Joburg

a world class African city

City Power
Johannesburg

TITLE	**STANDARD FOR THE MAINTENANCE AND EMERGENCY REPAIR OF DC SYSTEMS**	REFERENCE	REV
		CP_TSSTAN_075	**0**
		DATE:	**MAY 2018**
		PAGE: **1**	OF **21**

TABLE OF CONTENTS

FOREWORD

This standard was prepared by the following work group members:

Silvester Raseboka	Technology Services
Marc Paravano	Secondary Plant Field Services

The work group was appointed by the Distribution Study Committee, which, at the time of approval, comprised of the following members:

Silvester Raseboka	Technology Services
Herson Somo	Technology Services
Marc Paravano	Secondary Plant Field Services
Tony Nicolls	Secondary Plant Field Services
Fhatuwani Mphaphuli	Secondary Plant Field Services
Charlotte Mosia	Secondary Plant Field Services
Ntsako Mdaka	Secondary Plant Field Services
Tebogo Mohlapi	Secondary Plant Field Services

Recommendations for corrections, additions or deletions should be addressed to the:

Technology Services General Manager
City Power Johannesburg (SOC) Ltd
P O Box 38766
Booysens
2016

INTRODUCTION

To provide a routine inspection and maintenance service and emergency repair service for all DC systems, used primarily to power the various secondary plant systems and switchgear operating schemes, installed in City Power's electrical network. These DC systems are of strategic importance in the correct functioning of the Protection schemes and other associated control equipment.

1 SCOPE

This document deals with the inspection and maintenance of DC systems within the City Power Johannesburg area of electricity supply and the emergency repair of any faulty DC equipment. It will look into details of the inspections and different types of maintenance and repairs associated to DC systems. Iinternal staff and contractors shall follow the guidelines described here.

DC system components or accessories shall comply with the standards applicable when they were originally installed or with an alternative standard, confirmed in writing by an independent accredited test laboratory as being equivalent to, or better than, the specified standard. Equipment used in the DC installation shall be certified as compliant with the relevant standards and approved by City Power.

The scope shall also be extended to include all DC systems required to supply City Power's various SCADA, Telecommunication, fire alarm and emergency lighting systems where installed. These systems can often be interlinked to the stations main battery via DC to DC converters.

2 NORMATIVE REFERENCES

The following documents contain provisions that, through reference in the text, constitute requirements of this standard. At the time of publication, the editions indicated were valid. All standards and specifications are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the documents listed below.

Reference	Description
CP_TSSPEC_151	Specification for Nickel Cadmium Battery
CP_TSSPEC_160	Specification for Battery Charger
CP_TSSPEC_216 REV 0	Specification for Mobile DC unit
CP_TSSPEC_218 REV 1	Specification for PPE
CP_TSSPEC_017	Specification for Miniature Circuit Breakers
CP_TSSPEC_068	Specification for LV fuses
CP_TSSPEC_234 Rev 0	Specification for lead acid sealed battery for small installations
TACSPI09	Standard Tactical Work: Battery Bank and Charger Inspection and Testing

3 QUANTITIES

There are approximately 380 mixed type DC system installations within the City Power area of supply. The number of installations can change due to old installations being decommissioned and new installations being commissioned.

In terms of City Power's planned maintenance initiative, regular inspections and testing of the DC systems will be required. DC system maintenance Works Orders will be generated and issued to the contractor on a daily basis. It is incumbent upon the contractor to ensure sufficient resources are available to complete the Works Orders during normal working hours and within the specified timeframe. If the contractor is unable to complete the Works Orders during normal working time it may be required to perform the set maintenance task outside normal working hours, however, this must be seen as an exception and must be fully motivated and approved by City Power before any such work commences.

The ability to complete all Works Orders in the specified timeframe will be used to assess the competency of the contractor to fulfill his obligations in terms of this specification and any prolonged deviation from this requirement will be seen as non-compliance.

It is envisioned that on average 380 first line routine maintenance and 15 second line maintenance activities will be required to be completed on a monthly basis. These are only indicative figures and timeframes and should only be used to estimate the number of resources necessary to undertake the specified workload.

First line routine maintenance and second line maintenance will be defined and detailed hereafter.

4 RATING OF THE DC EQUIPMENT

Ampere hour ratings of the cells range from 4 A/h upwards to 1000 A/h. The voltages range from 24, 32, 48, 110 to 220 volts DC installations. Dual chargers with chop over /selection systems are used in many major stations.

