PART-A

GENSET SPECIFICATIONS

1. General

Thesespecifications cover the technical requirements forfiftyunits of Diesel engine drives electric alternators, 400/230V $+10\% - 15\%$, 3phase, 4 wires, 50HZ, 1500 rpm, prime output rating 10kVA, and 0.8 PF at an altitude of 2200m ASL and 30℃, sound and weather proof canopy outdoor unit.

1.1 *Applications*

Thegeneratorswill be used to supply the telecommunication services of Yemen Mobile Company.All units are expected to supply rectifiers,single phase air conditioners, single phase lights,and fans etc. In addition, one or two sets of generators shall be installed in each site according to availability of main electricity.

The tenderer shall provide customer list where similar Gen-sets and their facilitieshave been supplied and giving satisfactory services. The list should indicate the places where such equipment is currently in service.

The most important specifications and main points are summarized in the attached tables to be filledby the tender just as a secondary part from the whole Gen-set specification and it is significant to be fulfilled clearly and perfectly based on detailed required specifications. **The basic detailed required specifications are stated as following:**

1.2 *Sites conditions*

The Gen-sets will be working at operation conditions as follows:

a) At 2200m above sea level and 30℃.

b) At sea level, 45℃ andHumidity up to90%

De-rating tables and curves for electric power generator sets shall be supplied by the tender.

1.3 *Documentations supplied with offer:*

Proposals for approval shall include with the tenderer offer:

- Generator set photographs (suitable size) of all sides.
- Gen-set Technical Data , design and performance,specifications (tabulated data that identifies make , model and country of origin as attachment) for the following:
    1) **Engine** (Includingits relevant components).
    2) **Alternator**(Includingits relevant components).
    3) **Control panel**(Includingits relevant components).
    4) **Auxiliary components:**

a) Starter components.
b) Fuel Solenoid.
c) Dynamo charger.
d) Injection pump.
e) Exhaust system.
f) Gen-set circuit breaker etc.

- **Drawings:-** General dimensions drawings showing overall generator set measurements, mounting location, and interconnecting points for load leads, fuel, exhaust, cooling and drain lines.
- All Wiring and schematic drawing showing detailed circuits.
- **Standards Compliance**: Complying with requirements of the international and European Codes and standards applicable for diesel generator sets.

1.4 *Warranty Statements*

- All Gen-sets shall be under two years on-site comprehensive warranty support from the date of installation and operation at the siteor 30 months from date of final acceptancefor the tender equipment as a whole including spare partswhich is certainly after the technical test in warehouse ofYemen Mobile Company. All Gen-sets components shall be covered by the warranty. All components of the Gen-sets are to be warranted against any damage or malfunctions may occur during the warranty period. Andan approved quality assurance certificate should be provided.
- Service - Location and description of local spare parts suppliers and servicescenter including parts inventory and number of qualified generator set service personnel.
- The manufacturer shall have a local authorized dealer who can provide factory trained servicemen.

Notes: Any submitted offer without complete technical data for all units and parts will be ignored andrejected.

1.5 *Training*

- The supplier shall provide a complete training program in the country of manufacturing.
- Two engineers shall attend the factory test before supplying the required system.
- Training shall be prepared for other threeengineers in a period not less than two weeks of business days.

2- Diesel Engine Specifications:

S. No	Component Name	Required Specifications
2-1	***Cooling System***	Water cooled with fan and radiator
2-2	***Water Level Maintenance***	The Water cooled system of the engine shall be equipped with built in expansion tank. Engine should have high quality and finish to make it a zero leakage system. Similarly the water system should have seals to ensure no water leakage from the water pump.
2-3	***Radiator***	The radiator shall be Heavy duty with fan and corrosion resistance ***(provide technical details).***
2-4	***Output***	The engine prime power duty shall be de-rated capable of developing sufficient output HP not less than required by the alternator(10kVA prime power) at the following site conditions: Altitude: up to 2200 meter Above Sea Level (A.S.L) Ambient Temperature:30℃
2-5	***Maximum Output***	The Maximum engine prime power duty rated shall be not more than the power required by the alternator (15 kVA prime power) at sea level and 45℃.
2-6	***Speed***	1500 RPM
2-7	***Governor***	Mechanical Governorunder steady state conditions, whatever the load might be, the rotational speed shall remain between N and 1.04 N, where N is the normal speed in the event of a sudden load variation of 0.25L nominal, but with the load remaining between 0.5 L and L nominal, Where L nominal is the rated load, the instantaneous change in speed should not exceed 4% of N. The rotational speed then should be returned within offset limits is less than 3 seconds and stabilize in less than 8 seconds. The tender shall enclose graphic diagrams showing the de-rating of his units depending on altitudes, temperature and humidity varying.

