

PART C3: WORKS INFORMATION

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C3.1 EMPLOYER’S WORKS INFORMATION

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SECTION 1

1 Description of the *works*

1.1. Executive overview

TNPA, Port of East London, has three (3) existing UPS located in the Port Control server room, Port Admin server room, and Grain elevator server room. The area is access controlled and all security and safety protocols must be adhered to.

UPS for Port Control server room and Port Admin server room were purchased in February 2011 and Grain elevator server room UPS was purchased in April 2018.

The life span of these UPSs has ended as normally UPS's life span is 7-10 years and the Port environmental conditions affects these UPSs.

Furthermore, due to change in technology, when there is faulty equipment, replacement parts are no longer available in the market. This poses a risk in the operations of server rooms if there can be a major fault, the UPSs cannot be repaired.

It is necessary that this UPSs should be replaced to ensure that the power is not interrupted during power outages and loadshedding.

The UPSs shall work conjointly with existing standby generators that which shall switch-on automatically immediately when the power goes off before the generator is on as the standby diesel generator takes seconds to be on, ensuring that there are not interruptions or damage to equipment.

The *works* that the *Contractor* is to perform *involve*:

- removal of old uninterruptible power supplies (UPSs),
- Supply, delivery, installation and testing of new UPSs

1.2. Employer's objectives

Port Control Building, Port Admin building, and Grain elevator are equipped with server rooms accommodating critical equipment which ensures continuity of operations in the Port.

The objective is to procure new UPSs to replace old UPSs to ensure no interruptions to operations and protection of server equipment during power outages or faulty equipment.

2. SECTION 2 ENGINEERING AND CONTRACTORS DESIGN

There are no detailed designs to be performed in the project however the appointed *Contractor* will have to perform works strictly in accordance with:

2.1.1. Standards adherence

The bidder shall be aware that the standards to be adhered to are not limited to the listed below ones, should the bidder be the successful bidder.

2.1.2. Relevant standards and sans standards

- SANS 10111 (Latest): Engineering drawing
- The Occupational Health and Safety Act and Regulations (Act no. 85 of 1993 as amended)
- Any municipal by-laws and regulations
- The local authority requirements
- The earthing of low voltage distribution systems – SANS 10292
- The National Building Regulations – SANS 10400
- SANS 10142 – Code of Practice for the wiring of Premises

3. SECTION 3

3.1. SCOPE OF WORKS

3.1.1. Old/Existing UPS

- The scope of works includes the removal of the existing UPS from the stipulated areas. The removal of the existing UPS to be conducted by the appointed Contractor.
- The sizes of existing UPS are as follows:

NAME OF THE BUILDING	NAME OF THE UPS	NUMBER OF THE UPS	SIZE OF THE UPS
Port Admin	Tescom	1	30KVA
Port Control	Tescom	1	20KVA
Grain Elevator	PSS	1	10KVA

- The UPS to be transported and placed by the appointed Contractor at the location to be indicated by the electrical personnel.

3.1.2. New Uninterruptible Power Supplies (UPS's)

- The Contractor to supply, deliver, install, test and commission three (3) uninterruptible power supplies (UPS) at various areas in the Port of East London.

- The UPS unit shall consist of a rectifier/charger, inverter, and manual bypass switch.
- The application of the UPS shall be solely to supply power when it has been cut-off and ensure interference free power at Stipulated areas. Equipment requiring this supply is very critical, which is sensitive to frequency deviations, voltage transients and voltage dips. The UPS system shall compensate for the variations in the input supply as any irregularities will affect the load. The UPS shall comprise of the following major components:
 - PFC Rectifier
 - Battery charger
 - Inverter
 - Battery
 - Automatic bypass (Via a static switch)
 - User and communications interface
 - Battery management system
- The UPS shall be based on six-pack IGBT technology with built-in thermal monitoring and frequency chopping mode to dynamically optimise efficiency and power quality.
- The UPS shall accept high crest factors (3:1) without derating to ensure correct operation with computer loads.
- The UPS machine shall be equipped with completely sealed; maintenance free 10- year batteries rated for 30 minutes at full load rated 0.8 pf or 0.9 pf. The battery bank shall be split into 4 strings each controlled via separate isolators, to allow each string to be serviced independently, without affecting operation of the UPS.
- The Contractor shall supply and install cabling, sub-DB (if the existing cabling does not meet the capacity of the new UPS and or sub-DB is not sufficient or is affected) and all accessories such as connectors, mounting brackets, cable ducts and trays etc., required by the system to ensure successful operation of UPS. The Contractor to calculate and provide the correct cable sizes as per SANS 10142-1.
- The Contractor will be responsible for making good in all trades, damage or disturbances to the building, installation, concrete surfaces, and other existing services may have been interrupted during installation.
- The Contractor will be responsible for keeping the site tidy during the construction of the system and shall remove from the site all rubble and litter resulting from the work.

