

LOT 1

SUPPLY & INSTALLATION OF 1 No. 800KVA GENERATOR-SET

S/No.	DESCRIPTION	UNIT	QTY
A	BACK-UP GENERATOR-SET		
1	800 - 810KVA Diesel Engine Generator-set and associated spares / miscellaneous	U	1
	Sub-Total "A"		
B	GENERATOR-SET ASSOCIATED COMPONENTS		
1	Mains Protective Control Panel; containing 1No. Circuit Breaker rated In =1250A and associated busbars,	U	3
2	Generator Protective Control Panel; containing 1No. Circuit Breaker rated In =1600A and associated Busbars	U	1
4	Automatic Transfer Switch (ATS); 4 - Pole, 400V, 50Hz In =1600A	U	3
5	Load Protective Switchgear; containing 1No. CB each rated In = 1250A, Surge Arrestors and associated Busbars	U	3
6	Low Voltage Capacitor Bank; 600KVAR, 3-Phase, 400V, 50Hz, (Schneider or equivalent)	U	3
	Sub-Total "B"		
C	GENERATOR-SET INSTALLATION CABLES / ACCESSORIES		
1	LV Power Cable; 3 x 240mm ² + 95mm ² Stranded copper conductors, XLPE insulated PVC bedded, steel wire armoured, PVC sheathed 600 / 1000 V	M	250
2	LV Control Cable; 4 x 2.5mm ² Stranded copper conductors, XLPE insulated PVC bedded, steel wire armoured, PVC sheathed 600 / 1000 V	M	150
3	Cable Terminal Lug; 240 x 14, Copper	U	40
4	Cable Terminal Lug; 95 x 14, Copper	U	25
5	Insulation Scotch Tape 23	U	40
6	Insulation Scotch Tape 33	U	25
7	Multimeter. Clamp type, F13N CHAUVIN ARNOUX	U	12
8	Hydraulic Foot Pump Bearing Removal and Replacer Tool (Bearing Extractor and Press Tool), Complete	U	1
9	Earth Wire; 1 x 50mm ² , Bare Copper, stranded conductor	M	150
10	Earth Wire; 1 x 29mm ² , Bare Copper, stranded conductor	M	150
11	Earth Rod; 2.10m Long, Ø16mm + Clamp	U	15
12	Earth Cable; 1 x 35mm ² Insulated Copper Stranded Conductor	U	100
13	Earth Cable; 1 x 25mm ² Insulated Copper Stranded Conductor	U	100
14	Splicing Connector; 240mm ² , Copper	U	40
15	Splicing connector; 95mm ² , Copper	U	30



16	Complete Electrician Tool Kit; Large size kit (Craftman)	U	3
17	Heat Shrinking Insulation Tube; Ø100mm	M	60
18	Heat Shrinking Insulation Tube; Ø150mm	M	60
19	Heat Shrinking Insulation Tube; Ø200mm	M	60
20	Cable Tie; length = 140, width = 2.4	PKT	18
21	Cable Tie; length = 262, width = 9	PKT	18
	Sub-Total "C"		

1.0 TECHNICAL SPECIFICATIONS

1.1 INTRODUCTION

The Cameroon Development Corporation wishes to acquire a Generator-Set to act as back-up power supply to the Esoassoa pumping station, Mafanja Estate

The **eneo** power lines to the Esoassoa pumping station are often interrupted due to medium voltage network breakdown caused by fallen power lines and load shedding. The frequent interruptions of power supply results to huge losses in production.

Considering these factors the corporation thought it wise to provide back-up power supply as an alternative to enable it achieve its objectives.