S. No	Component Name	Required Specifications
2-8	***No. Of Cylinders***	The engine shall be multi cylinder,in line configuration, and four strokes.
2-9	***Flywheel***	Of suitable diameter and weight (indicate the diameter and the weight).
2-10	***Overload Capacity***	The engine should be capable of providing 10% overload for 1 hour for every 12 hour continuous running at full load
2-11	***Engine Aspiration***	Naturally Aspirated
2-12	***Standard That The Engine Should Meet***	The engine shall be complying with an international standard.
2-13	***Silencer&Exhaust System***	• Residential type with exhaust piping with vibration isolators, thermal insulation for exhaust line with glass wool, aluminum sheet. ***(Provide technical details).***
2-14	***Starting System***	▪ ***Electromagnetic solenoid switch*****:**it shall supply the required current to the starter motor and pull in and pull out pinion drive. ▪ ***Starter motor:***12 VDC, it shall have clutch for normal and abnormal operation. ▪ ***Battery:*** ➢ The battery shall be maintenance free, of known manufacture, sufficient to supply starting and control circuit. ➢ **The battery shall be adequately charged either from mains supply and / or from the Gen-set supply through the unit control panel**.

S. No	Component Name	Required Specifications
2-15	***Fuel System***	***Fuel injection:*** Fuel injection pump with fuel lift hand pump , fuel flow replaceable filter and*separate preliminary fuel filter (water separator)* and electric fuel solenoid (preferred energized to run type)should be provided. ***The tenderer shall furnish details of fuel injection pump, fuel consumption at full load and at varying loads.***
2-16	***Air Filter***	• Dry type air filter, heavy duty type with replaceable elements shall be provided. • Efficiency of the system at various stages shall be furnished.
2-17	***Lubrication System***	• Full pressure lubricating oil system including an oil cooler is to be fitted. • Oil pre-heating is required only before starting. • The Oil shall be drained through external hose-pipe – plug type is preferred. ***The tender shall indicate the frequent of changing oil.***
2-18	***Flexible Coupling***	A heavy duty flexible block coupling shall be fitted between the engine and the alternator to absorb the transmission of shock loads. ***Details should be offered by the tender.***

S. No	Component Name	Required Specifications
2-19	***Engine Protective Devices***	The engine shall be equipped with protective devices to provide warning and automatic shut-down under the following conditions:- 1) Low Lubricating Oil Pressure -*(W+SD)* 2) High Water Temperature -*(W+SD)* 3) Low Radiator Water Level -*(W)* 4) Fail To Start -*(W+SD)* *5)* Over Speed/Under Speed -*(W+SD)* 6) Low and high Battery Voltage-*(W)* *7)* Dynamo Charger Fail -*(W)* 8) The engine shall be equipped with an oil pressure and temperature detectors. 9) The engine shall be fitted with an oil pressure and Temperature sensors that shall be extended to the controller.
2-20	***Accessories***	▪ All fuel-lines before the cut off valve shall be fireproof. ▪ The engine color shall remain the original color as supplied by the manufacturer. ▪ Rubber hose pipes used on the water, lubricating oil or fuel systems and rubber belts shall not be painted. ▪ All cables that connect the engine auxiliary components such as sensors, dynamo charger,starter motor, and fuel solenoid shall be extendedthrough high quality conduit to be protected from engine heating.

3- Alternator Specifications

S. No	Component Name	Required Specifications
3-1	***Alternator***	***General*** 1) The alternator shall be three phases, 0.8 PF (lagging), four wires, 400/230V +10% -15%with a frequency of 50 Hz, star connected. 2) The alternator shall be screen protected, drip-proof, self-regulating, self-exciting, Brushless, and directly coupled to the engine.
3-2	***Rating***	Rating of alternator shall be determined in accordance to the engine output rating at sea level.
3-3	***Construction***	1) ***Design:***the alternator shall be design of welded steel construction. 2) ***Degree of protection*:** The alternator shall have an International Protection Code (IP) not less than "IP 23". 3) ***Insulation Level:***The alternator shall be to class 'H' insulation. 4) ***Bearing:***Only single bearing for alternator shall be supplied. ***Centrifugal fan*** High velocity cooling air circuit shall maintain internal winding and rotor free of dust particles.
3-4	***Excitation System***	• Permanent magnet (PMG) in exciter fieldis preferred (for fast voltage build up both after a short circuit and also after a long time of inactivity). • Self-excitation is acceptable, *if it gives* fast voltage build up both after a short circuit and also after a long time of inactivity.The main exciter shall be protected against surge voltage. ***The auxiliary exciter technique shall be described in full details by the tenderer.***

