TECHNICAL SPECIFICATIONS FOR THE TENDER FOR SUPPLY, INSTALLATION, AND COMMISSIONING OF DIESEL GENERATORS, DIGITAL VOLTAGE REGULATORS & UPGRADE OF THE EXISTING SCADA SYSTEM.

1. SUPPLY, INSTALLATION, AND COMMISSIONING OF DIESEL GENERATORS, DIGITAL VOLTAGE REGULATORS & UPGRADE OF THE EXISTING SCADA SYSTEM.

PART 1:

(a) GENERAL TECHNICAL REQUIREMENT

- **COMPOSITION**

The Two Diesel Generators to be supplied are follows:
- 450KVA;
- 150KVA.

The Diesel Generators Units shall consist of the following:

- Fuel Tank
- Exhaust System
- Outdoor Weather Protective and Sound Attenuating Enclosure
- Automatic Transfer Switch (ATS)

The Diesel Generators Unit shall be supplied as a complete pre-integrated and pre-assembled unit.
The supplied generator should be from an internationally recognized manufacturer and having authorized local technical representative for technical support.

- **SERVICE CONDITIONS**

The Diesel Generators unit shall be designed to be operated at following worse case conditions:

Altitude	At least 1000 meters above mean sea-level.
Ambient temperatures – Outdoor:	
Maximum outdoor	+55^0 C
Maximum outdoor daily average	+40^0 C
Maximum outdoor yearly average	+30^0 C
Minimum outdoor	-10^0 C
Highest one-day variation	+25^0 C

Relative Humidity:	
Maximum	92 %
Minimum	12 %
Yearly average	44%

➢ **SYSTEM CONDITIONS**

The Diesel Generators sets shall be designed to operate under following system parameters:

Nominal System Voltage	400 V / 230 V
Highest System Voltage	440 V / 253 V
Number of Phases	3ph, 4 wire
Frequency	50Hz
Neutral Point	Solidly Earthed

PARTII:

(b) PARTICULAR SPECIFICATION REQUIREMENT

➢ **STANDARDS**

The Diesel Generators Units shall be designed, manufactured and tested in compliance with the latest versions of the following standards:

- IEC 60034 Rotating Electrical Machines
- IEC 60085 Thermal Evaluation and Classification of Electrical Insulation
- IEC 60529 Degrees of Protection provided by Enclosures (IP Code)
- ISO 10816 Specification for Mechanical Performance: Vibration
- ISO 3046 Specification for Reciprocating Internal Combustion Engines
- SI 426 European Commission (Dangerous substances) (Classification, packing, labelling, and Notification of Regulations 1992.
- CIMAC Congress International des Machines a Combustion Recommendations for Diesel Engine Acceptance Tests
- ISO 9000 Quality assurance

➢ **RATINGS:**

- The Diesel Generators Units shall be rated for: 415V AC, 3 phases, and 50Hz.
- Required rated Emergency Standby Power Capacities (kVA) at an outdoor operating temperature of 55°C.

➢ **PERFORMANCE**

- The Diesel Generators sets shall be capable of delivering rated kVA indicated under item 1 at ESP (emergency standby Power) under the service conditions.
- Voltage regulation: ±0.5 %
- Frequency regulation: Random frequency variation with any steady load from no load to full load shall not exceed ±0.25%.

➢ **DIESEL ENGINE**

- The diesel engine shall comply with the specified International IEC Standards or an equivalent international standard and shall be of the four-stroke, multi-cylinder, water-cooled, cold start, direct fuel injection, compression ignition, and preferably turbo-charged type.
- The crankshaft speed shall not exceed 1500 r.p.m.

➢ **SPEED GOVERNOR**

- The diesel engine shall be fitted with a speed governor capable of accuracy to Class A2 of ISO 3046/IV. The governor is to be fitted with speed control facilities to enable the engine speed to be adjusted from the local control panel.

➢ **SHUTDOWN SYSTEM**

- The engine shall be fitted with a mechanically operated device, which will shut off the fuel supply to engine when any of the specified alarm conditions occur.

➢ **COOLING SYSTEM**:

- The equipment supplier shall fill the cooling system with chemically treated water mixture. Rotating parts shall be guarded against accidental contact in accordance with standard requirements.

