

# **SPECIFICATION**

## **THE APPOINTED SERVICE PROVIDER TO REHABILITATE SIGNALLING POWER AND UPS SYSTEMS**

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## 1. TABLES

### 1.1 TABLE 1: TABLE OF ABBREVIATIONS AND DESCRIPTIONS

ABBREVIATIONS	DESCRIPTIONS
UPS	Uninterruptible Power Supply
RM-TCC	Rail Management Traffic Control Center
SER	Signal Equipment Room
AR	Apparatus Room
SANS	South African National Standards
SABS	South African Bureau of Standards
kVA	KiloVolt Ampere
mΩ	Milli Ohm
Ah	Amp-hour
PRASA	Passenger Rail Agency of South Africa
LX	Level Crossing
FAT	Factory Acceptance Test
SAT	Site Acceptance Test
PICO	Post Installation Check Outs
OEM	Original Equipment Manufacturer

### 1.2 TABLE 2: TERMS AND DEFINITIONS

TERMS	DEFINITIONS
UPS system	The UPS shall denote all the complete power converter modules with associated controls, remote alarm panels, communication and batteries required by the design.
Modular UPS	A unit that is able to provide N+1 or N+X redundancy as well as being able to grow as power requirements increase
Three phase UPS	Three phase power contains either 3 live wires or 4 wires (3 phase wires and a neutral wire), providing three alternating currents, separated in phase angle.
Single phase UPS	Single phase electric power refers to the distribution of alternating current electric power using a system in which all the voltages of the supply vary in unison
Redundancy	The main principle behind redundancy in a UPS system is that it can continue to support the critical load should one or more UPS modules fail

## 2. SCOPE OF WORKS

### 2.1 The works for this installation includes:

- Supply, install, reconfigure and test & commission 20kVA modular UPS modules in the existing Modular UPS frame in our SER's and AR's across the Southern Corridor.
- Supply, install and test & commission a Modular UPS frames with existing modules
- Replace existing battery/battery banks with capacity rated batteries calculated for cycle usage, in all rooms housing UPS systems
- Replace capacitors and fans as per OEM requirements
- Replace damaged UPS systems.

The entire bid includes the Supply, Installation, Configuration and Test & Commissioning of Modular UPS frames, Single phase UPS and 20kVA Modules in our existing Modular UPS frames. UPS sizes vary from 3 kVA to 240 kVA systems. The contract also includes supply, deliver, replace and install suitable batteries to make up the required voltage and back-up power to provide standby time of not less than 4 hours at full load for our Apparatus Rooms (AR), 2 hour battery packs for our Level crossing Cabins, and not less than 8 hours for our Signal Equipment Rooms (SER).

- The batteries used for these Modular UPS system are 12 Vdc blocks that ranges from 150W to 620W.
- The batteries used for the 3 Phase, 4 wire UPS systems are 12 Vdc Blocks rated at 7.4 Ah.
- The batteries used for the 3kVA Single phase UPS systems are 2 hour full load battery packs.

In addition to the redundancy module installation and battery replacement, the contract shall include:

- Reconfiguring Modular UPS after installation of redundant module
- Repairing/replacing frames where it is difficult to remove or insert modules
- Replacing faulty/damaged termination cables between batteries
- Carrying out of tests and submission of test records and certificates
- Guarantees

### 2.2 Battery removal and disposal:

- The Contractor is responsible for the removal and disposal of all batteries used in the PRASA Metrorail region.

- The Contractor will issue PRASA with a disposal certificate for each battery/battery bank that was removed from site.