S. No	Component Name	Required Specifications
3-5	***Automatic Voltage Regulation (AVR)***	1) The alternator shall be AVR controlled. 2) The AVR shall be mounted in the connection box of alternator and all components must be accessible and replaceable. 3) The automatic voltage regulator (AVR) shall be of three phase sensing electronic type with accuracy regulation not more than ±1%. 4) The voltage shall be maintained within ±5% of nominal range from no-load to full-load, at unity and 0.8 P.F lag whatever the alternator temperature is. 5) The AVR shall be protected against failure due to low speed operation, over excitation, overvoltage and any abnormal conditions. ***The full technical data with schematic diagram for A.V.R shall be provided.***
3-6	***Wave Shape***	The output waveform should be pure sine. The residual harmonic percentage between full load and no load should not exceed +5%.
3-7	***Overload And Short Circuits***	1. The overload characteristic should be able to handle 110% of rated power continuously for at least one hour every 12 hours. 2. The design of the alternator and regulator system shall be able to maintain machine excitation for a period of 10 seconds at a rating of 300% before fault clearing. 3. Alternator shall be provided with full protection against abnormal conditions in order to withstand all types of short circuits without any damage. 4. The alternator and voltage regulator components shall be protected against voltage transients induced by switching or lightning surges. ***All protections shall be stated in details by the tender.***

S. No	Component Name	Required Specifications
3-8	***Frame***	Engine and alternator shall be coupled and mounted on sturdy, fabricated, welded construction base frame.
3-9	***Sensing AbnormalConditions***	• Sensing electrical conditions which might cause damages to the generator e.g. high and low output voltages and frequency and sudden severe phase unbalance. • In such circumstances and any fault electric problem the control equipment shall immediately isolate the generator from the load, stop the diesel engine and raise an alarm.

4- *Generator Control Panel :*

S. No	Component Name	Required Specifications
4-1	***General***	The control panel shall be fitted on the generator set and shall be able to function as follows:- a) Automatically starts up the generator set when receiving theremote start signalfrom (A.T.S)and stop after cooling the generator when removing the signal. b) Supervise and monitor all Gen-set devices and parameters and react for any abnormal conditions. c) Alloperation modes, monitoring, measurements, and protections processes should be functioned by using its control and display unit (electronic card).
4-2	***Control and Display Unit*** **(Electronic card)**	The control module shall stand the dip in voltage during starting processes, and it shall be isolated by external switch. The control module shall perform the following: • ***Operation mode selection :*** The panel shall contain the following operation modes: 1) Auto operation mode 2) Manual operation mode 3) Test operation mode 4) Off Mode ***All the above modes shall be selected via soft pressing keys.***

S. No	Component Name	Required Specifications
4-3	***Control And Display Unit*** **(Electronic Card)**	• ***Digital Instruments(Measuring,Monitoring and Display):*** 1) AC (line – line / line – neutral) Voltage values. 2) AC Current per phase values. 3) kVA, kVAR, kW/phase and total, kWh and Power factor. 4) Frequency and speed values. 5) Running hours for the generator set. 6) Battery DC voltage. 7) Battery charging DC ampere. 8) Oil pressure value (bar, Pascal). **9)** Engine Temp value (℃). • ***Indictors ,Alarms Lights and Protection for :*** 1) Fail to Start (LED) 2) Gen-set normal running (LED) 3) High engine temp. (W +SD) 4) Low oil pressure. (W +SD) 5) Battery charger fail. (W) 6) Over/Under speed. (W +SD) 7) Over/Under Frequency(W +SD) 8) Low water level. (W) 9) Over/Under voltage. (W +SD) 10) Over load and S.C. (Trip+SD) 11) Dynamo charge fail (W) 12) Emergency Stop (SD) 13) Phase sequence and missing protections. ***Any alarms (warning and shutdown) occurshall be interpreted as an alphabetic comprehensive text massage in display.*** • ***Alarm Retransmission*** - Gen-set running (shall be free contact) - Gen-set failure (shall be free contact)

