation for the site testing and commissioning of the specified boards including the keeping of all commissioning records in triplicate, including all material, test equipment and labour required for the testing and commissioning.

Item Unit

Supply and install extra circuits on Switchboards and Motor Control Centres ..... No

The unit of measurement shall be the number of circuits supplied and installed.

The tendered rate shall include full compensation for the manufacture, supply, testing and installing of extra circuits in switchboards or motor control centres (spare space being available on the board).

Item Unit

Supply and deliver level control equipment ..... No

The unit of measure shall be the number of level control systems supplied and delivered.

The tendered rate shall include full compensation for the supply, manufacturing, testing and delivery of all the material required for the level control system, including all float level switches, will the required length of cable attached to them, mounting brackets, terminal box and mounting equipment together will all material to facilitate a complete level control system.

Separate items will be measured for systems with different numbers of level switches.

Item Unit

Install level control equipment..... No

The unit of measure shall be the number of level control systems installed.

The tendered rate shall include full compensation for installing, testing and commissioning of the level control system including the required brackets, junction boxes, cables etc. for a complete working system.

Item Unit

Modify existing motor starter panels ..... No

The unit of measure shall be the number of motor starters to be modified.

The tendered rate shall include full compensation for the supply and delivery of all material and labour required to modify the motor starter panel as detailed in the detail specification.

Item Unit

Supply and install PLC/Scada alarm and status signals ..... No

The unit of measure shall be the number of MCC's for which a siren and alarm light has been installed.

The tendered rate shall include for the full compensation for the supply, delivery, installation and commissioning of the specified siren and alarm light including all required installation material including cables required to render a fully operational system.

JOHANNESBURG WATER (SOC) Ltd.

BULK WASTEWATER

PARTICULAR SPECIFICATION

E05 : ELECTRICAL LOW VOLTAGE POWER AND CONTROL CABLES

Johannesburg Water (SOC) Ltd.
PO Box 61542
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2107

Revision 5

August 2019

City of Johannesburg
Johannesburg Water (SOC) Ltd

DOCUMENT CONTROL SHEET

Document Title: **Particular Specification – E05 : Electrical Low Voltage Power and Control Cables**

JW Reference: **BWW523C**

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DOCUMENT APPROVAL

ACTION	FUNCTION	NAME	DATE	SIGNATURE

RECORD OF REVISIONS

Date	Revision	Author	Comments
5	2019-08-20	B Pieterse	Review of Electrical Standards, plus New Design Guidance
4	2014-06-03		Review of Mechanical / Electrical and Control / Instrumentation Standards, plus New Design Guidance
3	2012-05-30		Review of Mechanical / Electrical and Control / Instrumentation Standards, plus New Design Guidance
2	2010-05-03		Review Electrical Standards
1	2010-05-03		Review of Mechanical / Electrical and Control / Instrumentation Standards, plus New Design Guidance

PARTICULAR SPECIFICATION: VOLUME E05: ELECTRICAL LOW VOLTAGE POWER AND CONTROL CABLES

CONTENTS

E05.1 SCOPE

This specification covers the requirements with regards to the manufacture, supply, delivery, installation, testing and commissioning of power and control cables rated up to 600/1000V. The term cable shall indicate electrical conductors or carriers manufactured for supplying power for the control and supervision of multipurpose loads.

E05.1.1 Statutory Documents and Standards

Cables shall be strictly manufactured in accordance with the requirements of the latest editions of the following standards:

(a) SANS 1507	:	Electrical cables with extruded solid dielectric insulation for fixed installations (300/500 V to 1 900/3 300 V)
(b) SANS 1411	:	Materials of insulated electric cables and flexible cords
(c) SANS 1339		Electric cables - Cross-linked polyethylene (XLPE) insulated cables for rated voltages 3,8/6,6 kV to 19/33 kV
(d) SANS 1520	:	Flexible electrical cables for use in mines
(e) SANS 10198		The selection, handling and installation of electric power cables of rating not exceeding 33 kV
(f) SANS 10142-1	:	The Wiring of Premises Part 1 – Low Voltage Installations
(g) IEC 60245	:	Rubber insulated cables
(h) IEC 60287	:	Electric cables - Calculation of the current rating
(i) IEC 60811	:	Electric and optical fibre cables - Test methods for non-metallic materials
(j) DIN VDE 0250-816	:	Cables – Wires and flexible cords for power installation – Heat-resistant silicone rubber insulated flexible cable

The Occupational Health and Safety Act (Act No. 85 of 1993)

E05.1.2 Definitions and Terminology

In general, the following definitions and terminology shall apply:

Armouring	A layer or layers of galvanized steel wires applied to the cable to provide mechanical protection or earth continuity, or both.
Bedding	A layer of extruded compound applied to the cable beneath the armouring.
Cable	A length of core or more cores assembled, that may or may not be provided with an overall mechanical covering.
Core	A single insulated conductor without protective covering.
Direction of lay	The lateral direction of inclination to the axis (either left or right) of the receding helix formed by wire or core in a cable or flexible cord.
PVC	Polyvinyl chloride
Sheath	A solid extruded protective covering applied as the exterior of a cable or a flexible cord.

