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VOLUME 4 of 7

**TENDER SPECIFICATIONS & BILLS OF QUANTITIES FOR
SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF 1NO
100KVA STANDBY GENERATOR SET**

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**STANDBY GENERATOR INSTALLATION WORKS
PRELIMINARY & TECHNICAL EVALUATION CRITERIA**

TENDER EVALUATION CRITERIA

After tender opening, the tenders will be evaluated in **2 stages**, namely:

1. Preliminary Evaluation;
2. Technical Evaluation;

STAGE 1: PRELIMINARY EVALUATION

This stage of evaluation shall involve examination of the mandatory requirements as set out in the Tender Advertisement Notice or Letter of Invitation to Tender and any other conditions stated in the bid document.

These conditions shall include the following:

- i) Company Certificate of incorporation/registration,
- ii) Current certificate of Registration with National Construction Authority (NCA 8 and above in Generator Installation Works),
- iii) Current NCA contractor's Annual Practicing license;
- iv) Current Class of License with Energy and Petroleum Regulatory Authority (EPRA) (A1);
- v) Valid Tax Compliance Certificate;
- vi) Compliance with Technical Specifications;
- vii) Manufacturer's Authorization Letter for the GENSET being offered.

Note:

On compliance with Technical Specifications, bidders shall supply equipment/items which comply with the technical specifications set out in the bid document. In this regard, the bidders will be required to submit relevant technical brochures/catalogues with the tender document, highlighting (using a mark-pen or highlighter) the Catalogue Number/model of the proposed items. Such brochures/catalogues should indicate comprehensive relevant data of the proposed equipment/items which should include but not limited to the following:

- (i) Standards of manufacture;*
- (ii) Performance ratings/characteristics;*
- (iii) Material of manufacture;*
- (iv) Electrical power ratings; and*
- (v) All other requirements as indicated in the technical specifications of the bid.*

The bids will then be analyzed, using the information in the technical brochures, to determine compliance with technical specifications for the works/items as indicated in the tender document. Bidders not complying with any of the technical specifications shall be adjudged technically non-responsive while those meeting all technical specifications shall be considered technically responsive.

The tenderer shall also fill in the Technical Schedule as specified in the tender document for Equipment and Items indicating the Country of Origin, Model/Make/Manufacturer and catalogue numbers of the Items/Equipment they propose to supply.

The tenderers who do not satisfy any of the above mandatory requirements shall be considered Non- Responsive and their tenders will not be evaluated further.

STAGE 2: TECHNICAL EVALUATION

In order to be compliant, the Tenderers shall be required;

- a) *To fill the Standard Forms* provided in the bid document for the purposes of providing the required information. The tenderers may also attach the required information if they so desire;

The award of points considered in this section shall be as shown below:

<u>PARAMETER</u>	<u>MAXIMUM POINTS</u>
(i) Key personnel.....	12
(ii) Contract Completed in the last Five (5) years.....	9
(iii) Schedules of on-going projects.....	4
(iv) Schedules of Contractor's equipment.....	12
(v) Litigation History.....	2
TOTAL	<u>39</u>

The pass-mark under the Technical Evaluation is **28 points**.

The detailed scoring plan shall be as shown in table 1.

TABLE 1: Assessment for Eligibility

Item	Description	Points Scored	Max. Point	
1.	Key Personnel (Attach evidence)			
	Director of the firm <ul style="list-style-type: none"> • Holder of degree in relevant Engineering field----- 4 • Holder of diploma in relevant Engineering field----- 3 • Holder of certificate in relevant Engineering field----- 2 • Holder of trade test certificate in relevant Engineering field----- 1 • No relevant certificate----- 0 		4	12
	At least 1No. degree/diploma holder of key personnel in relevant field <ul style="list-style-type: none"> • With over 10 years of relevant experience----- 4 <li style="padding-left: 20px;">With over 5 years of relevant experience----- 2 • With under 5 years of relevant experience ----- 1 		4	
	At least 1No certificate holder of key personnel in relevant field <ul style="list-style-type: none"> • With over 10 years of relevant experience----- 2 <li style="padding-left: 20px;">With over 5 years of relevant experience ----- 1 • With under 5 years of relevant experience ----- 0.5 		2	
	At least 2No artisan (trade test certificate in relevant field) <ul style="list-style-type: none"> • Artisan with over 10 years of relevant experience----- 2 • Artisan with under 10 years of relevant experience ----- 1 • Non skilled worker with over 10 years of relevant experience-- 0 		2	
2.	Contracts completed in the last five (5) years (Max of 3No. Projects) - Provide Evidence <ul style="list-style-type: none"> • Project of similar nature, complexity or magnitude----- 3 • Project of similar nature but of lower value than the one in consideration----- 2 • No completed project of similar nature----- 0 		9	
3.	On-going projects – Provide Evidence <ul style="list-style-type: none"> • No Project of similar nature, complexity and magnitude ----- 4 • Three and below Projects of similar, nature complexity and magnitude ----- 3 • Four and above Projects of similar nature, complexity and magnitude ----- 2 		4	
4.	Schedule of contractors equipment and transport (proof or evidence of ownership/Lease)			
	a) Relevant Transport (at least 3No. each 2mks) <ul style="list-style-type: none"> • Means of transport (Vehicle)----- 6 • No means of transport----- 0 		6	12
	b) Relevant Equipment (at least 6No. each 1mks) <ul style="list-style-type: none"> • Has relevant equipment for work being tendered----- 6 • No relevant equipment for work being tendered----- 0 		6	

Item	Description	Points Scored	Max. Point
5.	Litigation History <ul style="list-style-type: none"> • Duly Filled ----- 2 • Not filled ----- 0 		2
	TOTAL		39

Any bidder who scores 28 Points and above shall be considered for further evaluation.

SECTION A
GENERAL SPECIFICATIONS
OF
DIESEL ENGINE GENERATORS

CONTENTS OF SECTION

DESCRIPTION

1. Extent of the Contract works
2. Regulation and Standards
3. Conformity with the Specification
4. Information required with Tenders
5. Site Conditions
6. Tropicalisation of Components
7. Surface Finish
8. Record of Drawings
9. Maintenance Manual
10. Factory Tests
11. Installation
12. Spare Parts
13. Tools
14. Maintenance Period
15. Maintenance Contract
16. Transport and Storage

1. Extent of Contract Works

The work covered by this specification includes the supply, delivery, installation, setting to work, commissioning to the satisfaction of the engineer and maintenance for a period of twelve months, of a Diesel Engine Generating set complete with all necessary ancillary equipment and as indicated.

2. Regulations and Standards

The equipment shall comply with all relevant statutory instruments and regulations current at the date of tender and in particular the following:

1. I.E.T Wiring Regulations
2. Regulation under the Electric Power Act
3. Factories Act
4. Any special regulations issued by the local Electricity or Water Undertakings
5. Kenya Bureau of Standards (K.B.S)

The equipment and all components shall comply with all relevant KBS standards and codes of practice or other equal and approved standards specifications and codes. Where the equipment or part of it complies with other internationally recognized standards which are less stringent than British standards or Codes of practice, then the difference is to be stated in writing and must accompany the tender submission.

3. Conformity with the specification.

The equipment to be supplied shall conform in all respects to the specifications. Unless another standard is specifically mentioned in the specification, all materials and practices employed in the works must, where such standards exist be in accordance with the current KBS standards or code of practices or in accordance with such other authorized standard appropriate to the country of manufacture as in the opinion of the Engineer ensures equivalent or higher quality.

Alternative which deviate in any respect from the specifications may only be submitted in addition to the main offer required by the Specification. Such alternative must be fully detailed and the price indicated may be considered for adoption after the comparison of quotation submitted in accordance with the Specifications.

4. Information required with Tenders

Each tender shall be accompanied by 2 sets of technical manual showing general arrangement and typical details of the equipment offered.

All tender documents and any communications thereof shall be in English language.

5. Site Conditions

The contractor is deemed to have visited the site and if unable to locate it to apply to the Engineer for directions to enable him to do so. The contractor is deemed to have acquainted himself therewith as to its nature, position, means of access, etc and no claim in the connection will be allowed. No claim will be allowed for traveling or other expenses which may be incurred by the contractor in visiting the site or preparing a tender for the contract works.

6 Tropicalisation of Components

All components shall fully be tropicalised and protected against mould growth.

7 Surface finish

All ferrous metal work shall be either painted or processed to give a rust proof coating. Ferrous metal work to be painted shall first be either shot blasted or thoroughly wire brushed to remove all scale and oxide and immediately given one brushed coat or two sprayed coats of primer.

After not less than four hours, one brushed or two sprayed undercoats followed by one brushed or two sprayed finishing coats of heat and oil resisting quality paint shall be applied.

Successive coats of paint shall be slightly differing shades. Interior surfaces of electrical equipment enclosures shall be finished white and all external surfaces shall be finished grey (Bs 2660, colour 9-097)

Engine crank cases shall not be painted internally unless the paint is resistant to the lubricating oil.

8. Recording Drawings

The Contractor shall provide to the engineer four sets of the following drawings:

- a) Where indicated a building drawing showing details of cable entries, pipe entries and ducts required, and the exhaust system.
- b) A general arrangement drawing showing the principal dimensions and weight of the set.
- c) A general arrangement of the diesel engine.
- d) A general arrangement of the alternator and exciter showing terminal markings, polarity and phase rotation
- e) A general arrangement of the electrical control panel(s).
- f) A schematic and wiring diagram of the electrical control panel (s)

9. Maintenance Manual

Upon practical completion of the Contract works the Contractor shall furnish to the Engineer four copies of Manuals. The manuals shall be printed on good quality paper International A4 size and shall have stiff covers of durable materials.