5 DC MAINTENANCE ACTIVITIES

Works Orders will be issued by City Power to the contractor to carry out the required maintenance and repair activities.

The following DC maintenance activities shall be considered;

Substation visual inspection activities for routine inspection maintenance.

Item	Task Description
Performance	Monitoring and trending DC performance and identifying those chargers and battery types that do not meet the required performance criteria
Analysis and assessment	Initiating corrective actions based on equipment failure patterns, analysis of performance data and assessment of fault reports
Integrity and accuracy	Ensure the accuracy and integrity of all performance and maintenance data so as to facilitate a comprehensive maintenance plan

5.1 Routine inspection maintenance

Routine inspection maintenance consists of actions focussing on the verification of the external general correctness of selected components of the DC system.

5.1.1 Scheduling and frequency

Routine inspection maintenance consists of non-intrusive investigative actions that can be executed on a per installation basis at the given recommended frequencies

5.1.2 Routine Inspection maintenance actions

Routine inspection of all DC equipment should be performed as outlined in Table 1. Below. The following guideline is offered as a base. All results will be kept on record for a period of three years.

Table 1: Guideline for DC system visual inspection activities for routine inspection maintenance

Item	Task Description
All DC equipment	• Visual inspection • AC supply to the charger • DC charger voltage and current • Charger alarms
All DC equipment	• Database information verification(Station, charger & battery type) • Battery cell voltages recorded • Battery cell SG's (Specific Gravity) recorded • Charger limits checked, adjusted (if necessary) and recorded • Pilot cell temperatures recorded.
Battery rooms and associated fittings	• Evaluation of overall condition and status of all equipment • General condition of battery room (water leaks, doors, paint) • Battery room running water (taps, shower).

6. DC SYSTEM TYPES

The DC system types vary considerably and typically will consist of the following main components:

6.1 Nickel cadmium cells
6.2 Lead Acid cells or
6.3 Sealed maintenance free type cells.
6.4 A single phase or a three phase charger.
6.5 DC to DC converters
6.6 Manual or automatic chop over/selection systems

The DC equipment may be fitted with old or new technology i.e. CV; CVC; solid state electronics; or programmable (intelligent electronic) chargers.

The more modern chargers have an auto boost feature, various alarms and self-checking features.

There are many different types of charger units in operation.

7. FREQUENCY OF FIRST LINE ROUTINE MAINTENANCE.

In general the following activities are required:

7.1 The NiCad and Maintenance free type DC systems must be inspected and maintained every three months.
7.2 The Lead acid type DC systems must be inspected and maintained monthly in stations where SCADA is available and every two weeks on stations without SCADA.
7.3 Detailed written inspection and maintenance reports are to be submitted to the DC Systems Maintenance Manager.
7.4 AC input and DC outputs on all chargers are to be tested every month.
7.5 Log book to be completed by the field resource during inspection.

8. FREQUENCY OF SECOND LINE MAINTENANCE.

This maintenance must be performed every two years.
Detailed written inspection reports are to be submitted to the DC Systems Maintenance Manager.

9. FIRST LINE INSPECTION, MAINTENANCE AND REPORTING DUTIES

The Contractor must adhere to the DC Maintenance Tactic: TACSPI09

The following details are required per installation and are to be submitted in each report.

9.1 Installation name and physical address.
9.2 Battery type
9.3 Manufacturers code e.g. YCP 20
9.4 Overall battery charging voltage and current
9.5 Individual voltages and discharge currents (Off charge on load)
9.6 SG levels, where applicable
9.7 Electrolyte levels: Report when levels have been adjusted and by how much.
9.8 Confirmation of testing of the DC alarms locally.
9.9 Confirmation of testing of the SCADA DC alarms to System Control, where applicable
9.10 Visual report of cables / charger panel etc.
9.11 Confirmation of cleaning of connectors, where necessary, and coating with neutral petroleum jelly.
9.12 The name and signature of the person carrying out the tests.

The contractor must adjust the voltage and current setting to ensure that correct DC control operation occurs and there's is no overcharging. Any adjustments made to the voltage and current settings must be detailed on the inspection sheet with full reasons for making the adjustments and the new values shall be recorded.