3.2. TECHNICAL SPECIFICATIONS UPS 3S 30KVA 400V (E3SUPS30KH)- Port Admin

Main Input Voltage	400 V AC 3 phases
Input voltage	415 V
Maximum input current	55 A
Load power factor	0.9 leading to 0.9 lagging
Cos phi	0.99
Input voltage limits	304...400 V
Network frequency	50 Hz
Output voltage	400 V AC 3 phases
Rated power in W	30 kW
rated power in VA	30 KVA
Bypass type	Built-in maintenance bypass
Crest factor	3 : 1
Harmonic distortion	Less than 3 %
Maximum configurable power in VA	30 KVA
Maximum configurable power in W	30 kW
Output overload operation	10 minutes at 125% and 60 seconds at 150%
UPS type	Double conversion online
Output frequency	50 Hz sync to mains
Complementary	
Maximum short-circuit current	10 kA
Battery type	Lead-acid external
Control panel	Touch Screen LCD User Interface
UPS connectivity	Optional network management card 3
Colour	White (RAL 9003)
Height	77 cm
Width	25 cm
Depth	80 cm
Product weight	60 kg
USB compatible	Yes
Provided equipment	Dust filter Installation guide
Range of product	Easy UPS 3S
Environment	
Ambient air temperature for operation	0...40 °C
Ambient air temperature for storage	-15...40 °C
Storage altitude	0...14999.8 m

IP degree of protection	IP20
Relative humidity	0...95 % non-condensing
Storage Relative Humidity	0...95 % non-condensing
Acoustic level	63 dBA
Heat dissipation	1410 W
Operating altitude	0...3281 ft
Batteries & Runtime	
Battery type	External battery system
Number of battery filled slots	0
Number of battery free slots	0
Packing Units	
Unit Type of Package 1	PCE
Number of Units in Package 1	1
Package 1 Height	101.5 cm
Package 1 Width	98.2 cm
Package 1 Length	40 cm
Package 1 Weight	77 kg

UPS 3S 20KVA 400V (E3SUPS20KFBS)-Port Control

MAIN	
Main Input Voltage	400 V AC 3 phases
Input voltage	220 V
Maximum input current per Phase	61 A
Maximum Short Circuit Withstand (Icw)	10 kA
Input Total Harmonic Distortion	Less than 4% for full load
Load power factor	0.9 leading to 0.9 lagging
Cos phi	0.99
Input voltage limits	304...400 V
Network frequency	50Hz
Output voltage	400 V AC 3 phases
Other Output voltage	400 V
Rated power in W	20 kW
rated power in VA	20 KVA
Bypass type	Built-in maintenance bypass
Crest factor	3 : 1
Harmonic distortion	Less than 3 %
Maximum configurable power in VA	20 KVA
Maximum configurable power in W	20 kW

Output overload operation	10 minutes at 125% and 60 seconds at 150%
UPS type	Double conversion online
Output frequency	50 Hz sync to mains
Complementary	
Maximum short-circuit current	10 kA
Battery type	Lead-acid external
Control panel	Touch Screen LCD User Interface
UPS connectivity	Optional network management card 3
Colour	White (RAL 9003)
Height	55.1 in (140 cm)
Width	15.0 in (38 cm)
Depth	37.8 in (96 cm)
Product weight	291.01 lb (US) (132 kg)
USB compatible	Yes
Provided equipment	Dust filter Installation manual
Range of product	Easy UPS 3S
Environment	
Ambient air temperature for operation	0...40 °C
Ambient air temperature for storage	-15...40 °C
Storage altitude	0...49212.6 ft (0...15000 m)
IP degree of protection	IP20
Relative humidity	0...95 % non-condensing
Storage Relative Humidity	0...95 % non-condensing
Acoustic level	68 dBA
Heat dissipation	1400 W
Operating altitude	0...4921 ft
Batteries & Runtime	
Battery type	External battery system
Battery Voltage	+/- 120 V
End of Discharge Battery Voltage	+/- 96 V
Packing Units	
Unit Type of Package 1	PCE
Number of Units in Package 1	1
Package 1 Height	62.8 in (1595 mm)
Package 1 Width	47.2 in (1200 mm)