S. No	Component Name	Required Specifications
4-4	***Protections Devices***	1) Gen-set output circuit breaker 4 poles (MCB), level protection at least IP 22, breaking capacity current at least 10kA. 2) Rated of MCB shall be suitable of Gen-set working at sea level. 3) 4-pole Gen-set output surge protection device (SPD) level-1 or level-2. 4) Suitable MCBs protection for all input and output (AC /DC) circuits.
4-5	***Terminals***	1) Power terminal contacts 4 terminals for output, each terminal shall suit a cross section area 16mm^2. 2) Control and alarm terminals cross section area 4mm^2, blade screwdriver. 3) Suitableterminals for Gen-set'sbattery (Positive / Negative) and an automatic battery charger(L-N) so that the Gen-set'sbattery can be easily connected to the automatic battery chargerinstalled in the ATS.

5- Base Requirement

S. No	Component Name	Required Specifications
5-1	***Set Requirements***	***Guards*** a) All moving and rotating parts such as belts, couplings and fans shall be protected by suitable guards to prevent accidental injury to personnel. b) Guards shall be fitted to all engines with side-mounted exhaust manifolds. ***Noise and vibration*** a) The engine / alternator combination shall be arranged to run free from excessive vibration and noise under all conditions of load and speed.
5-2	***Wiring And Conduits***	Engine Control wiring shall be multi-strand annealed copper conductor encased by cross-linked Polyethylene insulation resistant to heat, abrasion, oil, water, antifreeze, and diesel fuel. Wiring shall be suitable for continuous use at 120 ℃ (250°F) with insulation not brittle at -50C° (-60°F). Cables shall be enclosed in nylon flexible conduit which is slotted to allow easy access and moisture to escape.
5-3	***Labeling And Fixtures:***	• Each part shall be labeled similar to the drawings. • All wires and terminals shall be labeled according to the drawings. • All wire terminals and lugs should be tightly fixed. • The labels shall include all information required by IEC standards.
5-4	***Finish***	(a)The engine color shall remain the original color as supplied by the manufacturer. (b) Rubber material, which is not fire or fuel proof, is not acceptable.

6- Canopy And Sound Proof Specifications:

S. No	Component Name	Required Specifications
6-1	***Acoustic Enclosure***	***<u>Canopy Requirements :</u>*** a) The enclosure shall allow easy access to the engine, alternator, radiator filler cap and control cubicle for easy maintenance purposes. b) The starter battery in sound-proof canopy sets shall be housed in an insulated compartment with forced air flow when the engine is running. It should be provided with easy access for maintenance and removal of the battery. c) The enclosure shall be designed to be Water and weather-proof. d) The noise level generated by the set at full load should be less than 70 dB (A) at 1meter. e) The enclosure base frame should be designed with supports for easy transferred using forklift. f) Two doors for enclosure canopy are preferred. g) Canopy shall be capable of anti-corrosion to withstand high humidity.

7- Documents And Drawings :

S. No	Component Name	Documents Required
7-1	***Engine And Alternator***	***The contractor shall supply the following manual and drawings:*** 1) Original test factory certificate 2) Service and Maintenance Manuals 3) Workshop Manual. 4) Spare Parts Manual 5) Spare part list - indicating make, model,and rating etc.
7-2	***Control Panel***	1) Description (operating) manual. 2) Control module manual. 3) Fault-finding manual. 4) Component lists – indicating country of origin, make, etc. 5) One original Software program for control panel and three soft copies. 6) Software cable link (three). 7) Spare part list - indicating make, model, and rating etc.
7-3	***Gen-set***	1) Wiring and schematic drawing showing detailed circuits. 2) Each wire, component, terminal, etc. shall be clearly annotated on the drawing for identification and maintenance purposes. 3) Hardcopy of every handbook, manual and every drawing per unit (for each). 4) In case of handbooks, manual and drawings are not available at the time of final inspection the bidder will not be acceptable.

PART-B

GENERAL ATS PANEL SPECIFICATIONS

1-General

- These specifications cover the technical requirements for Fifty General ATS Panels.
- This ATS Panel Should be General design for used it with any two Gensets (from 10KVA-20KVA) or one Genset with mains.