1.2 BACK-UP GENERATOR-SET

1No. 800 – 810KVA Diesel Engine Backup Generator-sets, Spares and Miscellaneous

1.2.1 MODULES

S/N	QUANTITY	UNIT	DESCRIPTION
1	3	No.	Mains Protective Switchgear
2	1	No.	Generator Protective Switchgear
3	3	No.	Automatic Transfer Switch (ATS)
4	3	No.	Load Protective Switchgear
5	3	No.	Low Voltage Automatic Capacitor Bank (Condensateur BT)

1.2.2 CABLES / ACCESSORIES

S/N	DESCRIPTION
	Low Voltage (LV) Power Cables
	Low Voltage (LV) Control Cables
	Medium Voltage (MV) Power Cables
	Assorted Cable Accessories

1.3 DESCRIPTION

The project entails the procurement and installation of a diesel engine generator – sets, modules which when interconnected with the cables and associated accessories, will ensure seam less transfer of power.



1.3.1 THE GENERATING SET

The specifications of the generators shall be as indicated below.

ELECTRICAL PARAMETRES		CONTINUES RUNNING	STANDBY
POWER	KVA	800	810
	KW	640	648
VOLTAGE		400/230V	
MCB (A)		1600A	
FREQUENCY		50Hz	

ENGINE PARAMETRES	
ENGINE	V-12, 4-Stroke , Water-cooled Diesel
Functionality	Turbo Charged Engine
Governor Type	Electronic
Fuel System	Pump and Lines "injection"
Excitation	Self-Excitation
Voltage regulation	Less than +/- 1/2% (steady state) Less than +/- 1% (no load to full load)
Controller	Visual Diagnostics for ; Engine Coolant Level, Oil Pressure, battery/ charging, frequency
Sensor Shutdown System	Low Oil Pressure, High Engine Temperature, Over-Speed, Low Coolant Level, Over-Crank
Voltage Dip	Shall Not Exceed 30%, Recovery Within 15 Seconds.



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MISCELLANEOUS EQUIPMENT FOR THE GENERATOR-SET	
Automatic dual rate Battery Charger	1ph -230V- 10amps input; 35V output max
Heavy Duty batteries	120AH minimum
Intergrated Fuel Tank	Capable of running the set for at least 18hours
Fuel leak detector	With dedicated indicator light
MAINS PROTECTIVE SWITCHGEAR	
Main Circuit Breaker	1250 A
Associated monitoring	Control relay, surge arrestors, and earth protection
Location	Stand Alone Module
GENERATOR PROTECTIVE SWITCHGEAR	
Main Circuit Breaker	1600 A
Associated monitoring	Control relay, surge arrestors, and earth protection
Location	Stand Alone Module

1.4 SWITCHGEAR CONSTRUCTION

The switchgear shall consist of the required number of vertical sections bolted together to form a rigid assembly. The sides shall be covered with removable bolt-on covers. All edges of front covers or hinged front panels shall be formed. Provide ventilators located on the top of the switchgear over the breaker and bus compartments to ensure adequate ventilation within the enclosure. The rear covers shall be fabricated in two (2) pieces for ease of handling and shall be mounted using captive hardware] [Hinged rear doors, complete with provisions for padlocking, shall be provided.]

The assembly shall be provided with adequate lifting means and shall be capable of being moved into installation position and bolted directly to [Contractor supplied floor sills to be set level in concrete per manufacturer's recommendations] [the floor without the use of floor sills providing the floor is level to 1/8 inch per 3-foot distance in any direction]. Provisions shall be made for jacking of shipping groups, for removal of skids or insertion of equipment rollers. Base of assembly shall be suitable for rolling directly on pipes without skids. The base shall be equipped with slots in the base frame members to accommodate the use of pry bars for moving the equipment to its final position.

Each vertical steel unit forming part of the switchgear line-up shall be a self-contained housing having one or more individual breaker or instrument compartments, a centralized bus compartment and a rear cable compartment. Each individual circuit breaker compartment, or cell, shall be segregated from adjacent compartments and sections by means of steel barriers to the maximum extent possible. It shall be equipped with draw out rails and primary and secondary disconnecting contacts. Removable hinge pins shall be provided on the breaker compartment door hinges.