Topping up of cells with battery water will form part of the first line routine maintenance duties of the contractor and suitable water in accordance with the manufacturer's specification must be supplied by the contractor. Ad-Hoc samples will be taken for testing to ensure its quality. Failure to use the correct water will be viewed as a serious breach of the contract specification and may lead to a cancellation of the contract and of any work being undertaken. The cost of replacing the electrolyte on installations serviced will be claimed from the contractor.

It is the contractor's duty to ensure that the batteries are in a clean condition at all times (no corrosion on the batteries and connectors).

In substations where a remote SCADA system has been installed it will be a requirement that the integrity of the various alarms is tested by manually operating these alarms and confirming, via telephone with City Power's System Control Centre, that the correct alarm indication has been received. Details of this procedure and relevant instruction will be provided to the contractor.

Should an urgent problem be discovered during an inspection, that requires immediate attention, it must be brought to the attention of the Secondary Plant DC Maintenance supervisor immediately via cell phone and written reports must be submitted by the next working day. The problem must be solved immediately upon the approval by the Secondary Plant DC Maintenance supervisor.

Small repairs on chargers such as broken fuse holders, indication lights not working, broken switches, exchange of controller card etc. must be done by the contractor.

It is the contractor's responsibility to provide the appropriate tools and test equipment.

10. SECOND LINE MAINTENANCE AND REPORTING DUTIES

The Contractor must adhere to the DC Maintenance Tactic: TACSPI09

The following tests must be performed:

10.1 Complete load and discharge test.

10.2 Internal cell resistance measuring of all cells.

10.3 Complete dismantling of all cells, thoroughly cleaning of all cells and connectors, coating with neutral petroleum jelly and reassembly of the bank.

10.4 DC system chop over /selection functionality

It is the contractor's responsibility to provide the appropriate tools and test equipment.

A report of all the test results must be submitted to the Secondary Plant DC Maintenance supervisor in a hard copy and a soft copy (Excel readable).

11. ACCESS AND RESPONSIBILITY

City Power can only issue station access keys for contractor personnel with a valid ORHVS certificate.

As substation access keys will be provided to the contractor, the contractor must appoint a person or persons who will be held responsible in terms of the OHS ACT and City Power's System Operating Regulation for the safety and conduct of their staff. These names shall be supplied on submission of tender, together with proof of their valid ORHVS certificate.

At no time will the contractor's personnel be allowed to be on the premises without a responsible person being on site. Any violation of the above may lead to the cancellation of the contract and of any work being undertaken.

The contractor must sign City Power's standard Contractors Responsibilities form that will be provided to the successful tender.

12. EMERGENCY REPAIR AND AD-HOC WORK

The contractor is expected to undertake emergency repairs to the DC systems. Some of these repairs will be requested at short notice and may be required to be performed after normal working hours. These repairs must be executed within reasonable time frames. If a permanent repair solution is not possible immediately, a temporary repair or DC supply solution must be implemented in the meantime.

AD-hoc work shall consist of connecting and testing DC alarms and/or DC monitoring systems to SCADA. This will only apply where DC alarms are available from the DC system and SCADA is also available at the station, thereby only requiring the connection and testing of the alarms to SCADA.

It is the contractor's responsibility to provide the appropriate tools and test equipment.

The contractor is also expected to supply temporary chargers and battery banks during emergency situations.

Note: A hardcopy as well as electronic reports (Excel readable) must be submitted for any repair or ad-hoc work done.

13. EXPERIENCE

The contractor and his staff must have at least five years of experience in DC systems.
Details of relevant work, previously undertaken, must be provided together with contactable references. Copies of existing reports must be supplied together with the tender offer.

14. 24 HOUR EMERGENCY SERVICE

Emergency teams shall be made available 24 hours, 7 days a week for emergency service to address any problems that may arise. The contractor must be able to provide suitable standby plant for use whilst attending to breakdowns as necessary, or doing second line maintenance. City Power's officials will approve the suitability of this plant.

15. RESPONSE TIMES

The standby person must be able to respond to an emergency call-out within one (1) hour. Any emergency repairs must be resolved within six (6) hours from the initial call-out.

16. REPORTS

In cases where services of the 3rd party or contractor are used, the contractor must supply copies of all test reports manually and electronically. Preference will be given to computerized test reports submitted via email and with a hard copy issued later to Secondary Plant DC Maintenance.