- This ATSpanel should be transmit and received signal from any Genset control card (differential models) to start and shutdown Genset or connect loads.
- This ATS in PART- B should be suitable with ***Generator Control Panel*** in PART-A

1-1 Documentations Supplies with offer:

for approval shall include with the tender offer:

- ATS Technical data , design , Specifications (tabulated data that identifies make , model and country of origins) for all components:
  a) panel
  a) PLC card
  b) Contactors
  c) Load circuit breaker
  d) Relays.
  e) Circuit breaker control.
  f) Electrical charger (220VAC-12Vdc).
- Drawings: panel dimensions.
- All wiring and schematic drawing showing detailed circuits.
- Standard complains: complying with requirements of the International and European codes.

1-2 Warranty Statements

All ATS Panels shall be under 5 months on site comprehensive warranty support from the date installation and operation or one year from date of final acceptance for the tender.

1-3 Training

- The supplier shall provide a complete training program in the country of manufacturing.
- Training shall be prepared for two engineers in a period not less than one weeks of business days.

Notes: Any submitted offer without complete technical data for all units and parts will be ignored and rejected.

2- Automatic Transfer Switch [ATS] Specifications:

S. No	Component Name	Required Specifications
2-1	***General***	The ATS unit shall be separated; floor mounted, supported by a stand and can be fixed to the wall if needed. ATS shall be supplied to contain all equipment as a one set from the manufacturer. ATS panel shall control the operation and the protection for two sources and the load, **and it should be equipped to handle 15 kVA capacity in case this panel would be used with either 10 kVA or 15 kVA gen-sets capacities.** The type of the sources can be whether two generators or mains and one generator. This type of ATS shall be equipped with : • One-High efficiency 12-Volt DC electronic programmable logic controller (PLC)with display to control the two sources working in two main operation modes (Auto/Manual). • The PLCtimer should be protected from reverse polarity of its supply. • The PLCtimer shall stand the dip in voltage during starting processes in order to not be affected during the cranking period of a Gen-set, especially one source only is Gen-set and the other is mains. And it shall be isolated by external switch • The PLC shall have interface port suitable for inserting external back -up Memory and/or connecting PC interface Cable. Also,the PLC device shall be functioned to be programmed or modified without connecting to PC. • Each PLC shall be equipped with, programming-supervision software and connecting cable. • Abattery shall be provided of 12 Volt and not less than 7-AmpHours.

S. No	Component Name	Required Specifications
2-2	***ATS Components***	Also, the ATS unit shall be provided with and able to function as follows:- **Enclosures**: • General purpose type, suitable for relevant ambient conditions, flush or surface mounted as shown on the comprising of box, trim and door to approved manufacturer's standards and sizes. • Box, trim and doors should be electro-galvanized steel sheet more than 1.5mm thickness according to the standards. • Inner and outer surfaces of cabinet/boxes, trims, doors etc, should be cleaned, phosphatized, chrome passivated and treated with final thermosetting epoxy powder modified by polyester resins providing high resistance with mechanical injury, heat, acids and alkalis solvents, grease, ageing, corrosion and with standard grey color. • The enclosure dimensions shouldn't be less than (W x D x H) = 800 x 300 x800 mm. **Contactors:** • Two contactors, 4pole, 25A. • It should be provided with mechanically and electrically interlock. **Selector switches:** Four selector switches should be used and each one with different functions as follows: • Switch_1: Three positions selector switch (Auto-Off-Manual) to choose an option of the system operation mode. • Switch_2: Two positions selector switch **(Mains+Gen - Gen1+Gen2)** to choose the type of source. The first position means the system is mains electricity and one generator, and the second position means the system is two generators.

S. No	Component Name	Required Specifications
2-2	***ATS Components(Count.)***	• Switch_3: Twopositions selector switch **(Gen_1-Gen_2)** to choose the **priority**between the two generators in case the operation mode is Auto. • Switch_4: Three positions selector switch **(Source1 Loading - Off-Source2 Loading)** to choose the **manual loading** of the two sources in case the operation mode is Manual. **Terminals:** • Power terminal contacts 4 terminals for each sources and load, each terminal shall suit a cross section area 16mm^2. • Control and alarm terminals cross section area 4mm^2, blade screwdriver. • Suitableterminals for Gen-sets' batteries (Positive / Negative) and automatic battery charger (L-N). • Free contact terminals for alarms to be transmitted according to Switch_2 position that indicates the type of source: 1) **Mains+Gen Position:**Three alarms shall be transmitted ➢ Mainsdisconnect ➢ Gen-set run and Gen-set fail. 2) **Gen1+Gen2 Position:** Four alarms shall be transmitted ➢ Gen-set_1 run and Gen-set_1 fail ➢ Gen-set_2 run and Gen-set_2 fail **Automatic Battery charger:** • Automatic Battery charger to suit the PLC and Gen-set batteries 220V AC, 12V DC, 5A, andit shall be adjustable charge current and voltage. • **In addition,** the battery charger shall provide individual indication and common alarm at Charger failure and output voltage drops abnormally.