The Manual shall contain full operating and maintenance instructions for each item of equipment, plant and apparatus set out in a form dealing systematically with each system. It shall include, as may be applicable to the contract works, the following and any other items listed in the text of the specification hereinafter:

- a) System Description
- b) Plant
- c) Valve Operation
- d) Switch Operation
- e) Procedure of Fault Finding
- f) Emergency Procedures
- g) Lubrication Requirement
- h) Maintenance and Servicing periods and Procedures
- i) Colour coding legend for all services
- j) Schematic and wiring Diagrams of plant, Apparatus and Switchgear
- k) Record Drawings, true too scale, reduced to international A4 size
- l) Lists of primary and secondary spares

The Manual is to be specially prepared for the contract works and Manufacture's standard descriptive literature and plant operating instruction cards will not be accepted for inclusion unless exceptionally approved by the engineer. The contractor shall, however, affix such cards, if suitable, adjacent to plant and apparatus. One spare set of all such cards shall be furnished to the electrical Engineer.

The maker's name, the rating of the set, the contract number, the location of the site and the year of installation shall appear on the front covers.

10. Factory Tests

The set shall be tested as a unit at the manufacturer's workshop (or elsewhere by agreement) up to its rated output and performance generally in accordance with the requirements of BS 649 and as 2613.

The Engineer shall be given adequate notice in writing of the date and time of the work tests and he, or his representative shall if he so desires, be present at such tests and given all reasonable facilities for his own inspections during the course of the tests.

Whether or not the Engineer or his representative attends the tests, he shall be furnished, by the Contractor, with copies of all relevant tests certificates.

11. Installation

Installation of all plant and equipment shall be carried out by the contractor under adequate supervision from skilled staff provided by the plant and equipment's manufacturer or his appointed agent.

Plant or equipment which are shipped before the relevant test certificate has been approved by the Engineer shall be shipped at the contractor's own risk and should the test certificate not be approved, new tests may be ordered by the Engineer at the contractor's expense.

12. Spare parts

The contractor shall submit with his tender a separate priced list of recommended spare parts including any optional extras which he recommends should be purchased for the set and its control equipment and are not supplied as standard with the unit. The initial spares required at handover shall be deemed to have been included in the tender pricing.

13. Tools

A complete set of tools and general and special testing equipment shall be provided, including grease and oil guns, necessary for the normal maintenance of the set and its controls.

The tools shall be of the best quality, the spanners being of chrome vanadium steel, and shall be contained in a suitable robust steel tool box with lid fitted with a lock and two keys. All tools and testing equipment may be used by the Contractor in the execution of the contract works but will not be accepted as part of the Contract works by the Engineer unless they are handed over in clean and undamaged condition, in perfect working order and effectively in new condition.

14. Maintenance period

The Contractor shall maintain the complete set and associated control equipment forming the unit for a period of twelve calendar months from the date that the unit is put into commission and regular use.

During this maintenance period, the contractor shall at his own expense.

- a) Make good any defects in the unit and replace any parts that fail or show signs of weakness or undue wear in consequences of faulty design, workmanship or materials.
- b) Visit the site with all diligence and attend to any such defect that arises within 48 hours of receiving notification of the defect.
- c) Carry out regular examination and services of the unit at the intervals laid down by the manufacturer, or every three months, whichever is the sooner, the service examination to include all necessary adjustments, greasing, oiling, cleaning, changing of lubricating oils (where necessary) to keep the unit in sound and efficient working order.
- d) Instruct the maintenance personnel in the proper operation, care and maintenance of the set and its equipment.

If during the maintenance period the unit is or is likely to be out of use for a period greater than 48 hours, due to the unit or part thereof developing a defect attributable to faulty design, workmanship or materials, or due to neglect of maintenance by the Contractor, the Contractor shall at his own expense immediately provide and install on free loan a suitable temporary unit for use until the required repair or replacement has been satisfactorily undertaken and the original set (or its replacement) put to proper working order.

At the end of the twelve months period of maintenance the Contractor shall (in addition to normal servicing work) carry out a compressive examination and test of the set and its auxiliaries, to ensure that the unit is in proper working order and in satisfactory condition for handing over to the Engineer whose representative shall be present at such examination and test.

15. Maintenance Contract.

The Contractor may be called upon to enter into maintenance contract with the Employer for the servicing the Generating sets after the expiry of the initial maintenance period. The Contractor shall indicate his willingness to carry out this service at the time of tendering and shall ensure that component personnel are available locally to be called at short notice to attend to Generator faults.

16. Transport and Storage

All plant equipment shall, during transportation, be suitably packed, crated and protected to minimize the possibility of damage, and prevent corrosion or other deterioration.

On arrival at site all plant and equipment shall be examined and any damage to parts and protective priming coats made good before storage or installation.

APPENDIX TO GENERAL SPECIFICATIONS OF MATERIALS AND WORKS

The electrical sub-contractor shall comply with the following:-

1. Government Electrical Specifications No. 1 and No. 2.
2. All requirements of Kenya Power Company Limited, and Communications Authority of Kenya (CA).

SECTION B
PARTICULAR SPECIFICATIONS
FOR THE
STANDBY GENERATING SYSTEM

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DESCRIPTION

1. Location of Site
2. Climatic Condition
3. Operating Conditions
4. Functional objects
5. Scope of the Contract
6. Performance objectives
7. Generating Set Arrangements
8. Diesel Engine
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 - 8.2 Fuel Oil System
 - 8.3 Lubricating Oil System
 - 8.4 Starting of Engine
 - 8.5 Cooling System
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 - 8.7 Exhaust System
 - 8.8 Engine Instruments
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 - 9.6 Starting Battery and Charger
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 - 9.12 Enclosures for Equipment
 - 9.13 Digital Master Controller and Paralleling and Synchronizing Panel (synchronizer)
 - 9.14 Lifting Gear and Handling
- 10.0 Commissioning

PARTICULAR SPECIFICATIONS

1.00 SITE LOCATION

The site of the proposed works is at **Naivasha, Nakuru County.**

2.00 Climatic Condition

The following climatic conditions apply at the site of the contract work and the equipment, materials and the installations shall be suitable for these conditions.

Mean Maximum Temperatures 32 c

Mean Minimum Temperature 17.4 c

Range of Relative humidity 39% - 97%

Salt in the atmosphere 0.02%

Altitude 1095M above sea level

Latitude /Longitude 00 21' N/37 35' E

Solar Radiation, February Mean Max 630 Langleys

Extremely heavy rainfall is experienced at certain periods of the year and the contractor shall be deemed to have taken account of this factor both in his prices and his planning of the execution of the contract works.

3.00 Operating Conditions

The equipment and all components shall be suitable for the operation in ambient conditions of 24°C to 36°C and up to 100% relative humidity

- i) in an unheated ventilated building
- ii) In the open air as specified

Unless otherwise stated all ratings of equipment and components shall be interpreted as site rating and NOT sea level or other ratings.

4.00 Functional Objectives

The set shall be capable of operating continuously and satisfactorily in a medium dust laden atmosphere as defined in BS 1701 and in accordance with BS 649.

The generating set is required for standby duty and will be connected to the switchboard through a circuit. It shall have an automatic mains failure control, appropriately interlocked with the other incoming supply. Provisions shall be made in the control circuit of the generator for automatic and remote push button control, including the terminals and cable glands for all external cables, which will be supplied by others, where specified. It shall also be possible to start, operate and stop the set manually, independent of any automatic features.

Within the operating conditions specified in part 3 above the set shall be capable of starting and accepting full load within the shortest possible time, and in any case, in not more than 10 seconds. Any special features included to achieve this shall be stated in Section C.

5.00 Scope of the Contract Works

The work covered by this Specification includes the design, manufacture, supply, delivery, installation, commissioning and testing to the satisfaction of the Engineer and maintenance for a period of twelve months of a new generating set complete with all necessary ancillary equipment.

The equipment to comprise **1No. 100KVA**, 415 volts/3 phase /50Hz continuously rated standby diesel generator set with all integral accessories, and all necessary equipment for the safe and efficient working of the set. The diesel generator set will be site rated at level of 1660 metres, Kenya Datum.

Diesel generator set to include:

- a) Push button starting, starting battery and mains power supply trickle charger to be included.
- b) 72 hour operational running capacity auxiliary fuel oil storage tank, loose transfer pump and duplex oil strainer.
- c) An integral belly/ base fuel tank for daily service with an operational running capacity of 8 hours
- d) All interconnecting pipe work, valves and fittings between the storage tank, base tank and the diesel engine.
- e) An automatic generator control unit
- f) A diesel generator control cubicle
- g) Acoustic enclosure/ sound attenuated canopy
- h) All local wiring
- i) Maintenance tools and spare parts as specified.

6.00 Performance Objective

The output rating of the set in KVA, the voltage, the number of phases and the frequency shall be as specified in Bill No.2 Schedule 1 of the Bills of Quantities.

Within the operating conditions specified the set, equipped with its standard air intake filters, shall be capable of delivering its rated output continuously at rated voltage and 0.8 lagging power factor and of delivering 10% in excess of the continuous maximum rating for a period of one hour in any 12 hour period.