### 3. MAIN OBJECTIVES

- To build-in redundancy into our UPS back-up power system
- Increase charging capacity to mitigate load shedding
- To rebuild our back-up power discharge time frames to accommodate loadshedding
- To replace damaged/faulty UPS systems

### 4. SITE AND EXISTING SERVICES

The sites are all on Southern Corridor and are listed below:

4.1 TABLE 3: SITES

NO	CORRIDOR	ROOM	TYPE
1	Southern Corridor	Cape Town	SER
2		Cape Town	AR 1
3		Cape Town	AR 2
4		Cape Town	AR 3
5		Bay Junction	SER
6		Salt River	SER
7		Mowbray	AR
8		Newlands	AR
9		Retreat	SER
10		Wynberg	AR
11		Plumstead	AR
12		South Field	AR
13		Diep River	AR
14		Steenberg	AR
15		Muizenberg	AR
16		Fish Hoek	AR
17		Simonstown	AR
18		Wetton	AR
19		Hazendal	SER
20		Maitland	AR
21		Koeberg	AR

22		Kenilworth	LX Cabin
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## 4.2 Existing Services

- All Rooms excluding the LX cabins and Cape Town AR1, AR2, AR3 have Delta Modular UPS systems installed with at least 40 block battery banks. Exceptions to be made with the SER's. The battery for each bank differs in size. The size difference is because of the load calculation design for back-up running time.
- The LX cabins have 3kVA single phase UPS systems with 2 hour full load battery packs
- The Cape Town AR1, AR2 and AR3 rooms have 3 phase Delta HPH-20k-BN UPS with internal battery banks of 40 blocks rated at 7.5Ah.

## 5. TECHNICAL SPECIFICATIONS

### 5.1 The Modular UPS

Model		NHP-20K	NHP-40K	NHP-60K	NHP-80K	NHP-100K	NHP-120K
Power Rating - kVA		20	40	60	80	100	120
Power Rating - KW	< 25°C	18	36	54	72	90	108
	< 40°C	16	32	48	64	80	96
Input	Nominal Voltage	380/22, 400/230, 415/240 Vac (3 Phase, 4-wire + G)					
	Voltage Range	208 ~ 477 Vac (line – line)/ 120 ~ 276 Vac (line – neutral)					
	Current Harmonic Distortion	< 3% (full load)					
	Power Factor	➤ 0.99					
	Frequency	50 or 60 ± 5 Hz					
Output	Voltage	380/220, 400/230, 415/240 Vac (3phase, 4-wire +G)					
	Voltage Harmonic Distortion	< 3% (linear load)					
	Voltage Regulation	± 1% (static)					
	Frequency	50 or 60 Hz					
	Frequency Regulation	± 0.05 Hz (interior oscillator)					
		± 5 Hz (synchronized, adjustable in steps of 0.1 Hz)					
	Overload Capability	≤ 125%: 10 minutes; ≤ 150%: 1 minute					
Interface	Standard	RS232 × 1, SNMP slot × 2, Dry contact output × 6, Dry contact input × 2					
		Battery cabinet temperature × 4, Battery cabinet status detection × 1, Parallel port × 1, REPO × 1					
	Management Peripherals	SNMP card, Modbus card, Relay I/O control card, EnviroProbe					
		SNMP + 5 port hub, Battery cabinet temperature sensor, Battery cabinet status cable					
Conformance	Safety & EMC	CE, EN62040-1, EN62040-2 Class A					
Other Features	Parallel Redundancy and Expansion	Module and system redundancy; Maximum 4 units in parallel up to 480kVA					
	Emergency	Local and remote					

	Power Off						
	SRAM Event log	500 records					
Efficiency	AC – AC	94%					
	ECO Mode	97%					
Environment	Operating Temperature	0 ~ 40C					
	Relative Humidity	0 ~ 90% (non – condensing)					
	Audible Noise (at one meter)	65 dBA	68 dBA	70 dBA	72 dBA	73 dBA	
Physical Dimensions (WxDxH)	UPS	520 x 910 x 1165 mm			520 x 975 x 1695 mm		
	Battery Cabinet	520 x 850 x 1165 mm (26Ah x 40 pcs)			520 x 975 x 1695 mm (40Ah x 40 pcs)		
Weight		170 kg	200 kg	230 kg	260 kg	350 kg	380 kg