S. No	Component Name	Required Specifications
2-3	***ATSOperation Mechanism***	The System shall be designed to fulfill the following Operation sequence: ○ When switch_1 is in the position of Auto mode and switch_2 is in the position of(Mains+ Gen-set) that means the system is mains electricity with aGen-set, sothat when the mains electricityis available it will be automatically loaded after adjustable timer. If Mainsis disconnected, the PLC timer will give a signal to the Gen-set to start running and after adjustable timer the Gen-set will be loaded. If the Gen-set still cut off, the Gen-set must still running for an adjustable timer, 6 hours as an example, and stop for an adjustable timer as well, 2 hours as an example, then restart again and so on until the Mains getsback to be available. ○ When switch_1 is in the position of**(Auto)** mode and switch_2 is in the position of **(Gen-set_1+ Gen-set_2)**and switch_3 is in the position of (**Gen-set_1)** that means the system is two generators and the priority is for Gen-set_1, it is expected that the PLC timer will give signal to Gen-set_1 to start running and after an adjustable timer the Gen-set_1 will be loaded for an adjustable timer, after that the PLC timer will give signal to Gen-set_2 to start running and after an adjustable timer the Gen-set_2 also will be loaded for an adjustable timer. All mentioned sequences above shall continue functioned smoothly as long as no one of the Gen-sets out of work due to any reasons otherwise the other Gen-set will be working alone for an adjustable timer then rested for an adjustable timer frequently. ○ When switch_1 is in manual mode that means both sources will be loaded manually by the switch_4 after one of them is available whatever the type of source is. ○ The operation Manual mode shall be working directly without PLC timer.

S. No	Component Name	Required Specifications
2-3	***ATSOperation Mechanism (Count.)***	All timers shall be adjustable and implemented in software; no external hardware timer will be accepted. The following timers shall be existed: 1) Mains failure timer 2) Mains restoration timer 3) Gen-sets and mains loading timers 4) Gen-sets cooling-off timer. In case the mains fail for more than six hours, controller shall operate each Gen-set for adjustable set hours and also adjustable rest hours frequently.

S. No	Component Name	Required Specifications
2-4	***ATS Display Unit*** **(DigitalCard)**	**Digital Instruments (Measuring and Display):** • AC (line – line / line – neutral) voltage values,ACcurrent per phase values,frequency, and totalkW displayfor the load. • Current transformers: ➢ Three current transformers connected with mentioned module and fixed on Omega roll, DIN rail. ➢ The ratio of CT 60/5 to suit the digital module parameters. **Indictors , Alarms and Lights for:** ➢ Source_1,Source_2 Available(Yellow LEDS) ➢ Source_1,Source_2 On load (Green LEDS) ➢ Source_1,Source_2 Fail (Red LEDS)
2-5	***Protections Devices***	- 4-pole incomings mains surge protection device level-1 or level-2 at least shall be supplied. - Four- pole MCB load circuit breaker 25A, breaking capacity current at least 16kA. - Suitable MCBs protection for all input and output (AC /DC) circuits. - IncomingMains, source_1 only, shall be provided with programmable protection relay to include the following functions: • U/O voltage protection. • Phase sequence and phase missing protection. • U/O frequency protection. • Over & short circuit current protection. - Another relays that are needed for control panel ATS.

3- Documents And Drawings

S. No	Component Name	Documents Required
3-1	***Automatic Transfer Switch [ATS]***	1. Description (operating) manual. 2. Control manual. 3. Fault-finding manual. 4. Arrangement and layout drawings of the board enclosures indicating equipment and its arrangement and dimensions including areas of permissible cable entries shall be provided. 5. Component lists – indicating country of origin, make, model, and ratingetc.shall accompany the layout drawings. 6. Catalog data and instruction manuals on all electrical devices and components mounted on or within the board. 7. List of spare parts for all devices with prices, indicating make, model, and rating etc. 8. The tenderer shall introduce clearly drawing for ATS and put it inside enclosures of ATS. 9. One original Software program for control panel and three soft copies. 10. Software cable link (three).