- A vertical fan cooled sectional radiator, rated for the tropical site conditions shall be mounted at the end of the combined under base and driven from the diesel engine.
- The radiator shall be arranged to cool the engine jacket water and lubricating oil. The radiator must be generously sized to permit operation at full load and overload in the specified ambient conditions.
- The radiator shall be integral with the generating set. The radiator shall be provided complete with fan claw and guards.

➢ **PUMPS**

- Cooling water, lubricating and fuel oil pressurizing pumps shall be provided and mounted on the engine and shall be gear driven from the crankshaft.

➢ **LUBRICATION**

- Lubrication shall be by means of an engine-driven gear pump and the system shall include full flow oil filters with replaceable elements.

➢ **SAFETY GUARDS.**

- All moving parts shall be adequately guarded, to prevent danger to personnel.

➢ **FUEL.**

- The engine shall be designed for operation on diesel fuel.

➢ **LUBRICATING AND FUEL OIL FILTERS**

- The lubricating and fuel oil filters shall be of the fuel flow type.

➢ **AIR FILTERS:**

- Air filters shall be suitable for use in the environmental conditions which are likely to arise locally and the service conditions described in Part 1.

➢ **STARTING SYSTEM**

- The set shall be supplied with a completely self-contained starting system consisting of an engine driven dynamo, a lead acid battery and battery charger.
- The starting system shall be designed such that at engine speeds in excess of the minimum firing speed it shall be impossible to complete the starting circuit. The starting system shall preclude excessive consecutive starting attempts.

➢ EXHAUST SYSTEM

- The engine shall be efficiently silenced and be complete with primary and terminal silencer arrangements.

➢ ALTERNATOR

- The alternator shall be synchronous, four pole and brushless excitation type and shall comply with the relevant requirements of Specification IEC 60034 or an equivalent international standard.
- The alternator shall be designed for operation of 10% engine overload at any power factor between unity and rated power factor for a maximum period of one hour in any 12-hour period as permitted by ISO 3046/II.
- The alternator shall be rated for IP-23 protection. The insulation of the winding shall be class H. All windings shall be tropicalized and suitably impregnated to withstand the site ambient conditions.
- The alternator shall be complete with all necessary cooling fans, excitation and voltage regulating equipment. The alternator shall be capable of maintaining its continuous maximum rated output when operating within + 5% of rated voltage and at rated power factor.
- The alternator shall be brushless rotating field, self-exciting and self-regulating type complete with permanent magnets and fully connected damper windings. The stator winding shall be star connected and shall be brought out together with the neutral point to terminals located in a sheet steel box mounted on top of the generator to facilitate connection of a power cable of suitable capacity.
- The following protection shall be provided for the alternator:
  - Over Current Protection
  - Earth Fault Protection

➢ AUTOMATIC TRANSFER SWITCH (ATS)

- A Four-pole circuit breaker and auto transfer switch should be provided rated for full load of the current (+ 10% overload).
- The ATS equipment shall be of 3 attempt type and capable of sensing single phase and three phase failure of main supply or any variation in main supply voltage. The main supply and generator supply contactors or Solenoid/Motor operated change over switch shall be of fool proof design with mechanical and electrical interlock.

➢ MOUNTING

- Complete unit to be mounted on the existing concrete foundation. Vibration mountings to be used where required.
- Skid frame to be dimensioned to accommodate generator/alternator assembly, all accessories, and soundproof canopy. Skid frame to be of rigid construction suitable for locating on level ground surfaces ranging from compacted earth, crushed rock or a concrete pad.
- Dismantle the exiting generator and avail the space for the new generator

➢ FUEL TANKS

- Built-in Fuel Tank: A minimum capacity of not less than 8-10 hours full running time built in fuel tank shall be provided. Design shall be capable of preventing accidental spilling of fuel and hand pump feeding on emergencies is possible.
- Build in fuel tank shall be supplied from the existing external tank by an automatic fuel pump, this pump shall be capable to sense the minimum and maximum level and respond accordingly.

➢ FUEL DISTRIBUTION PIPE AND PIPE FITTINGS

- The design criteria shall conform to the following minimum requirements:
- Steel Pipe: ASME B36.10, Schedule 40 Black Steel Fittings:
- ASTM B16.3, 300 lb. Threaded malleable iron, or ASTM A234, forged steel welding type. Finish: Prime and finish paint with industrial enamel.