The steady state voltage shall be maintained within 2 ½ % of the rated voltage under control of the voltage regulator between the cold start ambient conditions and the maximum working temperature, from no load to 10% overload and from unity to 0.8 lagging power factor. After any change of load the voltage shall not vary by more than

+ 15% of the rated voltage and shall return to within +/- 3% within 3 seconds and to within 2 ½ % of rated voltage within 1 seconds. On starting the voltage overshoot shall not exceed 15% and shall return to within 3% in not more than 3 seconds.

The governing of the set shall be such that the steady load speed band shall not exceed 1% of rated speed. Sudden removal of the full load at rated frequency shall not cause the frequency to rise above 110% of the rated frequency and it shall return to within 105% of the rated frequency within 3 seconds. The resultant steady state frequency shall return to 104% within 15 seconds. If full load is then reimposed the frequency shall not fall below 94% of rated frequency and shall return to 99% within 3 seconds and to the rated frequency within 15 seconds. The cyclic irregularity of the set at full load shall not be worse than 1/150.

The deviated interference shall be suppressed to the limit specified in BS 800 and BS 833.

7.00 Generating Set Arrangement

Unless otherwise indicated the set and its auxiliaries shall be mounted on sufficiently substantial under-base. All items which must be held in correct relative alignment shall be located by means of dowels.

The set shall be designed and supplied for operation bolted to the floor on robust anti-vibration and shock absorbing devices. They shall have adjusting screws for optimum setting and levelling and be so designed and installed that no appreciable engine vibration shall be transmitted to the floor or to any surrounding.

Bearings shall be suitable for operation over long periods without the need for replacement of the lubricant. Oil lubricated bearings shall be fitted with a visible oil level gauge.

8.00 Diesel Engine

8.1 General

The engine shall comply in design and performance with BS.649 "Diesel Engines for General purposes" or its approved equivalent. The engine shall be designed for satisfactory operation on fuel oil and lubricating oils complying with BS. 2869.

The engine shall be totally enclosed, with forced lubrication from an integral pump having on the suction side a coarse strainer and on the delivery side a dual 'full flow' fine filter with a changeover cock incorporating pressure by-pass, so that the oil flow to the engine is maintained if the filter should choke. Alternatively a single filter of the self-cleaning type fitted with a by-pass relief valve and having the same filtration performance may be provided. Manual lubrication of any part of the engine will not be accepted. The capacity of the lubricating oil system shall be sufficient to enable the engine to run continuously for 12 hours at any load without replacement.

A filter with a by-pass relief valve shall be inserted in the fuel line immediately before the pump(s). The fuel filter element shall be incapable of passing particles larger than micrometers. The fuel system shall be so arranged that fuel resulting from filter, pump or pipe spillage shall be incapable of entering the engine sump.

Air filters complying with KS 06-294: 1986, Grade 'A' and Grade 'B' suitable for use in a dusty atmosphere shall be fitted on the engine air intake(s)

No significant critical speed of the complete shaft system, including the generator, shall be within 15% of the rated speed.

A manually reset overspeed trip shall be fitted to stop the engine if its speed exceeds the rated speed by 15%. A mechanical trip is preferred but an electrical overspeed trip may be offered. Both types shall be equipped with a pair of contacts which close on operation of the trip. If the device is belt driven, at least two belts shall be provided and the drive shall be capable of carrying full load with one belt removed.

The set shall be arranged such that on shut-down the cooling water temperature shall not rise with residual heat so that the high-water temperature lock-out operates. The engine may be naturally aspirated as pressure charged, or as indicated.

The starting shall be by means of electricity supplied from a starter battery. The starter motor shall be of axial type, de-energizing by a device operated from the engine. A means of manual starting shall also be provided.

Suitable means shall be provided for running by hand the engine main shaft and the associated generator to facilitate inspection and overhaul.

If weekly test runs are insufficient to prevent the drying out of the bearings, means shall be provided to ensure that the bearing surfaces are adequately and automatically wetted with lubricating oil either periodically or immediately prior to every start.

The engine shall be capable of being started from any crank position.

A thermostatically controlled 240-volt immersion heater may be fitted in the engine lubricating oil sump to facilitate starting. The heating surface loading of any lubricating oil heater(s) shall not exceed 0.015 watt per square millimeter to avoid carbonization of oil.

An efficient exhaust silencer with adequate draining facilities shall be supplied, and shall either be mounted on the set or installed in a generator room constructed as shown on the drawing indicated. The exhaust silencer system shall be so arranged that it may be readily relocated if required. Where any additional piping bends and fittings are specified, the manufacturer shall advise on any problems involved.

8.2 Fuel Oil System

An auxiliary fuel storage tank whose minimum capacity shall be sufficient to run the engine continuously on full load for 72 hours shall be installed in the position indicated in the contract drawing. It shall be supplied complete with supports.

The tank shall be fitted with a hand operated fuel with a flexible suction hose to permit filling from a drum on the floor.

A three way cock shall be fitted in the line from tank to the engine to enable the fuel to be supplied from a source other than the storage tank.

The position of the cock shall be clearly marked 'MANUAL, AUTOMATIC, OFF' as applicable.

A duplex oil filter shall be supplied between the storage tank and the diesel engine. The duplex filter shall be capable of being cleaned without dismantling, or in interruption of the fuel flow, and shall be easily maintainable. The tank shall be equipped with a graduated dipstick, a clearly visible contents' gauge (not of the site glass type) and with drain, vent, overflow and inlet and outlet connection.

The set shall also have an integral belly/base fuel tank for daily services with an operational running capacity of 8 hours.

8.3 Lubricating Oil System

An engine driven integral gear type lubricating oil pump shall be provided. The lubricating oil system shall include an oil cooler and fine mesh filters, together with devices to indicate lubricating oil pressure and to initiate a 240 volt A.C. Lubricating oil Low pressure Alarm, Lubricating Oil High Temperature Alarm and Cooling Water High Temperature Alarm.

As separate 240 volt A.C. Motor driven automatic lubricating oil priming pump shall be provided for intermittent operation when the diesel is lying idle.

8.4 Starting of Engine

The diesel generator set shall have facilities for local and remote push button starting, with a Local/ Remote/ Automatic selector switch at the local panel.

On mains failure the engine shall be capable of being automatically started from battery located near the generator set.

The battery shall be complete with drip tray and trickle charger.

All necessary relays, contacts, switches and miscellaneous items for the starting sequence shall be supplied and installed in the local control panel.

The system shall be designed to give maximum reliability in starting.

The Contractor shall state in detail his proposals to ensure reliable starting and prevention of deterioration of the diesel engine, generator and exciter during idle periods.

All manually operated valves and controls on whose setting the correct operation of the automatic starting equipment depends shall be provided with locking devices.

8.5 Cooling System

The engine may be air or water cooled unless a preference is indicated.

8.5.1 Air Cooling of Engine

Cooling air for the engine and lubricating oil shall be provided by fan(s) mechanically driven from the engine. The cooling system shall be adequate for the total requirements of the engine when running on continuous full load and on 10% overload for one hour in accordance with BS 649 and under the conditions of Section 3.

The engine shall be so designed that the cooling air discharges into or is drawn through a reasonably airtight ducted assembly enclosing the lubricating oil cooler, the cylinder barrels and the cylinder heads of the engine.

This assembly shall terminate in a flanged outlet to which trunking may be readily attached when necessary, to enable hot air from the cooling system to be discharged outside the building.

Belt driven fans shall have at least two belts and the drive shall be capable of transmitting the full load with one belt removed. The cooling air temperature shall be controlled so as to maintain a safe working temperature of the cylinder head(s) and the engine shall shut down if the maximum is exceeded.

8.5.2 Water Cooling of Engine

A radiator of the air blast type shall be provided. It shall either have separate sections for water and for lubricating oil or be arranged for jacket water cooling only.

The radiator shall be mounted on the set and the fan(s) shall be mechanically driven from the engine. Where indicated the radiators shall be suitable for remote wall or floor mounting, in which case the fan shall be electric motor driven from a supply

similar in voltage, phase and frequency to the alternator output and shall be started on line.

Where remotely mounted, the fan shall only operate when generating set is running and shall be controlled by a thermostat mounted in the radiator such that the fan motor will start on rising temperature 50°C and stop on falling temperature.

Belt driven fans shall be provided with at least two belts and the drive shall be capable of transmitting the full load with one belt removed. Circulation of the jacket water and lubricating oil through the respective radiator sections and /or heat exchanger shall be by means of pumps mechanically driven by the engine. Belt driven pumps shall be provided with at least two belts and drive shall be capable of transmitting the full load with one belt removed.

Circulation by thermo-syphon will be accepted provided the engine will operate under the conditions of section 6 and in accordance with BS 649.

An easily visible flow indicator provided with contacts shall be fitted in the water outlet from the engine; the contacts shall close in the 'no flow' condition and shut down the set.

Alternatively in thermo syphon systems and sealed or pressurized radiator systems the flow indicator may be dispensed with providing the engine shuts down by the operation of the high temperature or low oil pressure safety devices in accordance with section 8.3.

A thermostatically controlled diverter valve shall be inserted in the engine water discharge pipe with a return to the circulating pipe section, to maintain the circulating water at the optimum temperature irrespective of the load. Alternatively a thermostatic bypass will be accepted.

A radiator make-up/expansion tank, fitted with float control inlet, shall be provided. If a sealed or pressurized unit is offered the tank may be dispensed with.

Where indicated provision shall be made on the radiator framework to permit the attachment of ducting for the discharge air.

A thermometer shall be mounted near the cylinder head(s) to indicate water temperature. Where a lubricating oil cooler is fitted, thermometers shall be mounted at the oil inlet too and outlet from the engine. Alternatively, thermocouple may be provided at all thermometer positions and taken to an instrument panel.