E05.1.3 Particular Specifications to read in Conjunction with this Specification

This specification shall be read in conjunction with the following specifications:-

E06: ELECTRICAL MEDIUM AND LOW VOLTAGE CABLE INSTALLATION

E05.2 GENERAL SCOPE

E05.2.1 Design and Supply

(a) Conductor sizes

The minimum conductor size for control cables shall be 2.5mm^2.

The minimum conductor size for power cables on plant equipment (excluding small power and lighting) shall be 16mm^2.

(b) Conductor material

In the case of plants with a high risk of cable theft, cables with aluminium conductors must be used where the nominal core diameter exceeding 25mm^2. This must be agreed upon in writing by the Engineer.

E05.3 CONSTRUCTION

The cable shall be constructed as follows:

E05.3.1 Conductor Material

The copper conductors shall be of plain annealed or hard draw wire in accordance with the requirements of the latest edition of SANS 1411.

The aluminium conductors shall be of plain hard drawn aluminium wire in accordance with the requirements of the latest edition of SANS 1411.

E05.3.2 Insulation

The insulation material shall comprise of PVC in accordance with the requirements of the latest edition of SANS 1411.

E05.3.3 Core Colour Identification

The cable cores colour shall be in accordance with the requirements of the latest edition of SANS 1507-3.

E05.3.4 Bedding

The bedding shall consist of a continuous PVC extruded sheath.

E05.3.5 Armour

The armouring shall consist of one layer of round galvanised steel wire in accordance with the requirements of the latest edition of SANS 1411.

E05.3.6 Sheath

The outer sheathing shall be an impermeable, halogen free, reduced smoke emission, flame retardant PVC in accordance with the latest edition of SANS 1411.

E05.4 CABLE MARKINGS

The cables shall be legibly marked in accordance with the requirements of the latest edition of SANS 1507, and shall include the following:

(a) Conductor size in square millimetres
(b) Number of cores
(c) Conductor material (copper)
(d) The specification number (SANS 1507) to which the cable has been manufactured.
(e) The year of manufacture.
(f) Nominal voltage.

E05.5 STORAGE

Cables shall be packed on reeled drums. The moisture content of wooden cable drums shall not exceed 20%.

Each end of the cable shall before being secured to the reeled drum, be sealed by an acceptable

method approved by the Engineer. The outer end shall be secured to the reel drum and the inner end shall be protected in a manner against mechanical damage.

The cable reeled drums shall be capable of taking a round spindle and be lagged with strong, closely fitted battens, at the inner and outer circumference to prevent damage to the cables. The spindle bearing plates shall be steel. The dimensions of the drum shall not exceed 1 100 mm width, 2 000 mm diameter and the spindle bearing plate shall not be less than 9 mm thick. Each drum shall be clearly marked on both sides in accordance with the latest edition of SANS 1507.

The ends of the PVC sheathed cable shall be sealed to avoid penetration of moisture. Each cable drum shall be numbered.

E05.6 CABLE SIZING AND DE-RATING

The cables shall be sized and de-rated in accordance with the requirements of the latest edition of SANS 10142-1.

E05.7 TESTING OF CABLES

E05.7.1 Testing and Commissioning

The contractor shall supply factory test certificates for each drum of cable supplied under the Contract.

After the installation is complete, the contractor and the Engineer shall inspect the installation. The Engineer must be notified in advance of the inspection dates. The contractor will keep a snag list, reflecting all items not acceptable to the Engineer. The contractor will correct the snag items as required to the Engineers approval, updating the snag list as the items are completed and signed off by the Engineer.

On completion of his work, the Contractor will issue an Electrical Certificate of Compliance (CoC). All tests deemed necessary to issue the CoC should be included. The Contractor shall make all arrangements, pay all fees and provide all equipment for these tests. The Contractor shall notify the Engineer timeously so that he may witness the tests.

Each installed cable shall be tested in accordance with:

(a) The Occupational Health and Safety Act (OHSA) 1994;
(b) SANS 1507 (Electric cables with extruded solid dielectric insulation for fixed installations (300/500 V to 1 900/3 300 V));

SANS 1507 Test Wave	Duration (min)	Commissioning test voltage between conductors (V)			Commissioning test voltage between conductors / earth (V)		
		300/ 500	600/ 1000	1900/ 3300	300/ 500	600/ 1000	1900/ 3300
AC (rms)	15	1000	2000	6000	1000	2000	3500
DC	15	1500	3000	9000	1500	3000	5000

This test will be conducted to the Engineers judgement. The constructer must obtain written approval from the Engineer before conducting any tests.

(a) The requirements of the Local and Supply Authorities.

E05.8 QUALITY ASSURANCE

All the cables supplied under the Scope of Works of this project shall be designed and manufactured under a quality control system, typically to ISO 9000 series. The contractor must supply current compliance certificates on the manufacturers ISO classification.

E05.9 MEASUREMENT AND PAYMENT

Measurement and payment will distinguish between supply/delivery and installation/commissioning of the cabling lengths required.

Item **Unit**

Supply and delivery of low-voltage cable..... metre

The unit of measurement shall be the length of low-voltage cable supplied. It is the responsibility of the Contractor to verify the lengths of cables required on site. The Contractor shall only supply the required length of cables required. The final quantity of installed cable lengths shall determine the final quantity to be paid of the supplied cable lengths.

The tendered rate shall include for the design, manufacture, supply and delivery of the specified cable to the site.

Separate items shall be scheduled under this payment item for each size and type of cable.