➢ DRAWINGS

- The contractor shall submit design (shop) drawings for the generator, the tank and fuel pipe distribution, location of fittings and accessories with specific dimensions, for approval by prior to product fabrication.
- The contractor shall also submit as-built drawings
- The tank shall withstand an internal air pressure test of 3-5 psi.

➢ OUTDOOR WEATHER PROTECTIVE SOUND ATTENUATING ENCLOSURE

- The generator set shall be provided with a sound attenuated housing which allows the generator set to operate at full rated load in the ambient conditions. The enclosure shall reduce the sound level of the generator set while operating at full rated load to below 95 dBA at 1 meter from the generator set. Housing configuration and materials used may be of any suitable design which meets

application needs, except that acoustic materials used shall be oil and water resistant. No foam materials shall be used.

- The enclosure shall include hinged doors for access to both sides of the engine and alternator, and the control equipment. A panel-viewing window shall be provided. Key locking door latches shall be provided for all doors. Door hinges shall be stainless steel.
- The enclosure shall be provided with an exhaust silencer, which is mounted outside of the enclosure, and allows the generator set package to meet specified sound level requirements. Silencer and exhaust shall include a rain cap and rain shield.

➢ OTHER REQUIREMENTS

- The control panel shall have the following provisions for the control of DIESEL GENERATORS Set:

a) Master engine control which for OFF/AUTO/MANUAL/TEST with a facility for starting and stopping of the set.
b) Selectable Multifunction meter
c) Engine control monitor.
d) Alternator voltage monitor.
e) Engine hours run counter.
f) Voltmeter and Ammeter
g) Combined frequency and tachometer

- The Diesel Generators shall automatically shut down under following conditions.
    a) Low Oil Pressure
    b) High Engine Temperature
    c) Low Fuel Level
    d) Over/Under Speed
    e) Battery Charge Fail
- Extension of alarms
    a) Terminal for provision of all faults alarm outputs shall be provided for monitoring of generator by external systems
    b) Status output terminal connections shall be provided for monitoring of health state of generator
- Earthing studs need to be provided

➢ WARRANTY

- Warranty period shall be 2 years.

2. SUPPLY, INSTALLATION AND COMMISSIONING OF DIGITAL VOLTAGE REGULATOR

PARTI – GENERAL TECHNICAL SPECIFIFATIONS

Characteristics	Three-Phase unity
Input voltage	3Phase+N, 400V ±10%,
Output	3phase+N, 400V ±1%
Frequency	50/60 ±5%
Efficiency	> 98%
Configuration	Independent regulation of each phase
Type of cooling	Air cooling
Protection degree	Designed for indoor continuous operation (IP 21 indoor use)
Insulation	Class B
Wave form Distortion	None
Effect of load power factor	Nil
Ambient Temperature	0-55^{0}C
Rating	1250kVA & 400kVa

PARTII – PARTICULAR TECHNICAL REQUIREMENT

1. **STANDARDS**

- The supplied Digital voltage stabilizer shall be supplied from the approved manufacturer and complies with the international standards (ISO 9001-2015, the latest).

2. **FIELD APPLICATIONS**

- The supplied product shall be capable to eliminate the voltage drop phenomena in electrical network, thus allowing the connected systems to be free of fault (under/over voltage faulty) and provides a desired output voltage.
- It has to cover a wide range of sectors, from industrial equipment of high amperage and capacity to the commercial appliances with lower consumption.
- The regulation should be automatic and continuous, with fast correction speed
- The supplied DIGITAL VOLTAGE REGULATOR Unit should be from an internationally recognized manufacturer and having authorized local technical representative for technical support.
- The DIGITAL VOLTAGE REGULATOR Unit to monitored on the SCADA system to be upgraded.