Adequate drains shall be provided at low points in the water and lubricating oil systems of the radiator and, where applicable, of the heat exchanger.

8.6 Governing System

Governing shall conform to B.S. 640 Class A. The governor shall control the frequency within the limits stated in Section 6 Part. Manual speed adjustment shall be provided over a range of +/-15% of the rated speed at any load. The governor system shall be of the mechanical or hydraulic type. In addition the engine shall be fitted with an approved over speed trip device which shall operate independently of the normal speed governor and shall act directly upon the fuel supply to the engine.

The over speed shall act at a speed of 12% to 15% in excess of normal operating speed.

8.7 Exhaust System

The diesel engine shall be provided with a suitable exhaust system for horizontal discharge outside the diesel generator room.

The silencer shall be of spark arresting type and shall be equipped with cleaning and draining arrangements.

If an exhaust driven turbo-charger is supplied it shall include air intake filters, mani-folds and outlet manifolds.

All necessary ducting, piping, supports and lagging required for the system shall be included.

Weatherproof wall boxes permitting expansion shall be fitted where the exhaust piping passes through the building wall or roof. Pipe work shall be connected at site by butt weld connections or use of flanged joints. The use of screwed connectors shall be avoided.

Flanges shall conform to the appropriate Table of B.S.10: 1962. Welding of flanges at site shall be carried out in accordance with B.S.806. The faces of flanges shall be machined and the backs shall be machined or spot faced to receive the bolt heads.

Valves and fittings shall be of approved design and manufacture and shall be subject to the same tests as the highest pressure piping or vessel to which they are connected.

8.8 Engine Instruments

Unless otherwise indicated the following instruments shall be provided:

- (a) a lubricating oil pressure gauge
- (b) a running hours meter
- (c) a tachometer
- (d) a water thermometer
- (e) an exhaust gas pyrometer or thermometer mounted near the mani-fold
- (f) lubricating oil thermometers on the inlet to and outlet from the engine, when a lubricating oil cooler is fitted
- (g) Exhaust turbo-blower pressure gauge(s) as applicable

8.9 Pipe work, Valves and Fittings

All piping shall comply with requirements of KS-259:11989 for mild steel pipes. Provision shall be made for ready handing of all parts of the plant during assembly or disassembly of the unit.

Adequate provision shall be made for attaching lifting devices, slings and eyebolts.

9.00 The Generator (Alternator and Exciter)

9.1 General

The generator shall comply with B.S.2613:197, for service in tropical conditions, and shall withstand being idle for considerable periods without any harmful drop in the insulation resistance.

The generator shall have a prime rated net output of **100 KVA** as specified in the schedules of the Bills of Quantities, at 0.8 lagging power factor, 415 volts, 3 phase, 4 wire, 50 Hertz with brushless rotating rectifier excitation system and voltage regulator. It shall be directly coupled to the engine and be sized such that it will accept the maximum output of the engine including overload. The output voltage shall be maintained within plus or minus 2 ½ % from no load to full load conditions. The alternator shall be capable of operating within the range of plus or minus 15% of the nominal voltage according to the automatic voltage regulator.

Three phase machines shall be star connected, and a diagram showing the terminal marking and phase rotation shall be provided in the terminal box. Cables connecting the machine winding and machine terminals shall not have a higher de-rating factor for temperature than the windings.

The insulation shall comply with BS 2757 excluding Classes Y and A. The insulation shall have an oil, moisture and fungus proof finish, with a surface which will not retain dust or condensation. It shall be possible to put the set in service after long periods in unheated storage without necessarily drying out the insulation.

The alternator shall be capable of withstanding a short circuit for three seconds when under the control of the automatic voltage regulator.

9.2 Excitation

Excitation shall be by means of brushless direct coupled exciter armature.

The alternators shall be designed for an excitation voltage at full load of not less than 50 Volts unless prior approval is given.

9.3 ELECTRICAL CONTROL PANEL

The Automatic Mains Failure control panel shall be provided and fitted with the following: -

- a) Two four pole contactors and two TP & N incoming MCCB's each of suitable rating for controlling the supply from the mains transformer and standby generator.
- b) An automatic voltage regulator for the set.
- c) Control equipment as necessary including phase failure protection relay for both the mains supply and the generator supply (with both under and over voltage protection) and phase sequence protection relay for the mains supply all to fulfill the functional requirements and automatic changeover as detailed in Part 9.3.2
- d) One ammeter and a selector switch to measure each phase current and neutral current
- e) One voltmeter and a selector switch to read line to line and line to neutral voltage
- f) A frequency meter

The meters shall comply with BS 89, table 7.

9.3.1 General

The set is to be used for mains failure duty and an automatic starting panel shall be provided which shall contain all necessary equipment for controlling the automatic starting and stopping of the set, lubricating oil priming (if necessary), all auxiliaries, fault warnings and shut-downs. All faults, warning and shut-downs shall be separately indicated. There shall be test facilities for indication lamps, etc, preferably by means of a single test button.

Means shall be provided for isolating all supplies to the starting panel either by an isolating switch or by withdrawable fuses.

When the set is stopped other than under lock-out conditions, it shall be self-resetting ready for the next start.

The set shall be suitable for starting by manual means. e.g. by cranking or direct operation of the starter solenoid.

All switches and push buttons shall be clearly marked to indicate their function.

It shall be possible to operate the 'Start' and 'Stop' buttons and to see the 'Set Failure' indications without opening the panel doors.

9.3.2 Automatic Changeover Controls

The controls shall be installed and wired in the machine control panel.

The control shall be provided such that on failure of the normal electricity supply, it will automatically initiate the starting of and effect the transfer of load to the standby generator. The schematic for the controls shall be approved by the Electrical Engineer before manufacture commences.

Where failure of the normal supply is referred to, it shall be defined as follows:

- a) Complete loss of voltage in one line Or in all the three lines
- b) Falling of voltage below 85% of the normal voltage between two lines or line and neutral
- c) Voltage overshoot to 110% of the normal voltage between two lines or line and neutral
- d) Incorrect phase sequence

On failure of the normal supply, the unit shall operate in the following manner:

- (a) After a delay, adjustable from 0 to 15 seconds (to avoid operation by a transient dip in voltage) a signal shall be given to start the standby generating set.
- (b) On receipt of a signal from the standby generating set that it is ready to take load, and providing that the failure of the normal supply still persists, the normal supply contactor in the control panel shall open and the standby contactor shall close. If the normal supply has been restored before the changeover has taken place, the contactor shall not operate and the starting relay contacts shall open to initiate the shutting down of the standby generating set.

When the standby supply is in operation and the normal supply is restored and remains within 10% of rated voltage on all phases for a pre-set time (adjustable up to 120 second) the standby contactor shall open and the normal supply contactor shall close; the starting relay contacts shall then open to shut down the generating set.

Provision shall be made so that automatic return to normal supply can be prevented if required.

Once a start signal has been sent to standby generating set, the engine starting sequence shall be allowed to continue until the set is ready to take the load before a stopping signal is sent.

A push button labelled 'Test' shall be provided to enable a failure of normal supply to be simulated. If the button is pressed and released the equipment shall complete the starting sequence, and when the set is ready to take load it shall be shut down. If the button is held depressed the equipment shall change over to the standby supply when the set is ready to take load.

Indicating lamps or illuminated panels shall be provided on the front of the panel. They shall be appropriately labelled, easily visible and shall give the following information:

- 'Main Supply Available'
- 'Generator Supply Available'
- 'Mains Supply on load'
- 'Generator Supply on load'

9.4 Lock out

9.4.1 General

The set shall stop and lock out to prevent further starting when:

- a) It fails to start when the electric starter motor has been in operation for 20 seconds under automatic start condition.
- b) The lubricating oil pressure falls to a value at which it would be unsafe to continue running the engine.
- c) The cooling water does not flow, when the engine is fitted with a visible flow indicator on the cooling water system.
- d) (i) In water cooled engines the cooling water temperature exceeds a predetermined limit.

(ii) In air cooled engines the cylinder head temperature exceeds a safe maximum.
- e) The overspeed trip has operated.

9.4.2 Failure of the circuits concerned in sub-section 9.4.1 (b) to 9.4.1(e) shall cause a set to shut down. Reset of lock out shall be by hand.

9.5 Fault indication

Each lock-out detailed in section 9.4.1 shall be indicated by a lamp on the panel together with an indication of the fault causing the shut-down. The fault warning lights shall be set to operate before the lock-out.

9.6 Starting Battery and Charger

The battery shall be 24 volts and capable of with-standing the loads imposed upon it by its specified duties. It may be of lead-acid or alkaline type and shall be of sufficient capacity for four starts in succession once in an eight-hour period. Auxiliary circuits connected to the battery shall be protected by fuses.

The battery shall be used to supply an automatic starting and control equipment, and relay operation shall not be impaired when the battery is supplying current to the starter motor.

A single phase supply for battery charging shall be available from the main M.V SWITCHBOARD.

A charger shall be provided which will recharge the battery after engine starting and maintain it in a charged condition when the set is standing or is in service. It may also supply the load of any automatic starting and control equipments, and an additional load up to 24 watts when the set is running and in service.

An alternative quick charge rate shall be provided. The charger shall be fitted with an ammeter to measure the charger and discharge current excluding the starter motor current.