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The stationary part of the primary disconnecting devices for each power circuit breaker shall be breaker mounted and consist of a set of contacts extending to the rear through glass polyester insulating support barrier; corresponding moving finger contacts, suitably spaced, shall be furnished on the power circuit breaker studs which engage in only the connected position. The assembly shall provide multiple silver-to-silver full floating high pressure point contacts with uniform pressure on each finger maintained by springs. Each circuit shall include the necessary three-phase bus connections between the section bus and the breaker line side studs. Load studs shall be equipped with copper load extension buses terminating in solder-less type terminals in the rear cable compartment of each structure. Bus extensions shall be [silver-plated] [tin-plated] where outgoing terminals are attached.

The circuit breaker door design shall be such that the following functions may be performed without the need to open the circuit breaker door: lever circuit breaker between positions, operate manual charging system, close and open circuit breaker, examine and adjust trip unit, and read circuit breaker rating nameplate.

The secondary disconnecting devices shall consist of floating terminals mounted on the stationary unit and engaging mating contacts at the front of the breaker. The secondary disconnecting devices shall be gold-plated and engagement shall be maintained in the "connected" and "test" positions.

The removable power circuit breaker element shall be equipped with disconnecting contacts and interlocks for draw-out application. It shall have four positions, "connected," "test," "disconnected" and "removed." The breaker draw-out element shall contain a worm gear levering "in" and "out" mechanism with removable lever crank. Levering shall be accomplished via the use of conventional tools. Mechanical interlocking shall be provided so that the breaker is in the tripped position before allowing access to the levering mechanism for levering "in" or "out" of the cell. Interlock systems that trip the breaker when accessing the levering mechanism will NOT be acceptable. The breaker shall include an optional provision for key locking open to prevent manual or electric closing. Padlocking shall provide for securing the breaker in the connected, test, or disconnected position by preventing levering.

An insulating flash shield shall be mounted above each circuit breaker to prevent flashover from the arc chutes to ground.

The switchgear shall be Caterpillar low voltage metal-enclosed switchgear structures as specified herein.

The switchgear shall be suitable for use as service entrance equipment and be labelled in accordance with UL requirements.

Provide a rear compartment barrier between the cable compartment and the main bus to protect against inadvertent contact with main or vertical bus bars.



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Provide in the cell when the circuit breaker is withdrawn a safety shutter which automatically covers the line and load stabs and protects against incidental contact.

Provide a metal barrier full height and depth between adjacent vertical structures in the cable compartment.

Provide a glass polyester full height and depth barrier between adjacent vertical structures in the bus compartment with appropriate slots for main bus.

All bus bars shall be [silver-plated copper] [tin-plated copper]. Main horizontal bus bars shall be mounted with all three phases arranged in the same vertical plane. Bus sizing shall be based on ANSI standard temperature rise criteria of 65 degrees C over a 40 degrees C ambient (outside the enclosure).

In addition to full UL air clearances, the phase bus shall be insulated with a minimum of 5 mil thickness of epoxy resin coating. Removable boots shall be provided to give access to the cross bus joints for inspection and maintenance.

Provide a full capacity neutral bus where a neutral bus is indicated on the drawings.

A copper ground bus shall be furnished firmly secured to each vertical section structure and shall extend the entire length of the switchgear. The ground bus short-time withstand rating shall meet that of the largest circuit breaker within the assembly. All hardware used on conductors shall be high-tensile strength and zinc-plated. All bus joints shall be provided with Belleville-type washers.

1.5 BACKUP POWER SYSTEM (BPS) AUTOMATION & CONTROLS

The automation and control system shall facilitate overall BPS operation including automatic standby operation, monitoring and control of the generator sets including start/stop, alarm/fault monitoring, synchronizing, generator kW load sharing, generator kVAR load sharing, generator loading/unloading, load shed/add, and protective relaying.