BOQ (KIGALI INTERNATIONAL AIRPORT, RWANDA)					
S/No.	Description of Item	Qty	Unit	Rate RWF	Amount RWF
A	DIESEL GENERATORS Set				
A.1	Design, Supplying, installation, testing and commissioning of silent type 450 kVA D.G. Set, AMF Panel, Bus Trucking /cables from DIESEL GENERATORS Set to essential changeover panel, control cable, Earthing of DIESEL GENERATORS Set and AMF Panel, DIESEL GENERATORS set exhaust piping as per CPCB norms and minor allied works.	Nos.	01		
A.2	Dismantling the existing generator (350kVA) and prepare the terrain for the new supplied generator. Contractor shall do it in accordance with the dimension of the acquired generator for the proper sitting.	Sum	01		
A.3	Upgrade the existing termination cables from the generator to the main LV board/cabinet. The contract shall do such connections, by additing a single core the existing cables (single core XLP insulated aluminium - 1x300mm2-1000Volts) to bass-bar in the main LV cabinet/Distribution board.	Lm	300		
A.4	Upgrade of the existing changeover from 630A to 800A (800A 4P MCCB type NSX800F)	Nos.	01		
A.5	Allow for earthing requirement for the above A.1 up to A5, including cabling, cable lugs, cable glands and other related accessories.	Sum	01		
A.6	Design, Supplying, installation, testing and commissioning of silent type 150 kVA D.G. Set. This will come complete with diesel tank, control cable, Earthing of DIESEL GENERATORS Set and AMF Panel, DIESEL GENERATORS set exhaust piping as per CPCB norms and other minor associated works.	Nos.	01		
A.7	Design, supply, installation and connect 50sqmmx4core PVC SWA PVC cable (1000Volts) from the genset unit to the changeover system installed in the substation. This should be complete with cable glands, cable lags and other necessary accessories.	Lm	300		
A.8	Allow for earthing requirement for the above A.6 and A.7, including cabling, cable lugs, cable glands and other related accessories.	Sum	01		
B	DIGITAL/ AUTOMATIC VOLTAGE REGULATOR				

B.1	a) Design, Supplying, installation, testing and commissioning of Digital and Automatic Voltage Stabilizer 1250kVA with integrated Manual Bypass. Entry: 3PH+N 400V ±10%, 50/60Hz ±5% • Output: 3PH+N 400V ±1% RMS • Protection degree: IP 21 indoor use • Efficiency: > 98% • CONFIGURATION: Independent Regulation of each phase • Output: 3PH+N 400V ±1% RMS	Nos.	01		
B.2	a) Design, Supplying, installation, testing and commissioning of Digital and Automatic Voltage Stabilizer 400kVA with integrated Manual Bypass. Entry: 3PH+N 400V ±10%, 50/60Hz ±5% Output: 3PH+N 400V ±1% RMS • Protection degree: IP 21 indoor use • Efficiency: > 98% • CONFIGURATION: Independent Regulation of each phase • Output: 3PH+N 400V ±1% RMS	Nos.	01		
B.3	Allow for the modification of the above said bass bar, to permit a proper connection of the installed AVR.	Nos.	02		
B.4	Allow for earthing requirement for the installed AVR, including cabling, cable lugs, cable glands and other related accessories	Lm	150		
C	**UPGRADE OF SCADA SYSTEM, MODIFICATION AND INTEGRATION OF THE NEW EQUIPMENT**				
C.1	A) The upgrade shall include of the development of the new software management with a permanent license. During this upgrade, the contractor shall refer to the existing functionality of the existing SCADA platform and develop a software management without changing the related hardware. The main items to be controlled is found on the annex 001 B) The upgrade shall include the following: - Supply and installation of additional PLC M340 for the Digital voltage regulator	Sum	01		

	(DVR) and its connection to the existing communication network. - Re-use of the existing PLC M340 to control the new 450KVA Generator to be supplied. - The contractor shall include it his offer all necessary accessories for the proper integration. - The contractor shall include in his offer the necessary expertise to ensure the integration is done properly. - The contractor shall include in his offer all necessary accessories to ensure all existing and new equipment are compatible with the upgraded SCADA system. - The contractor shall include in his offer all necessary modifications on the existing control cabinets to ensure all the information of the items listed in annex 001 are reachable to the HMI. A Proposal shall be discussed and approved by the Engineer prior to the implementation. - The contractor shall include in his offer the cost for testing, commissioning and training of the upgraded SCADA system.				

N.B: Bidders must provide Manufacturer Authorization for each items to be supplied.