9.7 Wiring and Earthing

Power cables and small wiring cables interconnecting major components shall be of the heat and oil resistant type and shall be metal sheathed or run in metal ducts or metal conduit, which shall be coded and terminated with lugs or eyes or to be soldered, the terminations shall be clearly marked with the numbers and letters of the terminals to which they are connected. Terminals shall be numbered or lettered, easily accessible and fitted with individual insulating barriers or adequately spaced. Barriers shall be fitted to separate control terminals from power wiring terminals.

All metal work housing electrical equipment shall be bonded to a brass earthing terminal and connected to station Earth and as detailed in the schedule.

9.8 Contactors

Contactors shall have magnetic circuits designed for a.c or d.c operation and shall be rated in accordance with ks 04-182:1982. Four pole- contactors shall be fitted for three phase-equipment and two-pole contactors for single phase equipments. Main and auxiliary contacts shall be silver faced or better.

9.9 Relays

Relays shall preferably be of sealed type mounted in approved plug-in bias with spring loaded retainers but if this is not practicable they shall be mounted on individual sub-bases and wired so that easy access is obtained to soldered connections. Unsealed relays shall be enclosed in individual or common dust protecting cases.

Time delays, if of the pneumatic type, shall operate on filtered air. The thermal type of time delay relay will not be accepted.

9.10 Fuses

Fuses shall comply with KS-183:1978. A spare fuse cartridge for each pole shall be mounted inside each equipment.

9.11 Rectifiers, Capacitors and solid-State components

Rectifiers, capacitors and solid-state components shall be suitable for any transient voltage and high currents likely to be uncouncted during the operation of the equipment and for the internal operating temperature of the enclosures at the specified maximum external ambient temperature.

9.12 Enclosures for Equipment

Enclosures for electrical and control equipment shall be drip proof and dust protecting, with adequate front and rear access as necessary for maintenance and repair. Special attention shall be given to the method of construction and to the mounting of the components to minimize the effect of vibration. Diagrams of connections in durable form shall be mounted inside the enclosures.

password protected and only accessed by authorized personnel and protect the configuration from unauthorized users.

9.13 Lifting Gear and Handling.

Provision shall be made for ready handling of all parts of the plant during assembly or disassembly of the unit. Adequate provision shall be made for attaching lifting devices, slings and eyebolts.

10.00 Commissioning

The Contractor shall include for fully commissioning the set and its control equipment and for the purpose of the required tests, shall provide all necessary instruments, tools, fuel and lubricating oil.

The following tests and checks as applicable shall be carried out by the contractor in the presence of the electrical engineer or his representative.

- a) Check that the main frame is level in all directions, engine and generator shafts are in proper alignment and the vibration absorbing devices are properly installed and located.
- b) Check water and sump oil levels and that the water jacket and radiation eaters (if fitted) are in working order.

- c) Check the battery electrolyte levels and the specific gravity.
- d) Examine the containers in which the fuel and lubricating oils were delivered and check that the type and grade of oils are as recommended for the unit.
- e) Ensure that sufficient fuel oil is in the fuel tank for a two hours test run.
- f) Check that all radiator and engine block water drain points are free from sludge and other blockages.
- g) Check engine bolts, main drive coupling, valve clearance, fuel pumps settings, governor settings, pipeline connections, water hose, exhaust couplings, flexible pipe work etc, and where a separate cooling water tank is fitted, that the water levels is satisfactory and the ball valve and overflow work.
- h) Check all outgoing connections on the generator and the control panel. All lugs for principal connections shall have clean and bright contact surfaces. A suitable abrasive shall be used where necessary.
- i) Check access panels and doors for proper opening and closing and for functioning of any interlocks fitted.
- j) With the set isolated from the main supply and the selector switch in the 'manual' position, start the engine by means of the 'start' push button and allow it to run up to normal speed. Check that the main battery charger is automatically switched off to avoid its being overloaded by the reduction in voltage across the battery. Where a battery charging dynamo is fitted, check that the main battery charger is disconnected by the operation of the auxiliary contact during the time the engine is running.
- k) Check instruments and gauges for normal operation and response and that the generator voltage is being maintained within the prescribed limits, making due allowance for no-load conditions. Compare the reading of the frequency meter with that of engine tachometer, where both are fitted
- l) Stop engine by turning selector switch to off position and verify that the generator contactor opens at between 95% and 85% of normal voltage. Re-check water and oil levels.
- m) Turn selector switch to 'Auto' position. Disconnect the sensing circuit supply and check that the set starts, the mains contactor opens, and the generator contactor closes in correct order. Reconnect the sensing circuit to verify that the engine stops on restoration of the mains supply and the contactors operate correctly. Check voltage sensing and time delays on each phase in turn and also the push buttons for mains failure simulation and engine stopping operate correctly.

NOTE: Running of the engine for any length of time under no load condition is undesirable and tests calling for such operation should be carried out in as short time as possible consistent with thoroughness.

- n) Operate the necessary isolators and switches to put the set on standby for essential services network with the mains failure simulation push, verify that the set

operates correctly with the appropriate time delay for taking up load and that the carrying of the load and its distribution over three phases are satisfactory.

- o) Run the set at various loads for periods totaling at least 30 minutes. Check that the voltage and frequency are being maintained within the required limits with large alterations of load. Note the rate of charge on the dynamo ammeter with the engine running (if a dynamo is fitted), and the rate of charge on the battery charging ammeter with the engine stopped. Check against manufacturers recommendations and adjust charging rates if necessary.
- p) Check that the various engine safeguards operate satisfactorily.
- q) Check the vibration absorbing devices for proper operation and that performance of all flexible connections, both mechanical and electrical, is satisfactory.
- r) When all tests are satisfactory and agreed with the Engineer or his representative, the lubricating oil and water levels shall be finally checked, the fuel oil tank replenished and set left in normal operating order.
- s) An initial supply of all lubricating oils and greases shall be provided by the Contractor.
- t) Additional lubricating oil shall be provided for recharging the engine sump once together with a supply of lubricating oils and greases to cover the normal use and serving of the set during the 12 months maintenance period referred to in Part 14 of Section A.

SECTION C

INFORMATION TO BE SUPPLIED BY THE TENDERER

CONTENTS

DESCRIPTION

1. General
2. Information on the set to be supplied
3. Deviations from the specifications

1. GENERAL

- a). The tenderer shall complete Part 2 of this section in full with details of the set he is offering.
- b). Any equipment which he wishes to offer but which does not comply with the specification shall be fully detailed in Part 4 of this section together with details of any other deviation or omissions which he may wish to make.

Any tender which is submitted without filling these sections will be deemed non-responsive.

- c). The tenderers shall be required to submit, together with their tenders, brochures detailing technical specifications of the generator set they intend to supply. Any tender which is submitted without the brochures will be deemed non-responsive

2 – INFORMATION OF THE 100KVA SET TO BE SUPPLIED

ITEM	EQUIPMENT	DETAILS
1.	<p>Diesel _____</p> <p>Engine Make</p> <p>Type</p> <p>Net continuous rating (B.S.649)</p> <p>(a) at sea level</p> <p>(b) at site</p> <p>Speed</p> <p>Supercharger</p> <p>Make</p> <p>Type</p> <p>Air cooling</p> <p>Quantity of air required</p> <p>Details of ducting</p> <p>Water cooling</p> <p>Details of water cooling circuits</p> <p>Radiator:</p> <p>Make</p> <p>Type</p> <p>Length</p> <p>Breadth</p> <p>Height</p>	<p>KVA</p> <p>KVA</p> <p>Rev/min</p> <p>Not Applicable</p> <p>To be Applicable</p> <p>mm</p> <p>mm</p> <p>mm</p>

ITEM	EQUIPMENT	DETAILS
2.	<p>Aspiration Method</p> <p>Quantity of air required</p> <p>Auxiliaries Filters</p> <p>Coolers Primary pumps Tachometer and drive Governor</p> <p>Special cold start devices Running hours meter Safety devices</p> <p>High temperature</p> <p>Low pressure (lubricating oil)</p> <p>Cooling water flow trip over speed trip Speed sensing devices</p> <p>Lubricating oil thermometers: Number Position (s) Water thermometer Position Exhaust thermometer Position</p> <p>Starting Battery Battery charger Immersion Heater</p>	
3.	<p>Lubrication</p> <p>Recommended oil (s)</p> <p>Sump</p> <p>Elsewhere (state where)</p>	Grade quantity (litres)
4.	<p>Alternator and Exciter Make and type Bearings</p> <p>Insulation class (BS.2757)</p>	

ITEM	EQUIPMENT	DETAILS	
5.	<p><u>Electrical Control Panel</u> Main circuit breaker Bypass switches Automatic changeover contactor Automatic voltage regulator Ammeter selector switch Voltmeter selector switch Frequency meter Ammeters ----- No. Voltmeters –No. Power factor meter Other equipment – give details</p>		<p>Amps Amps Amps Volts Hertz Amps Volts KVAR</p>
6.	<p><u>Performance data</u> Fuel consumption Maximum output</p>	<p><u>Rated output</u> % 110 100 75 50 <u>Ambient temp.</u> oC 40 30 20 10</p>	<p><u>Consumption</u> Litres/hour <u>Out-put KVA</u></p>

ITEM	EQUIPMENT	DETAILS		
6.	Performance Data (cont'd) Voltage regulation Frequency regulation Time to accept 75% full load from 5°C Time to accept 100% full load from 5°C Time to accept 100% full load from 40°C		%	
			%	
			Seconds	
			Seconds	
			Seconds	
7.	<u>Physical Details</u> Auxiliary fuel storage tank for 72 hour operational running capacity Size of set Total weight of set Overall dimensions of set Weight of heaviest component Weather proofing Integral belly/base fuel tank for daily service for 8 hour operation capacity		Litres	
		mm long	mm wide	mm high
			Kg.	
		mm long	mm wide	mm high
			Kg.	
			Litres	
8.	<u>Operational Details</u> Description of Operation Sequence of the automatic control Details of drawings, literature, etc., included with tender.			