## 5.2 Three Phase UPS

Model	HPH-20K-LV-B	HPH-30K-LV-B	HPH-40K-LV-B	HPH-60-LV-B	
Power Rating	20kVA/20k W	30kVA/30k W	40kVA/40k W	60kVA/60k W	
Waveform	Sine Wave				
Input	Nominal Voltage	208/120Vac, 220/127Vac			
	Voltage Range	125~253Vac (L-L)/72 ~ 146Vac (L-N)			
	Frequency	50/60 Hz			
	Frequency Range	40 ~ 70 Hz			
	Input current	67.5A	100A	135A	200A
	Power Factor	➤ 0.99 (full load)			
Output	Voltage	208/120Vac, 220/127Vac			
	Power Factor	Unity			
	Voltage Regulation	± 1%			
	Voltage Harmonic Distortion	< 1.5% (Linear Load)			
	Overload Capability	≤ 105%: Continuous; 105% ~ 125%: 10 minutes; 125 ~ 150%: 1 minute; > 150%: 1 second			
	Output Frequency	50/60 Hz ± 0.05 Hz			
Efficiency	Online Mode	Up to 94%			
	ECO Mode	Up to 98%			
Battery	Type	SMF/VRLA			
	Battery Voltage	± 144 Vdc (default)			
	Charge Current	10A		20A	

	Charge Voltage	Float charge $163 \pm 3$ Vdc; Boost charge $168 \pm 3$ Vdc (default)			
	Discharge Time	9.5 minutes (9Ah 4 48pcs)	9.5 minutes (9Ah * 72 pcs)	6.5 minutes (9Ah * 72 pcs)	5.2 minutes (9Ah * 96 pcs)
Audible Noise		< 65 dBA		< 70 dBA	
LED & LCD		LED indicators and Multi-language LCD display			
Communication Interfaces		SMART Slot * 1, MINI Slot * 1, Parallel Port * 2, RS232 Port * 1, REPO Port * 1, Charger Detection Port * 1, Input Dry Contact * 2, Output Dry Contact * 6			
Environment	Operating Altitude	1000 meters (without derating)			
	Operating Temperature	0 ~ 40°C			
	Ambient Storage Temperature	-15 ~ 40°C			
	Relative Humidity	0% ~ 95% (non – condensing)			
Physical	Dimensions(W*D*H)	520 * 800 * 1380 mm		52 * 800 * 1760 mm	
	Weight (with batt)	340 kg	420 kg	450 kg	530 kg
	Weight (without batt)	196 kg	204 kg	234 kg	242 kg

### 5.3 Single Phase UPS

GENERAL DATA	G2 1kVA B/S	G2 2kVA B/S	G2 3kVA B/S
Output rated power	900W	1800W	2400W
Output power factor	0.9	0.9	0.9
Topology	Online double conversion		
Parallel configuration	No	No	No
Inbuilt batteries	Yes/No	Yes/No	Yes/No
<b>INPUT</b>			
Nominal input voltage	220/230/240 Vac		
Input voltage tolerance	100-300 Vac (load dependent)		
Input current THD1	5% with full resistive load		
Frequency range	45-55 Hz / 54-66 Hz		
Power factor	$\geq 0.99$		
<b>OUTPUT</b>			
Rated output voltage	220/230/240 Vac		
Voltage tolerance	$\pm 1\%$ (referred to 230V)		
Voltage distortion	<2% Linear load, <6% non linear load		
Overload capacity (linear load) on inverter	60s: 106-130% load 10s: 131-150% load 300ms: $\geq 150\%$ load		
Nominal frequency	50 or 60 Hz		
Crest factor	3:1 (load supported)		
<b>EFFICIENCY</b>			