1.6 AUTOMATIC TRANSFER SWITCH (ATS) CONSTRUCTION

<i>AUTOMATIC TRANSFER SWITCH (ATS)</i>	
poles	Four (3ph + neutral)
Rated (Voltage)	400 V / 230
Rated Current	1600amps
INTERLOCK	Mechanical and Electrical
Maximum transfer time	180 seconds
Retransfer of load	5 – 10 minutes



sensors	Under voltage for all the sources
Plant Exercise Clock	Seven days, 24 hour programmable clock powered from the load side of the transfer switch, With a 150 hour internal battery incorporated.
Rated Frequency	50 Hz

1.7 (ATS) CONSTRUCTION

Front mounted controls shall include a selector switch to provide for a NORMAL TEST mode with full use of time delays, FAST TEST mode which bypasses all time delays to allow for testing the entire system in less than one minute, or AUTOMATIC mode to set the system for normal operation.

Provide coloured indicator lamps to be energized when the transfer switch position is in either UTILITY (white) or BACKUP (red). A third lamp shall be provided to indicate STANDBY OPERATING (amber). These lights shall be energized from utility or the engine-generator set.

Provide manual operating handle to allow for manual transfer. This handle shall be mounted inside the lockable enclosure so accessible only by authorized personnel. Provide a safety disconnect switch to prevent load transfer and automatic engine start while performing maintenance. This switch will also be used for manual transfer switch operation.

Provide LED status lights to give a visual readout of the operating sequence. This shall include: utility on, engine warm up, engine warm up bypass, standby voltage "ready", standby frequency "ready", standby on, transfer to standby, return to utility, engine cool-down, engine minimum run and fast test mode.

The transfer switch mechanism and controls shall be mounted in an enclosure for outdoor, weatherproof, corrosion-proof, dustproof installation.

1.8 TECHNICAL REQUIREMENTS

1.8.1 INSTALLATION

Equipment shall be stored in a clean and dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage. The Contractors shall provide technical expertise on installation of all equipment as per the manufacturer's instructions, contract drawings and National Electrical Code.

The equipment shall be installed and checked in accordance with the manufacturer's recommendations. This shall include but not limited to:

- Checking to ensure that the pad location is level to within 0.125 inches per three foot of distance in any direction.
- Checking to ensure that all bus bars are torqued to the manufacturer's recommendations.
- Assembling all shipping sections, removing all shipping braces and connecting all shipping split mechanical and electrical connections.



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- Securing assemblies to foundation or floor channels.
- Measuring and recording Megger readings phase-to-phase, phase-to-ground, and neutral-to-ground (four wire systems only).
- Inspecting and installing all circuit breakers in their proper compartments.
- The assembly shall be provided with adequate lifting means and shall be capable of being moved into installation position and bolted directly to [Contractor supplied floor sills to be set level in concrete per manufacturer's recommendations] [the floor without the use of floor sills providing the floor is level to 1/8 inch per 3-foot distance in any direction]. Provisions shall be made for jacking of shipping groups, for removal of skids or insertion of equipment rollers. Base of assembly shall be suitable for rolling directly on pipes without skids. The base shall be equipped with slots in the base frame members to accommodate the use of pry bars for moving the equipment to its final position.

1.8.2 FIELD QUALITY CONTROL AND STARTUP

Provide the services of a qualified factory-trained manufacturer's representative for start-up of the equipment specified under this section for a period of 5 working days. The manufacturer's representative shall provide technical direction and assistance to the contractor / customer in general assembly of the equipment, connections and adjustments, and testing of the assembly and components contained therein.

The manufacturer's representative shall provide inspection of the final installation. The manufacturer's representative shall perform site start-up and functional checkout of the Switchgear. Functional Testing shall include testing of the following as a minimum:

- Pre-start-up inspection of the generator, dc system, control wiring, power cables, and switchboard / switchgear.
- Crank and run engine / generators at the local engine control panel.
- Crank and run engine / generators from the HMI touchscreen.
- Verify engine / generator alarms and shutdowns to HMI.
- Verify protective relay / breaker trip units are set to coordination study if applicable.
- Test all modes of operation.
- Verify and test all system alarms to HMI.
- Test with EPS with Load.

Upon completion of the manufacturer's start-up and checkout, the manufacturer shall demonstrate to the customer all the automated sequences of operation as specified herein.