4. DEVIATIONS FROM THE SPECIFICATION

The tenderer shall give details of any equipment which does not meet the specification, or any other deviations, omissions, additions or alternatives in respect of the set which he is offering.

If none, write none

Statement of Compliance

- a) I confirm compliance of all clauses of the General Conditions, General Specifications and Particular Specifications in this tender.

- b) I confirm I have not made and will not make any payment to any person, who can be perceived as an inducement to win this tender.

Signed:*for and on behalf of the Tenderer*

Date:

Official Rubber Stamp:

SECTION D

SCHEDULE OF UNIT RATES

SCHEDULE OF UNIT RATES

1. The tenderer shall insert unit rates against the items in the following schedules and may add such other items as he considers appropriate.
2. The unit rates shall include for supply, transport, insurance, delivery to site, storage as necessary, assembling, cleaning, installing, connecting, profit and maintenance in defects liability and any other obligation under this contract.
3. The unit rates will be used to assess the value of additions or omissions arising from authorized variations to the contract works.
4. Where trade names or manufacturer's catalogue numbers are mentioned in the specification, the reference is intended as a guide to the type of article or quality of material required. Alternative brands of **equal** and **approved** quality will be accepted.

NO	DESCRIPTION	UNIT RATE (KSHS)
1	PVC/SWA/PVC Copper cables per metre a) 2.5mm sq. 2 core b) 35 mm sq 4 core c) 50 mm sq 4 core d) 70 mm sq 4 core e) 95 mm sq 4 core	
2	300 4 pole bus bar chambers complete with bus bars and all accessories included	
3	300 Amperes Amoured cable connection box	

SECTION E

BILL OF QUANTITIES

BILLS OF QUANTITIES

A) PRICING OF PRELIMINARIES ITEMS

Prices will be inserted against item of preliminaries in the Contractor's Bills of Quantities and specification. These Bills are designated as Bill No.1 in this Section. Where the Contractor fails to insert his price in any item he shall be deemed to have made adequate provision for this on various items in the Bills of Quantities. The preliminaries form part of this contract and together with other Bills of Quantities covers for the costs involved in complying with all the requirements for the proper execution of the whole of the works in the contract.

SPECIAL NOTES TO THE BILLS OF QUANTITIES

1. The Bills of Quantities form part of the contract documents and are to be read in conjunction with the contract drawings and general specifications of materials and works.
2. The prices quoted shall be deemed to include for all obligations under the sub-contract including but not limited to supply of materials, labour, delivery to site, storage on site, installation, testing, commissioning and all taxes (including **VAT** and all other taxes applicable at the time of tender).

All prices omitted from any item, section or part of the Bills of Quantities shall be deemed to have been included to another item, section or part.

3. The brief descriptions of the items given in the Bills of Quantities are for the purpose of establishing a standard to which the sub-contractor shall adhere to. Otherwise alternative brands of **equal** and **approved** quality will be accepted.

Should the sub-contractor install any material not specified here-in before receiving **approval** from the Project Manager, the sub-contractor shall remove the material in question and, **at his own cost**, install the proper material.

4. The grand total of prices in the price summary page must be carried forward to the **Form of Tender**.
5. Tenderers must enclose, together with their submitted tenders, detailed coloured manufacturer's Brochures detailing Technical Literature and specifications on all the equipment they intend to offer.

**PROPOSED CONSTRUCTION OF PRESIDENTIAL PAVILION AT KWS SERVICE PARK, NAIVASHA
STAND-BY GENERATOR INSTALLATION WORKS BILL NO.1: SUB-CONTRACT PRELIMINARIES**

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT (Kshs)
1	Samples and materials generally clause - The Sub- contractor shall, when required, provide for approval at no extra cost, samples of all materials to be incorporated in the works. Such samples, when approved, shall be retained by the Engineer and shall form the standard for all such materials incorporated.	1	Item		
2	Bills of quantities clause - All the Quantities are based on the Contract Drawings and are provisional and they shall not be held to gauge or to limit the amount or description of the work to be executed by the Sub- contractor but the value thereof shall be deducted from the Sub-contract Sum and the value of the work ordered by the Engineer and executed there under shall be measured and valued by the Engineer in accordance with the contract. All work liable to adjustment under this Sub-contract shall be left uncovered for a reasonable time to allow measurements needed for such adjustment to be taken by the Quantity Surveyor or Engineer. Immediately the work is ready for measuring the Sub- contractor shall give notice to the Quantity Surveyor or Engineer to carry out measurements before covering up. If the Sub-contractor shall make default in these respects he shall, if the Architect so directs, uncover the work to enable the necessary measurements to be taken and afterwards reinstate at his own expense.	1	Item		
3	Setting to work and regulating system clause- No testing or commissioning shall be undertaken except in the presence of and to the satisfaction of the Engineer unless otherwise stated by him (Sub-contractor's own preliminary and proving tests excepted). It will be deemed that the Sub-contractor has included in the Sub-contract Sum for the costs of all fuel, power, water and the like, for testing and commissioning as required.	1	Item		
4	Identification of plant components clause - Sub-contractor shall supply and fix identification labels to all plant, starters, switches and items of control equipment etc with white traffolyte or equal labels engraved in red lettering denoting its name, function and section controlled.	1	Item		
5	Working drawings clause - Sub-contractor shall prepare such Working Drawings as may be necessary. The Working Drawings shall be complete in such detail not only that the Sub-contract Works can be executed on site but also that the Engineer can approve the Sub-contractor's proposals, detailed designs and intentions in the execution of the Sub-contract Works.	1	Item		
6	Records Drawings (As Installed) and instructions clause - Record Drawings, will be subject to the approval of the Engineer, include approved Working Drawings adjusted as necessary and certified by the Sub-contractor as a correct record of the installation of the Sub-contract Works.	1	Item		
Sub Total carried to next page					

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT (Kshs)
	Sub-Total B/F from Previous Page				
7	Maintenance Manual clause - Upon Practical Completion of the Sub-contract Works, the Sub- contractor shall furnish the Engineer four copies of a Maintenance Manual relating to the installation forming part of all of the Sub- contract Works.	1	Item		
8	Hand over clause - The Sub-contract Works shall be considered complete and the Maintenance and Defects Liability Period shall commence only when the Sub-contract Works and supporting services have been tested, commissioned and operated to the satisfaction of the Engineer and officially approved and accepted by the Employer, provided always that the handing over of the Sub- contract Works shall be coincident with the handing over of the Main Contract Works.	1	Item		
9	Testing and inspection - manufactured plant clause - The Engineer reserves the right to inspect and test or witness of all manufactured plant equipment and materials. The right of the Engineer relating to the inspection, examination and testing of plant during manufacture. Sub-contractor shall give two weeks' notice to the Engineer of his intention to carry out any inspection or tests and the Engineer or his representative shall be entitled to witness such tests and inspections	1	Item		
10	Initial Maintenance Clause - The sub-contractor shall make routine maintenance once a month during the liability for the Defects Period and shall carry out all necessary adjustments and repairs, cleaning and oiling of moving parts. A monthly report of the inspection and any works done upon the installation shall be supplied to the Engineer. Shall allow in the sub-contract Sum of the initial maintenance, inspection and break-down service	1	Item		
11	Temporary Works clause - The contractor shall include for the cost of and make necessary arrangements with the Project Manager for such temporary works.	1	Item		
Total for Bill No. 1: Sub-Contract Preliminaries C/F to Summary Page					

BILL NO. 2 Schedule No. 1 : GENERATOR SET

Item	Description	Qty	Unit	Rate (KShs)	Amount (KShs)
1.01	Supply, deliver to site, install, test and commission a prime rated 100 KVA 3 phase, 415V, 50Hz diesel generating set with a continuous power factor of 0.8 lagging and as fully described in the particular specifications. The generator set is to be complete with a sound attenuated canopy and an integral base/belly daily service fuel tank with an operational running capacity of 8 hours.	1	No.		
1.02	Supply, deliver to site and install a steel exhaust pipe of not less than 14 SWG and of adequate diameter running from the generating set to the outside of the generator house	30	LM		
1.03	Connect the exhaust pipe above in item 1.2 using steel pipes of adequate diameter, and flexible piping off engine exhaust manifold complete with heavy duty silencer	1	Item		
1.04	Complete earthing of generating set to electrical engineer's approval	1	Item		
Total Amount Carried Forward to Summary Page					

BILL NO. 2 SCHEDULE NO. 2 : CONTROL PANEL

Item	Description	Qty	Unit	Rate (KShs)	Amount (KShs)
2.01	240V AC/12V DC mains power supply trickle battery charger as specified in clause 9.6 of specifications. The trickle charger shall charge the battery when the set is on IDLE mode , otherwise when the set is RUNNING , the battery shall be charged by the generator charger . Wiring shall be done such that the two chargers shall not operate at the same time.	1	No.		
2.02	12 Volts battery as specified in clause 9.6 of the particular specifications	1	No.		
2.03	Armoured cables complete with glands				
	(a) 4 core 120mm ² PVC/SWA/PVC Copper cables drawn in ducts inside ground and in cable trays from Generator House to the LVBOARD for the 100KVA generator	50	LM		
	(c) 2.5mm ² , 4 core, PVC/SWA/PVC copper cable	50	LM.		
2.04	Inter-wire the control panel with the Mains L.V board	1	Item		
Total Amount Carried Forward to Summary Page					