17. TRAVELLING AND TRANSPORT

Travelling and transport costs are the contractor's responsibility and must be included in the work rates supplied.

In cases where services of the 3rd party or contractor are used, the contractor must supply contract pricing and the travelling and transport costs must be built in to the pricing structure, but also indicated separately for emergency work travelling and transport.

18. STANDBY ROSTER

For the 24 hour emergency service requirement, the contractor must supply a standby roster of their services personnel or the services personnel of any 3rd party or contractor used, to the Secondary Plant DC Maintenance Manager or supervisor.

19. QUALITY MANAGEMENT

A quality management system shall be set up in order to assure the quality of work during maintenance and emergency work. Guidance on the requirements for a quality management system may be found in the following standards: ISO 9001. The details shall be subject to agreement between the City Power and contractor.

20. ENVIRONMENTAL MANAGEMENT

An environmental management system shall be set up in order to ensure the environmental compliance for operation and maintenance of DC systems. Guidance on the requirements for an environmental management system may be found in SANS 14001 and City Power Policies. The details shall be subject to agreement between the City Power and the contractor.

Annexure A – Bibliography

None

Annexure B - Revision information

DATE	REV. NO.	NOTES
May 2018	0	First issue

TECHNICAL SCHEDULES A & B:

ITEM No. 1: Activities

Schedule A: Purchaser's specific requirements
Schedule B: Guarantees and technical particulars of equipment, material or material offered

Item	Description	Schedule A	Schedule B
1	Load Test (per battery bank)	Yes	
2	Discharge (per hour)	Yes	
3	COC per battery charger installed	Yes	
4	Repositioning of battery charger	Yes	
5	Setting and calibration of charger controls	Yes	
6	Connect and test DC alarms to SCADA	Yes	

NOTE: TICKS [✓✗], ASTERISK [*], WORD [NOTED], OR TBA [TO BE ADVISED] WILL NOT BE ACCEPTED.

Tender Number:_____

Tenderer's Authorised Signatory: _____

Name in block letter_____Signature_____

Full name of company: _____

DEVIATION SCHEDULE:

ITEM No. 1: Activities

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.		
Item No.	**Sub-clause of CP_TSSTAN_075**	**Proposed deviation**

Tender Number:_____

Tenderer's Authorised Signatory: _____

Name in block letter_____Signature_____

Full name of company: _____

TECHNICAL SCHEDULES A & B:

ITEM No. 2: Repair or Replacement of Battery Charger Components

Schedule A: Purchaser's specific requirements
Schedule B: Guarantees and technical particulars of equipment, material or material offered

Item	Description	Schedule A	Schedule B
1	Supply of single phase control card in compliance with CP_TSSPEC_160	Yes	
2	Supply of 3 phase control card in compliance with CP_TSSPEC_160	Yes	
3	Supply of multi-alarm card/ relay card/ ribbon cable in compliance with CP_TSSPEC_160	Yes	
4	Supply of earth fault alarm card in compliance with CP_TSSPEC_160	Yes	
5	Supply of universal timer - Mains fail timer card in compliance with CP_TSSPEC_160	Yes	
6	Supply of single phase motherboard in compliance with CP_TSSPEC_160	Yes	
7	Supply of 3 phase motherboard in compliance with CP_TSSPEC_160	Yes	
8	Supply of Indication lamp in compliance with CP_TSSPEC_160	Yes	
9	Supply of Fuse/Fuse holder in compliance with CP_TSSPEC_068	Yes	
10	Supply of MCB in compliance with CP_TSSPEC_017	Yes	
11	Supply of Indication meter in compliance with CP_TSSPEC_160	Yes	
12	Supply of Selection switch in compliance with CP_TSSPEC_160	Yes	
13	Supply of Push button in compliance with CP_TSSPEC_160	Yes	
14	Supply of DC contactor/relay in compliance with CP_TSSPEC_160	Yes	
15	Supply of Power diode in compliance with CP_TSSPEC_160	Yes	

NOTE: TICKS [✓✗], ASTERISK [*], WORD [NOTED], OR TBA [TO BE ADVISED] WILL NOT BE ACCEPTED.