Package 1 Length	31.5 in (800 mm)
Package 1 Weight	363.8 lb(US) (165 kg)

UPS 3S 10KVA 231V (E3SUPS10KFBS)- Grain Elevator

MAIN	
Main Input Voltage	231 V AC single phases
Input voltage	231 V
Maximum input current per Phase	31 A
Maximum Short Circuit Withstand (Icw)	10 kA
Input Total Harmonic Distortion	Less than 4% for full load
Load power factor	0.9 leading to 0.9 lagging
Cos phi	0.99
Input voltage limits	220...231 V
Network frequency	50 Hz
Output voltage	231 V AC single phases
Other Output voltage	220 V
Rated power in W	10 kW
rated power in VA	10 KVA
Bypass type	Built-in maintenance bypass
Crest factor	3 : 1
Harmonic distortion	Less than 3 %
Maximum configurable power in VA	10 KVA
Maximum configurable power in W	10 kW
Output overload operation	10 minutes at 125% and 60 seconds at 150%
UPS type	Double conversion online
Output frequency	50 Hz sync to mains
Complementary	
Maximum short-circuit current	10 kA
Battery type	Lead-acid external
Control panel	Touch Screen LCD User Interface
UPS connectivity	Optional network management card 3
Colour	White (RAL 9003)
Height	55.1 in (140 cm)
Width	15.0 in (38 cm)
Depth	37.8 in (96 cm)
Product weight	120 kg
USB compatible	Yes

Provided equipment	Dust filter Installation manual
Range of product	Easy UPS 3S
Environment	
Ambient air temperature for operation	0...40 °C
Ambient air temperature for storage	-15...40 °C
Storage altitude	0...49212.6 ft (0...15000 m)
IP degree of protection	IP20
Relative humidity	0...95 % non-condensing
Storage Relative Humidity	0...95 % non-condensing
Acoustic level	65 dBA
Heat dissipation	700 W
Operating altitude	0...4921 ft
Batteries & Runtime	
Battery type	External battery system
Battery Voltage	+/- 120 V
End of Discharge Battery Voltage	+/- 96 V
Packing Units	
Unit Type of Package 1	PCE
Number of Units in Package 1	1
Package 1 Height	62.8 in (1595 mm)
Package 1 Width	47.2 in (1200 mm)
Package 1 Length	31.5 in (800 mm)
Package 1 Weight	335.1 lb(US) (152 kg)

3.3. TECHNICAL REQUIREMENTS

3.3.1. AC to DC Battery Charger

- The UPS system shall be provided with a supply via the normal incoming cable from the diesel-driven standby plant in the event of a mains failure.
- The UPS control system shall be arranged to limit boost charging of the battery system when UPS is supplied from the standby supply. A voltage free N/O contact shall be provided to signal operation of the standby plant.
- A Battery System of sufficient capacity to supply the specified inverter load for the required time shall be provided. Each single/modular UPS unit shall be equipped with its own battery of the sealed lead-acid type, mounted, and wired in a cabinet identical in aspect to that of the UPS and shall have a service life of 10- years.
- The Contractor shall state the 10-hour discharge capacity of the batteries and the battery voltage at its terminals under various conditions.