BILL NO. 2 SCHEDULE NO. 3 : SPARE PARTS FOR THE 100 KVA GENERATOR

Item	Description	Qty	Unit	Rate (KShs)	Amount (KShs)
3.01	Oil Filters	8	No.		
3.02	Air Filters	8	No.		
3.03	Fuel Filter	8	No.		
3.04	Set of Fan belts to suit the set	2	No.		
3.05	10 litres container of sump oil of grade..... *	2	No.		
3.06	2 kilogram grease in a tin of grade *	2	No.		
3.07	10 litre plastic container of distilled water	2	No.		
3.08	20 litre of engine oil in a tin of grade..... *	2	No.		
3.09	Any other spare parts recommended by Tenderer ** *The tenderer to fill in the Grade quality to be supplied **The tenderer to fill in the details and price of items but the price not to be included in total carried forward to summary page				
Total Amount Carried Forward to Summary Page					

BILL NO. 2 SCHEDULE NO. 4 : TOOLS FOR THE 100 KVA GENERATOR

Item	Description	Qty	Unit	Rate (KShs)	Amount (KShs)
4.01	Metal tool box with lock and two keys	No.	2		
4.02	Set of 8 No. Chrome vanadium ring spanners in sizes to suit the set	No.	4		
4.03	Set of 3 screwdrivers, 75mm, 200mm and 300mm plus one 200mm Philips type	No.	2		
4.04	- ditto -but open ended spanners	No.	2		
4.05	Set of feeler gauges	No.	2		
4.06	Grease gun to suit greasing points	No.	2		
4.07	Oil can, trigger type	No.	2		
4.08	Any other special tools which the tenderer recommends should be purchased as an optional:* NOTE* Tenderer should give detail and prices of item 9 but the price not to be included in total carried forward.				
Total Amount Carried Forward to Summary Page					

BILL NO. 2 SCHEDULE NO. 5: TANK

Item	Description	Qty	Unit	Rate (KShs)	Amount (KShs)
5.01	Supply, deliver to site and install, to the approval of the project manager, and connect to the daily service base/belly fuel tank, an auxiliary fuel tank with level indicator and with an operational running capacity of 48 hours for the 100KVA Generator at 100% full load. The tank is to be of mild steel plates of minimum thickness of 3mm complete with stand and all interconnecting G.I pipe work.	1	No.		
5.02	Supply, install, test and commission a 240V AC 50Hz fuel pump complete with DOL starter. This is to pump fuel from the supply tank to the auxiliary fuel tank.	1	No.		
Total Amount Carried Forward to Summary Page					

MAIN SUMMARY PAGE

Item No.	Description	Amount (KShs)
1.00	BILL NO. 1 PRELIMINARIES AND GENERAL CONDITIONS	
2.00	BILL NO. 2 SCHEDULE NO.1 : GENERATOR SET	
3.00	BILL NO. 2 SCHEDULE NO. 2 : CONTROL PANEL	
4.00	BILL NO. 2 SCHEDULE NO. 3 : SPARE PARTS	
5.00	BILL NO. 2 SCHEDULE NO. 4 : TOOLS	
6.00	BILL NO. 2 SCHEDULE NO. 5: TANK	
7.00	Allow for training of 2No. technicians	
8.00	Allow for Contingency Sum	400,000.00
	Grand Total Carried Forward to Grand Summary Page	

Amount of tender in words:

Kenya Shillings.....

.....

Tenderers Signature and Stamp (Domestic Sub-Contractor)

Address.....

Date.....

Witness: Name and Signature.....

Address.....

Date

SECTION F

STANDARD FORMS

**PROPOSED CONSTRUCTION OF PRESIDENTIAL PAVILION AT KWS SERVICE PARK, NAIVASHA
STAND-BY GENERATOR INSTALLATION WORKS BILL NO.1: SUB-CONTRACT PRELIMINARIES**

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT (Kshs)
1	Samples and materials generally clause - The Sub- contractor shall, when required, provide for approval at no extra cost, samples of all materials to be incorporated in the works. Such samples, when approved, shall be retained by the Engineer and shall form the standard for all such materials incorporated.	1	Item		
2	Bills of quantities clause - All the Quantities are based on the Contract Drawings and are provisional and they shall not be held to gauge or to limit the amount or description of the work to be executed by the Sub- contractor but the value thereof shall be deducted from the Sub-contract Sum and the value of the work ordered by the Engineer and executed there under shall be measured and valued by the Engineer in accordance with the contract. All work liable to adjustment under this Sub-contract shall be left uncovered for a reasonable time to allow measurements needed for such adjustment to be taken by the Quantity Surveyor or Engineer. Immediately the work is ready for measuring the Sub- contractor shall give notice to the Quantity Surveyor or Engineer to carry out measurements before covering up. If the Sub-contractor shall make default in these respects he shall, if the Architect so directs, uncover the work to enable the necessary measurements to be taken and afterwards reinstate at his own expense.	1	Item		
3	Setting to work and regulating system clause- No testing or commissioning shall be undertaken except in the presence of and to the satisfaction of the Engineer unless otherwise stated by him (Sub-contractor's own preliminary and proving tests excepted). It will be deemed that the Sub-contractor has included in the Sub-contract Sum for the costs of all fuel, power, water and the like, for testing and commissioning as required.	1	Item		
4	Identification of plant components clause - Sub-contractor shall supply and fix identification labels to all plant, starters, switches and items of control equipment etc with white traffolyte or equal labels engraved in red lettering denoting its name, function and section controlled.	1	Item		
5	Working drawings clause - Sub-contractor shall prepare such Working Drawings as may be necessary. The Working Drawings shall be complete in such detail not only that the Sub-contract Works can be executed on site but also that the Engineer can approve the Sub-contractor's proposals, detailed designs and intentions in the execution of the Sub-contract Works.	1	Item		
6	Records Drawings (As Installed) and instructions clause - Record Drawings, will be subject to the approval of the Engineer, include approved Working Drawings adjusted as necessary and certified by the Sub-contractor as a correct record of the installation of the Sub-contract Works.	1	Item		
Sub Total carried to next page					

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT (Kshs)
	Sub-Total B/F from Previous Page				
7	Maintenance Manual clause - Upon Practical Completion of the Sub-contract Works, the Sub- contractor shall furnish the Engineer four copies of a Maintenance Manual relating to the installation forming part of all of the Sub- contract Works.	1	Item		
8	Hand over clause - The Sub-contract Works shall be considered complete and the Maintenance and Defects Liability Period shall commence only when the Sub-contract Works and supporting services have been tested, commissioned and operated to the satisfaction of the Engineer and officially approved and accepted by the Employer, provided always that the handing over of the Sub- contract Works shall be coincident with the handing over of the Main Contract Works.	1	Item		
9	Testing and inspection - manufactured plant clause - The Engineer reserves the right to inspect and test or witness of all manufactured plant equipment and materials. The right of the Engineer relating to the inspection, examination and testing of plant during manufacture. Sub-contractor shall give two weeks' notice to the Engineer of his intention to carry out any inspection or tests and the Engineer or his representative shall be entitled to witness such tests and inspections	1	Item		
10	Initial Maintenance Clause - The sub-contractor shall make routine maintenance once a month during the liability for the Defects Period and shall carry out all necessary adjustments and repairs, cleaning and oiling of moving parts. A monthly report of the inspection and any works done upon the installation shall be supplied to the Engineer. Shall allow in the sub-contract Sum of the initial maintenance, inspection and break-down service	1	Item		
11	Temporary Works clause - The contractor shall include for the cost of and make necessary arrangements with the Project Manager for such temporary works.	1	Item		
Total for Bill No. 1: Sub-Contract Preliminaries C/F to Summary Page					

BILL NO. 2 Schedule No. 1 : GENERATOR SET

Item	Description	Qty	Unit	Rate (KShs)	Amount (KShs)
1.01	Supply, deliver to site, install, test and commission a prime rated 100 KVA 3 phase, 415V, 50Hz diesel generating set with a continuous power factor of 0.8 lagging and as fully described in the particular specifications. The generator set is to be complete with a sound attenuated canopy and an integral base/belly daily service fuel tank with an operational running capacity of 8 hours.	1	No.		
1.02	Supply, deliver to site and install a steel exhaust pipe of not less than 14 SWG and of adequate diameter running from the generating set to the outside of the generator house	30	LM		
1.03	Connect the exhaust pipe above in item 1.2 using steel pipes of adequate diameter, and flexible piping off engine exhaust manifold complete with heavy duty silencer	1	Item		
1.04	Complete earthing of generating set to electrical engineer's approval	1	Item		
Total Amount Carried Forward to Summary Page					

BILL NO. 2 SCHEDULE NO. 2 : CONTROL PANEL

Item	Description	Qty	Unit	Rate (KShs)	Amount (KShs)
2.01	240V AC/12V DC mains power supply trickle battery charger as specified in clause 9.6 of specifications. The trickle charger shall charge the battery when the set is on IDLE mode , otherwise when the set is RUNNING , the battery shall be charged by the generator charger . Wiring shall be done such that the two chargers shall not operate at the same time.	1	No.		
2.02	12 Volts battery as specified in clause 9.6 of the particular specifications	1	No.		
2.03	Armoured cables complete with glands				
	(a) 4 core 120mm ² PVC/SWA/PVC Copper cables drawn in ducts inside ground and in cable trays from Generator House to the LVBOARD for the 100KVA generator	50	LM		
	(c) 2.5mm ² , 4 core, PVC/SWA/PVC copper cable	50	LM.		
2.04	Inter-wire the control panel with the Mains L.V board	1	Item		
Total Amount Carried Forward to Summary Page					

BILL NO. 2 SCHEDULE NO. 3 : SPARE PARTS FOR THE 100 KVA GENERATOR

Item	Description	Qty	Unit	Rate (KShs)	Amount (KShs)
3.01	Oil Filters	8	No.		
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3.05	10 litres container of sump oil of grade.....*	2	No.		
3.06	2 kilogram grease in a tin of grade*	2	No.		
3.07	10 litre plastic container of distilled water	2	No.		
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Total Amount Carried Forward to Summary Page					

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5.02	Supply, install, test and commission a 240V AC 50Hz fuel pump complete with DOL starter. This is to pump fuel from the supply tank to the auxiliary fuel tank.	1	No.		
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MAIN SUMMARY PAGE

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7.00	Allow for training of 2No. technicians	
8.00	Allow for Contingency Sum	400,000.00
	Grand Total Carried Forward to Grand Summary Page	

Amount of tender in words:

Kenya Shillings.....