Tender Number: _____

Tenderer's Authorised Signatory: _____

Name in block letter _____ Signature _____

Full name of company: _____

DEVIATION SCHEDULE:

ITEM No. 2: Repair or Replacement of Battery Charger Components

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.		
Item No.	**Sub-clause of CP_TSSTAN_075**	**Proposed deviation**

Tender Number:_____

Tenderer's Authorised Signatory: _____

Name in block letter_____Signature_____

Full name of company: _____

TECHNICAL SCHEDULES A & B:

ITEM No. 3: Refurbishment or replacement of faulty DC equipment

Schedule A: Purchaser's specific requirements
Schedule B: Guarantees and technical particulars of equipment, material or material offered

Item	Description	Schedule A	Schedule B
	All equipment below shall comply with CP_TSSPEC_160		
1	Supply of 24V 1A Charger	Yes	
2	Supply of 32V 10A Charger	Yes	
3	Supply of 48V 5A Charger	Yes	
4	Supply of 110V 30A Charger	Yes	
5	Supply of 220V 60A Charger	Yes	
6	Supply of DC to DC converter	Yes	
7	Supply of DC chop over/selection panel	Yes	

NOTE: TICKS [✓ ✗], ASTERISK [*], WORD [NOTED], OR TBA [TO BE ADVISED] WILL NOT BE ACCEPTED.

Tender Number:_____

Tenderer's Authorised Signatory: _____

Name in block letter_____Signature_____

Full name of company: _____

DEVIATION SCHEDULE:

ITEM No. 3: Refurbishment or replacement of faulty DC equipment

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.		
Item No.	**Sub-clause of CP_TSSTAN_075**	**Proposed deviation**

Tender Number:_____

Tenderer's Authorised Signatory: _____

Name in block letter_____Signature_____

Full name of company: _____

TECHNICAL SCHEDULES A & B:

ITEM No. 4: Replacement of faulty battery cells

Schedule A: Purchaser's specific requirements
Schedule B: Guarantees and technical particulars of equipment, material or material offered

Item	Description	Schedule A	Schedule B
	All battery cells below shall comply with CP_TSSPEC_151 for NiCad and CP_TSSPEC_234 Rev 0 for Sealed Lead Acid		
1	Supply of Sealed Lead Acid 12V DC 250Ah	Yes	
2	Supply of Sealed Lead Acid 24V DC 50Ah	Yes	
3	Supply of Sealed Lead Acid 24V DC 120Ah	Yes	
4	Supply of Sealed Lead Acid 32V DC 50Ah	Yes	
5	Supply of Sealed Lead Acid 48V DC 50Ah	Yes	
6	Supply of Sealed Lead Acid 48V DC 100Ah	Yes	
7	Supply of Sealed Lead Acid 110V DC 50Ah	Yes	
8	Supply of Sealed Lead Acid 110V DC 150Ah	Yes	
9	Supply of NiCad 24V DC 20Ah	Yes	
10	Supply of NiCad 30V DC 54Ah	Yes	
11	Supply of NiCad 48V DC 50Ah	Yes	
12	Supply of NiCad 110V DC 250Ah	Yes	
13	Supply of Lead Acid 24V DC 120Ah	Yes	
14	Supply of Lead Acid 30V DC 250Ah	Yes	
15	Supply of Lead Acid 48V DC 100Ah	Yes	
16	Supply of Lead Acid 110V DC 100Ah	Yes	
17	Supply of Lead Acid 110V DC 250Ah	Yes	
18	Supply of Lead Acid 110V DC 450Ah	Yes	
19	Supply of Lead Acid 110V DC 1000Ah	Yes	
20	Supply of Lead Acid 220V DC 100Ah	Yes	
21	Supply of Lead Acid 220V DC 400Ah	Yes	
22	Supply of Lead Acid 220V DC 800Ah	Yes	
23	Supply of Dry cell 32V DC 10Ah	Yes	

NOTE: TICKS [✓✗], ASTERISK [*], WORD [NOTED], OR TBA [TO BE ADVISED] WILL NOT BE ACCEPTED.

Tender Number: _____

Tenderer's Authorised Signatory: _____

Name in block letter_____Signature_____

Full name of company: _____

DEVIATION SCHEDULE:

ITEM No. 4: Replacement of faulty battery cells

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.		
Item No.	**Sub-clause of CP_TSSTAN_075**	**Proposed deviation**

Tender Number:_____

Tenderer's Authorised Signatory: _____

Name in block letter_____Signature_____

Full name of company: _____