3.3.2. DC to AC Inverter

- A solid-state DC to AC inverter providing a three-phase output within the specified output requirements from a DC source originating from the rectifier or battery output shall be provided. Self-commutated or load commutated and three single phase units phase controlled within 120 electrical degrees or three phase inverter bridges are acceptable. The inverter shall be fully rated to provide the specified output power between the upper and lower battery voltage limits.
- The inverter shall be adequately protected against excessive overloads or short circuits that may occur in the load.
- The UPS shall be capable of supplying for at least 10 minutes a load representing 125% of the rated load and 60 seconds a load is representing 150% of the rated load.
- The overload capacity shall be capable of considering temperature conditions for more than ten minutes, by allowing a continuous, 10% overload when the temperature is less than or equal to 200 C. The output of the inverters is of the transformer less type and the neutral shall be recreated electronically.
- The IGBT inverter bridge shall contain the necessary auxiliary circuitry to ensure satisfactory operation with non-linear loads such as saturating transformers or other rectifier bridges as well as loads with low power factors.
- The inverter shall be switched off as soon as the DC input reaches a predetermined minimum value.
- The output of the inverter shall be connected through a very high-speed electronic switch to the output busbar. The switch shall be capable of disconnecting the inverter when operating at full load at any power factor from the output busbar in less than 1 msec.
- The operation of the electronic switch shall be such that failure of the inverter will cause the switch to isolate the faulty inverter from the busbar without any disturbance to the load.
- A soft start circuit shall be provided at the input to the inverter to limit inrush current at switch on. The DC input to the inverter shall be fuse protected.
- An isolator shall be provided allowing the inverter and electronic switch to be isolated from the output busbar for maintenance purposes.
- The instrumentation, alarms and controls may be placed on either an inverter panel or the bypass switch front panel. All controls shall be arranged on a system schematic provided on the front panel to simplify the control and identification.

3.3.3. Auto Bypass Switch

- A very high-speed electronic bypass switch (static switch) shall be connected in parallel to the rectifier/inverter between the mains and output busbar. Transfer shall take place automatically without a break in the event of a major overload or on an internal inverter

fault on the condition that bypass source voltage and frequency are within specified tolerances and that the inverter is synchronised. Manually initiated transfer shall also be possible.

- The Static switch shall be equipped with an RC filter for protection against switching overvoltage's and lightning strikes. An input and output isolator shall isolate the switch for maintenance purposes.

3.3.4. Mechanical Bypass

- A manually operated, quick make, quick break, fault break load make isolator rated for the full output load of the system, shall be provided as bypass circuit from load to mains, enabling maintenance of the rectifier/inverter system and electronic switch.

3.3.5. Indications Controls and Alarms

- UPS system operation shall be facilitated by a user interface on each of the modular UPS units, comprising:
 - The UPS should have a simple, user friendly system of control and indication.
 - Start-up shall be limited to a few actions such as closing the input circuit breaker to automatically start the charger/ rectifier, closing the battery circuit breaker and a push-button to start the inverter.
 - A graphic display [at least quarter VGA and high resolution are preferable.
 - ON and OFF control buttons [independent of the display]
 - Status indications with mimic panel.

3.3.6. Alarm Indications

- Low Battery / Shutdown imminent
- Charger Fault
- Rectifier Fault
- Inverter Fault
- Mains 2 Fault
- Phase Rotation Fault
- Rectifier Temperature
- Inverter Temperature Fault
- Battery Circuit Open
- Thermal Overload
- Inverter Shutdown on Low Battery
- Overload
- Battery Fault
- Load Protected / Power Supply OK
- Load Protected / Minor Fault
- Load Protected / Battery Discharging
- Load on Automatic Bypass

3.3.7. Measurement Display

- Inverter output currents
- Inverter output frequency
- Voltage across battery terminals
- Battery charge or discharge current.
- Rectifier/charger input phase-to-phase voltages
- Rectifier/charger input currents
- Crest factor
- Active and apparent power
- Power factor of the load
- Battery temperature
- Battery percent charge
- Available backup time
- The remaining battery service life

3.3.8. Battery Monitoring

- The UPS shall be standard with the following enhanced battery protection.
- The charger cycle shall adapt to ambient temperature charges.
- The UPS via the battery monitor shall be protected against deep discharges.
- The battery monitor shall precisely measure the remaining backup time.
- The battery monitor shall do the following tests:
 - Battery circuit test every 12 hours.
 - Open circuit battery tests every month.
 - Partial discharge tests every 3 months.
 - Alarm indicating the end of battery service life.
- All the features of the battery monitoring testing shall be done automatic and manually.
- Any negative results or faults indications shall produce visual indications and shall send messages via the remote diagnostic service.