The Contractor shall provide three (3) copies of the manufacturer's field start-up report.

1.9 TRAINING

The Contractor shall provide a training session for up to six (6) owner's representatives for normal workdays at a jobsite location determined by the owner.



Upon successful completion of a demonstration of the automated sequences of operation by the manufacturer and acceptance by the customer, the manufacturer shall provide an eight-hour "hands-on" training course for the customer's operating personnel which shall cover the following topics:

- ✓ Overall System Description and Theory of Operation
- ✓ Modes of Operation as per the Sequence of Operations to include at a minimum:
 - Automatic Operation
 - Manual Operation
 - Safety and Protective Relays
 - Recommended System Checks and Log Sheets
 - Recommended Preventive Maintenance

The training session shall be conducted by a manufacturer's-qualified representative. The training program shall also include instruction on the operation of the assembly, circuit breakers, and major components within the assembly.

1.9.1 FIELD ADJUSTMENTS

The relays shall be set in the field by a qualified representative of the Emergency Power System Supplier, retained by the Contractor, in accordance with settings designated in a coordinated study of the system as required elsewhere in the contract documents.

The Contractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. The settings shall be in accordance with the approved short-circuiting study, protective device evaluation study and protective device coordination study.

Necessary field settings of devices and adjustments and minor modifications to equipment to accomplish conformance with an approved short circuit and protective device coordination study shall be carried out by the Contractor at no additional cost to the owner.

1.9.2 FACTORY TESTING

Before shipment of the equipment, the engine-generator set shall be tested under rated load and power factor for performance and proper fronting of control and interfacing circuits. Tests shall include:

- Verifying all safety shutdowns and components are functioning properly.
- Single step load pick-up
- Transient and voltage dip responses and steady state voltage and speed (frequency) checks.
- The factory test data sheet shall identify all tests (PASSED or FAILED) and accompany each generator set.

1.10 GENERAL REQUIREMENTS

1.10.1 GENERAL

All equipment, including the associated weatherproof enclosure, exhaust piping and mufflers, shall be manufactured and assembled to withstand the seismic forces specified in the 2009 International Building Code (IBC).



Design and installation of seismic restraints for all equipment, weatherproof enclosure, exhaust piping, and mufflers, shall be in compliance with the applicable provisions of the IBC, and the manufacturer's recommendations and instructions.

The engine generator shall be mounted on vibration isolators positioned between the skid and the support pad/foundation. Seismic restraint provisions, if required, shall be incorporated into the isolators' design or provided separately. Where a sub-base fuel day tank is used, use only one set of isolators between skid and tank, or between tank and foundation.

All vibration isolators and snubbers shall be products of a single manufacturer.

Isolators shall reduce transmitted vibration from gen-set to foundation to maximum 40 microns total amplitude throughout frequency ranges down to 66 Hz during all phases of set operation.

1.10.2 OWNERS MANUALS

Two (2) hard copy sets of owner's manuals specific to the gen-set and products supplied shall be located inside each unit and accompany the equipment. General operating instruction, preventive maintenance, wiring diagrams, schematics and parts exploded views specific to this model shall be included. A PDF version of the owner's manuals shall also be provided on a compact disc and shipped with each generator.

Two (2) hard copy sets of Spare Part Book for engine, alternator, control wiring and ATS panel shall be located inside each unit and accompany the equipment. A PDF version of these manuals shall also be provided on a compact disc and shipped with each generator.

Equipment operation and maintenance manuals shall be provided with each assembly shipped, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.

1.10.3 SUBMITTALS

Provide two complete sets (for each rating of machine) of Engineering Submittal for approval, prior to production release, showing all components, in addition to the engine, generator and automatic transfer switch. Submittals shall include complete system interconnection wiring diagrams and manufacturer's warranty form indicating compliance with these specifications.

1.11 SPARES

1.11.1 GENERAL PARTS:

Provide one set of maintenance (spare) parts for each gen-set ordered under this contract.