Overall system efficiency	Up to 89%	Up to 91%	Up to 91%
In eco-mode	Up to 97%	Up to 98%	Up to 98%
<b>ENVIRONMENT</b>			
Protection rating	IP20		
Storage temperature	UPS: -25°C to 60°C; Batteries: 0°C to 35°C		
Operating temperature	0°C to 40°C		
Relative humidity	0% to 95%		
Altitude (above sea level)	1000m without derating		
<b>BATTERIES</b>			
Type	VRLA (valve regulated lead-acid)		
Inbuilt batteries	2*9.4 Ah (B)	4*9.4 Ah (B)	6*9.4 Ah (B)
Charging current	1.5A / 3-6A adjustable	1.5A / 1.5-6A adjustable	1.5A / 1.5-6A adjustable
Recharge time (inbuilt batteries)	4h to 90%		
<b>COMMUNICATIONS</b>			
User interface	LCD display		
Optional communication cards	SNMP; Modbus; AS400; Environmental monitoring sensor probe		
<b>STANDARDS</b>			
Safety	IEC/EN 62040-1		
EMC	IEC/EN 62040-2		
Performance	IEC/EN 62040-3		
Manufacturing	ISO 9001;2015, ISO 14001;2015, OHSAS 18001		
<b>WEIGHT, DIMENSIONS</b>			
Weight	9.2/3.9 kg	17.4/6.4 kg	22.7/6.4 kg
Dimensions (w*h*d)	144*228*356mm 102*228*346mm	190*327*399mm 102*327*390mm	190*327*399mm 102*327*390mm

## 5.4 Battery Specifications

Cells per unit	6
Voltage per unit	12
Capacity	150W-620W @ 15 min-rate to 1.67V per cell @ 25°Cn(77F)
Weight	Approx 17.6 kg
Maximum discharge current	300A(5sec)
Internal resistance	Approx 5.9 mΩ
Operating temperature range	Discharge: -15°C ~ 50°C (5F ~ 122F) Charge: -15°C ~ 40°C (5F ~ 104F) Storage: -15°C ~ 40°C (5F ~ 104F)
Nominal operating temperature range	25°C ± 3°C (77F ± 5F)
Float charging voltage	13.5 to 13.8 VDC / unit Average at 25°C (77F)

Recommended maximum charging current limit	20A
Equalization and cycle service	14.4 to 15.0 VDC/unit Average at 25°C (77°F)
Self discharge	CSB Batteries can be stored for more than 6 months at 25°C (77°F). Please charge batteries before using. For higher temperatures the time interval will be shorter.
Terminal	I2 – Thread alloy recessed terminal to accept M6 bolt
Container Material	Polypropylene (UL 94-V0/File E50955)*Flammability resistance of (UL 94-HB/File E216959) can be available upon request

## **6 INSTALLATION**

### **6.1 Work that forms part of the installation**

- Liaison and arrangement with various departments within PRASA, done via the Project Manager
- Battery Link cables as required to complete the installation
- Software/Reconfiguring update on modular UPS systems to accommodate the redundancy
- Connection/Configuration on Modular UPS frames of interface SNMP cards
- Repairing/replacing damaged modular UPS frames
- Replace damaged UPS systems

## **7 SYSTEM OPERATION**

- The redundant module shall be installed while the system is operational (hot swappable)
- The software update of system reconfiguration shall only be done on an agreed time between the PRASA project manager and Contractor UPS specialist
- The replacement of damaged Modular UPS frames shall only be done after hours or on weekends
- The replacement of damaged Single Phase UPS system shall only be done on an agreed time between the PRASA project manager and Contractor UPS specialist
- The full procedure in detail from the UPS specialist perspective in line with the UPS manufacturer operational manual shall be documented and handed over to the Client.

## **8 PROGRAMME OF WORKS**

- A detailed programme to be provided by the winning bidder which shall include lead times of all equipment and material.

## **9 PAYMENT STRUCTURE**

- A detailed payment structure will be presented to the winning bidder at the kick off meeting. The details of the structure will be agreed upon by both PRASA Project Manager and Winning bidder.

## 10 TEST & COMMISSIONING

- The Testing & Commissioning shall be done during working hours (9h00 – 15h00), Monday to Friday.

### 10.1 Prior to Final Testing & Commissioning

- FAT (Factory Acceptance Test) with the PRASA project manager. Sufficient notification time to be communicated. Contractor to be responsible for travelling arrangement if outside the 10km radius of PRASA Infrastructure Office Western Cape.
- PICO (Post-Installation Check Outs) / wire/link and battery count to be done by the Contractor and recordings to be presented of the test. The recording sheet shall also include the voltage reading of each block. Recording sheet to be presented to the PRASA project manager.
- SAT (Site Acceptance test) of portions of the installation.