3.3.9. Advanced Communications

The UPS shall be supplied with management hardware and software for remote monitoring facilities via local area network i.e.

- Graphic monitoring of UPS status
- Detailed UPS parameter display
- Events log and graphical display
- Block and functional diagrams
- Notification of alarms via e-mail, SMS etc.

3.3.10. PCB Coating

The PCBs must be conformably coated to provide superior protection against:

Dust, Dirt, Abrasion, Fungus, Moisture, Chemicals, Mechanical stress, Shock and vibration, and salt air environment.

3.3.11. Service conditions

All electrical equipment shall be suitable for operating under the following conditions.

Environmental Conditions

Altitude	0 to 1800m without de-rating
Ambient temperature	0 to 40° C (Continuous)
Relative Humidity	Up to 95% (non-condensing)

3.4. ADDITIONAL REQUIREMENTS

- The system shall be offered complete in all respects, including all standard equipment normally offered by manufacturers, users manuals. Layout and interconnection diagrams, to all of which shall be specified in detail during the tendering stage.
- Any further items of equipment and accessories not listed above but considered essential by the tenderer, shall be detailed, and quoted for separately under the heading "Additional Requirements".
- Whether all essential renewable parts for the system will be readily available in the Republic of South Africa.

3.5. GENERAL

- The UPS equipment shall provide continuous interference free power to essential equipment.
- The equipment requiring the power is a critical load, which is sensitive to frequency deviations, voltage transients and voltage dips. The UPS system shall compensate for the variations in the input supply as any irregularities will affect the load.
- This aspect shall be carefully considered when executing UPS machines as the static UPS machines will be deployed to supply server equipment which has shown to have an extremely aggressive load profile.
- The UPS shall accept high crest factors (3:1) without derating to ensure correct operation with server equipment loads.
- The UPS shall comprise of the following major components for each system as numbered in the Detailed Technical section of this document:

- PFC Rectifier
 - Battery charger
 - Inverter
 - Battery
 - Automatic bypass [via a static switch]
 - User and communications interface
 - Battery management system
- The UPS shall be based on six-pack IGBT technology with built-in thermal monitoring and a Frequency chopping mode to dynamically optimise efficiency and power quality.
 - Input power factor (pf) greater than or equal to 0.99

3.6. GUARANTEES

All equipment offered include batteries shall be guaranteed to be free of defects for a minimum period of 36 months or as per OEM supplier. Full details must be provided.

3.7. COMPLETION, TESTING AND CORRECTION OF DEFECTS

The work to be done by the Completion Date stipulated:

- On or before the Completion Date the Contractor shall have done everything required to provide the works including the work listed as per the scope of work which is to be done before the Completion Date and in any case before the dates stated.
- The Employer cannot certify completion until all the work listed on the scope of work has been done and is also free of defects, which would have, in his/her opinion, prevented the Employer from using the works and others from doing their work.
- All remedial work regarding the closing of holes and making right any areas affected by the works will be done by the Contractor and approved by the Civil Supervisor before sign-off for the works.
- The appointed Contractor to issue certificate of compliance of each UPS installation work after the completion of the works.

3.8. SAFETY

The *Contractor* shall:

- shall accept his obligation to complying fully with Transnet safety requirements.
- provide a written Health and Safety plan.
- provide a basic risk assessment that covers the work to be undertaken.
- Always keep a safety file.
- provide proof of induction before the commencement of the work.
- keep a site diary and instruction book.
- be responsible to arrange occupations.
- TNPA reserves the right to audit the Tenderer's office and workshop.
- allow for induction before starting work.

3.9. ENVIRONMENTAL RESPONSIBILITY

The *Contractor* shall:

- Separate hazardous or non-hazardous waste and where practical, waste for recycling prior to disposing thereof.
- Also undertakes to minimize the amount of waste generated or released, whether it is hazardous or non-hazardous waste, as far as possible to reduce the impact on the Environment.
- Undertake to dispose of all waste generated, albeit hazardous or non-hazardous waste in a responsible manner and submit proof of all disposal documents to the Project Manager.