An order of maintenance parts is defined as all items necessary to perform scheduled maintenance functions for 2000 operating hours plus replacement bulbs for indicators, replacement fuses for each fuse used on the gen-set and any other like items that the manufacturer deems desirable.

Package these maintenance parts in polyethylene bag, and pack inside the gen-set for which they are intended. Should there be insufficient room inside gen-set, enclose parts bag in protective package and attach to shipping skid.

This group of parts shall include a complete list of all vendors recommended spares, including, but not limited to, the items listed below:



- ✓ Engine lubricating oil filters and filters gaskets, if separate from filter.
- ✓ Fuel filters and filters gaskets, if separate from filter.
- ✓ Engine intake air filters and filters gaskets, if separate from filter.
- ✓ A minimum of ten light bulbs of each size light bulb used in the gen-set.
- ✓ A minimum of ten electrical fuses of each size fuse used in the gen-set.
- ✓ One engine lubrication oil system drain plug.
- ✓ A complete kit each of mechanical and electrical tools for gen-set / system maintenance.
- ✓ A complete set of measuring and testing instrument for gen-set / system maintenance for the 2000-hour requirement for replacement parts,
- ✓ One replacement cycle for all filters and associated gaskets shall be 250 hours.
- ✓ The offer shall include a complete list of all vendors recommended spares.
- ✓ The offer shall explicitly identify each Table I line item by packaged dimensions, weight and price.

The Supplier shall have factory trained technicians that maintain a stock of spare parts and programming tools; provide a complete listing of available spares parts with O&M Documents; at a minimum, provide the following spare parts for the Generator Control Switchgear:

- ✚ One of each type of automation processor (including CPU, Power Supply, and I/O)
- ✚ One of each component required for synchronization, load control, and VAR control
- ✚ One of each control relay
- ✚ One of each power transducer

1.12 WARRANTY

The offer shall provide a one-year warranty on parts, which starts from the date the equipment is commissioned on-site. This requirement shall not modify or change the standard contract warranty agreement.

1.13 QUOTATION FORMAT

- ✚ Vendors shall provide all information in their quote as specified herein. That information includes brochures and other descriptive details to help explain the product being quoted. The vendor shall also provide the following format for the quote, providing, as a minimum, the information outlined below, in the English language:
- ✚ **Diesel prime-rated generators— Specification (Spec)** Show the make, model, prime KVA rating, voltage, phases, and frequency ratings of each generator for each property listed in the schedule. Provide brochures for each type of generator.
- ✚ **Dual-wall tank with leak alarm—Spec** Indicate if the fuel tank has a dual wall with leak alarm. Indicate the fuel tank capacity and run time at full load. Fuel tanks without dual wall are unacceptable.
- ✚ **Fuel/water separator—Spec** Indicate presence and type of fuel/water separator provided in quote.
- ✚ **Battery charger with trickle/float functions—Spec**
 - Indicate presence and type of battery charger in quote.
 - **Batteries—Spec** Indicate presence and type of batteries provided in quote.
- ✚ **Anti-Condensation Heater—Spec** Indicate presence and type of anti-condensation heater in quote.



- ✦ **Automatic transfer switch—spec** Show the make, model, voltage, poles, and frequency ratings of each transfer switch being offered. Show weather proof rating of transfer switch enclosure. Indicate if the switch is industrial rated as required in the specifications. Provide brochures for each type of transfer switch.
- ✦ **Initial set of spare parts for 2000 operating hours—Spec** List the type and number of spare parts being provided, Note that spec recognizes 250 hours to be one change cycle for all filters and associated gaskets.

Testing of generator before shipping according to requirement – Spec Indicate intent to test each generator before the generator leaves the factory or vendor. Test reports must be sent to us and approved by us before generator can be shipped. Tests on prototype generators **are not acceptable.**

NB: Please, for further information liaise with the Engineering Services Manager Banana Manager, CDC Tiko.

Contact:

Cell Phone: 699 35 17 59; E-mail: simopierre@cdc-cameroon.com