.....

Tenderers Signature and Stamp (Domestic Sub-Contractor)

Address.....

Date.....

Witness: Name and Signature.....

Address.....

Date

CONTENTS

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4.	Schedule of on-going projects	F/4
5.	Contractor's Equipment	F/5
6.	Details of Litigation or Arbitration Proceedings	F/6
7.	Commissioning Guide for Electrical Installation works	F/7 - F/12

NOTE:

Tenderers must duly fill these Standard Forms as a mandatory requirement as they will form part the evaluation criteria.

KEY PERSONNEL

Qualifications and experience of key personnel proposed for administration and execution of the Contract.

POSITION	NAME	HIGHEST QUALIFICATION <i>(Attach proof)</i>	YEARS OF EXPERIENCE (GENERAL)	YEARS OF EXPERIENCE IN PROPOSED POSITION

I certify that the above information is correct.

.....
Title

.....
Signature

.....
Date

CONTRACTS COMPLETED IN THE LAST FIVE (5) YEARS

Work performed on works of a similar nature, complexity and volume over the last 5 years.

PROJECT NAME	NAME OF CLIENT	TYPE OF WORK AND YEAR OF COMPLETION	VALUE OF CONTRACT (Kshs.)

I certify that the above works were successfully carried out and completed by ourselves.

.....

.....

.....

Title

Signature

Date

SCHEDULE OF ON-GOING PROJECTS

Details of on-going or committed projects, including expected completion date.

PROJECT NAME	NAME OF CLIENT	CONTRACT SUM	% COMPLETE	COMPLETION DATE

I certify that the above works are currently being carried out by ourselves.

.....

Title

.....

Signature

.....

Date

**SCHEDULE OF MAJOR ITEMS OF CONTRACTOR'S EQUIPMENT
PROPOSED FOR CARRYING OUT THE WORKS (Attach proof of
ownership)**

ITEM OF EQUIPMENT	DESCRIPTION, MAKE AND AGE (Years)	CONDITION (New, good, poor) and number available	OWNED, LEASED (From whom?), or to be purchased (From whom?)

DETAILS OF LITIGATION OR ARBITRATION PROCEEDINGS IN WHICH THE TENDERER HAS BEEN INVOLVED AS ONE OF THE PARTIES IN THE LAST 5 YEARS

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____



REPUBLIC OF KENYA

**MINISTRY OF TRANSPORT, INFRASTRUCTURE,
HOUSING, URBAN DEVELOPMENT PUBLIC WORKS**

**STATE DEPARTMENT FOR PUBLIC WORKS
(ELECTRICAL DEPARTMENT)**

**PROPOSED CONSTRUCTION OF PRESIDENTIAL PAVILION AT
KENYA WILDLIFE SERVICE (KWS) SERVICE PARK – NAIVASHA**

W.P. ITEM NO. D113 RV/NKU/2001 – JOB NO. 10850A

TESTING & COMMISSIONING GUIDE FOR

STANDBY /DUTY GENERATORS

Issued by:

**The Chief Engineer (Electrical),
Ministry of Transport, Infrastructure, Public Works, Housing
& Urban Development, State Department of Public
Works, P. O.BOX 41191 – 00100 GPO,
NAIROBI.**

PROJECT NAME:

.....

W.P ITEM NO.:

JOB NO.

PROJECT SITE:

CLIENT:

CLIENT USER:

A. CONFIRMATION OF FACTORY TEST RESULTS

ITEM	TEST DESCRIPTION	OBSERVATIONS/RESULTS	REMARKS
1	Check that the make of the generator set is as per the Factory Test Certificate		
2	Check that the Engine make and serial number are as per the Factory Test Certificate	Engine make.....	
		Serial No.....	
3	Check that the Alternator make and serial number are as per the Factory Test Certificate	Engine make.....	
		Serial No.....	
4	Check the alternator name plate and confirm that the following are as per the Factory Test Certificate		
	KVA rating		
	Voltage rating		
	Power factor rating		
	Speed rating		

B. PRELIMINARY CHECKS

ITEM	TEST DESCRIPTION	OBSERVATIONS/RESULTS	REMARKS
1	Check that the main frame of the set is level in all the directions		
2	Check that vibration mountings have been done properly		
3	Ensure that there is sufficient fuel, oil (and water where required) for 2 hours test run		
4	Is the generator sound proofed or an open set. If it is sound proofed, measure noise levels and check that they are as per the levels in the brochure for that particular generator		
5	Check access all around the set, and if the set is sound proofed, check access panel and doors for proper opening and closing. Check that there are safety screen to moving parts and that the exhaust pipe is of right size and is properly anchored.		
6	Engine cooling method (water or air cooled)		
7	Check existence of generator instruments		
	Ammeter		
	Voltmeter		
	Frequency meter		
	Hours running meter		
	Temperature gauge		

	Oil pressure gauge		
8	Check the auxiliary AMF panel or the generator integral panel		
	Does it have a properly rated isolating MCCB TP/SP		
	Does it have a by-pass switch as described in the contract documents		
	Does it have a trickle charger as described in the contract documents		
	Is wiring properly done / arranged for ease of maintenance and trouble shooting		
	Does the panel have indicator lamps for both generator and mains power supply		
	Does the panel have phase failure relay for the mains power supply (with both under and over-voltage protection). Confirm the settings on the phase failure relay are 85% for under-voltage and 110% for over-voltage		
	Is there a fault indication lamp for any of the faults that may cause lock-out or shut-down		
9	Are there diagnostic wiring / circuit diagrams for the auxiliary AMF panel and the generator integral panel well secured and displayed in the generator room		
10	Are there user / maintenance manuals		
11	Does the set have the necessary lubricators, tools and spare parts as indicated and priced in the contract document		
12	Does the set have a daily service fuel base tank for 8 hours operational capacity		

13	Does the set have an auxiliary fuel storage tank for 72 hours operational capacity		
----	--	--	--

C. RUNNING TESTS

ITEM	TEST DESCRIPTION	OBSERVATIONS/RESULTS	REMARKS
1	With the set isolated from the mains supply and on no-load conditions, start the set manually and check the output voltages, frequency pressure and temperature readings. Check that the mains battery charger is disconnected by the operation of an auxiliary contact during the time the set is running (this test should take a maximum of 10 – 15 minutes)	Voltage.....	
		Frequency.....	
		Oil Pressure.....	
		Engine Temperature.....	
2	With the generator selector switch on 'auto' position, disconnect the mains power supply sensing circuit and check that the set starts, the mains contactor opens, and the generator contactor closes to transfer power to the load side. Check output voltage readings, frequency readings and current readings including pressure and temperature readings and confirm whether phases are balanced or not (this test should take a maximum of 30 minutes)	Voltage.....	
		Current.....	
		Frequency.....	
		Pressure.....	
	Temperature.....		
3	On receipt of a signal to start (i.e. when mains power supply fails), what is the time duration taken by the set from start up to the time when the generator contactor closes to transfer power to the load side (this time should not exceed 10 secs)		

4	Reconnect the mains power supply sensing circuit. Verify that the engine stops on restoration of the mains supply and the contactors operate normally		
5	On restoration of the mains power supply, what is the time duration taken to change over from generator to mains power supply. The minimum time should be 30 secs	Time taken.....	
6	On restoration of the mains power supply and after changing over, what is the time duration taken by the set to stop. The minimum engine run-off or run-down time should be 120 secs	Time taken.....	
7	Test the set on mains power supply phase failure. With the generator selector switch on 'auto' position, disconnect one of the phases of the mains power supply sensing circuit and check that the set starts, the mains contactor opens, and the generator contactor closes to transfer power to the load side		
8	Test the operation of the Manual By-pass Switch. With the generator selector switch on 'auto' position, confirm that the set does not get a signal to start when the Manual By-pass Switch is on OFF and BY-PASS positions		
8	Replenish fuel tank as required after doing all the test runs		

Commissioning witnessed by:

SDPW REPRESENTATIVE/ PROJECT ENGINEER

Name.....Signature.....

.

Date.....

CONTRACTOR'S REPRESENTATIVE

Name.....Signature.....

.

Date.....

Official Rubber Stamp.....

CLIENT USER'S REPRESENTATIVES

Name.....Signature.....

.

Date.....

Official Rubber Stamp.....

*****If there are other defects / outstanding works noted, list them over leaf.**