### 10.2 Final Testing & Commissioning

- SAT of the entire installation to be done during the following time - (9h00 – 15h00)
- Final Testing & Commissioning to be done by a competent Technician provided by the client in conjunction with the Contractors knowledgeable UPS specialist.
- Final testing will consists of various tests set out by the Contractor UPS Specialist and PRASA project manager
- Sufficient staff for the final commissioning to be made available by the Contractor. The Contractors team must be adequate to perform the necessary changeover quickly and efficiently to complete the process.

### 10.3 Tests

- During testing the Contractor shall record both steady state and transient loads, voltage and load transfers and provide test report to PRASA project manager.
- If any portion of the works fails to pass the tests, tests of the said portion after replacement or rectification of the fault at the Contractors expense, shall be repeated within a reasonable time upon the same terms and conditions agreed between PRASA project manager and Contractor

- The Contractor to perform different load tests that will be witnessed by the PRASA project manager
- The Contractor shall provide all necessary test equipment, materials and tools and competent staff for the performance of the acceptance tests of the complete installation on site.

## **11 MAINTENANCE & GUARANTEE**

- A 12 month maintenance and guarantee period is required, which shall include replacement of parts, labour, consumables, travel and all other associated costs.

## **12 HANDOVER**

- The following shall form part of the Handover:
  - The Contractor shall submit a written report of each room/cabin where work was done.
  - On job training regarding module swapping and configuration shall be given during commissioning.

## **13 DRAWINGS**

- The Contractor shall:
  - Update all applicable drawings on AutoCAD for record Information (AS-built)
  - A CD with a soft copy (AutoCAD & PDF) and 3 \* hard copies stamped to be provided upon completion of the project
  - Provide full switching procedure drawings for all rooms. Drawings shall be hard copy and laminated. A soft copy (AutoCAD & PDF) shall also be provided.

**END OF SPECIFICATION**

## 14 ANNEXURE A - BILL OF QUANTITIES (BOQ)

Bills of Quantities - Benchmark						
RFQ- UPS and Batteries						
Main Item	Sub-Item	Item Descriptions	UoM	QTY	Rate	Amount Total
<b>1)</b>	<b>Preliminaries and Generals</b>					
	1.1	P & G's	sum	1		R -
	1.2	Health and Safety Plan	sum	1		R -
						R -
<b>2)</b>	<b>Build in redundancy</b>					
	2.1	Supply Modular 20kVA modules	each	13		R -
	2.2	Install 20kVA modules	each	13		R -
	2.3	Configure UPS with redundant 20kVA module	each	13		R -
						R -
<b>3)</b>	<b>Battery Back-up restoration</b>					
	3.1	Supply 12Vdc Battery to accommodate the Modular UPS system	each	240		R -
	3.2	Install the 12Vdc battery for the Modular UPS system	each	240		R -
	3.3	Supply 12VDC Battery to accommodate the Three (3) Phase UPS system (7Ah)	each	120		R -
	3.4	Install the 12Vdc battery for the Three (3) phase UPS system (7Ah)	each	120		R -
	3.5	Supply 2 hour full load battery packs for our Single Phase UPS systems	each	1		R -
	3.6	Install the 2 hour full load battery packs for the Single Phase UPS systems	each	1		R -
						R -
<b>4)</b>	<b>Caps and Fans replacement</b>					
	4.1	Modular UPS capacitor and fan kit	each	12		R -
	4.2	Installation of caps and fans	each	12		R -
						R -
<b>5)</b>	<b>Replacement of damaged equipment</b>					
	5.1	Supply Modular UPS frame	each	1		R -
	5.2	Install Modular UPS frame	each	1		R -
						R -
<b>1. Preliminaries and Generals</b>						R -
<b>2. Build -in Redundancy</b>						R -
<b>3. Battery back-up restoration</b>						R -
<b>4. replacement of capacitors and fans</b>						R -
<b>5. Replacement of damaged equipment</b>						R -
<b>Sub-Total</b>						R -
<b>Contingency @5%</b>						R -
<b>VAT @15%</b>						R -
<b>TOTAL Including VAT and Contingency</b>						R -

