

**DEPARTMENT OF PUBLIC WORKS
 ATTERIDGEVILLE LABOUR CENTRE
 INSTALLATION OF A NEW 40kVA STANDBY POWER GENERATOR AND 2 X 3KVA UPS
 BILL NO.1 - PRELIMINARIES AND GENERAL**

ITEM	DESCRIPTION	UNIT	QTY	RATE	TOTAL
1	PRELIMINARIES AND GENERAL				
1.1	Site Facilities				
1.1.1	Site camp, accommodation and office	sum	1		
1.1.2	Site measurements	sum	1		
1.1.3	Security	sum	1		
1.1.4	Water and Electricity	sum	1		
1.1.5	Ablution and latrine facilities	sum	1		
1.1.6	Clearing of Site after completion	sum	1		
1.1.7	Transport				
1.2	Insurances				
1.2.1	Works Insurance	sum	1		
1.2.2	Workmen's Compensation	sum	1		
1.2.3	Third Party Insurance	sum	1		
1.3	Organisation of staff	sum	1		
1.4	Progress meetings on site	sum	1		
1.5	Unloading and Storage	sum	1		
1.6	Health and Safety including Covid 19 regulations and requirements				
1.6.1	Safety,Health and Enviromental Management	sum	1		
1.6.2	Personal Protecive Clothing	sum	1		
1.6.3	Training of client's staff	sum	1		
1.6.4	Contract management	sum	1		
1.6.5	Painting and Marking	sum	1		
1.7	Issue of COC complete with labelling as per SANS10142 and latest amendments	sum	1		
TOTAL BILL NO. 1 - CARRIED TO SUMMARY					

ITEM	DESCRIPTION	UNIT	QTY	SUPPLY RATE	INSTALL RATE	TOTAL
	Brought forward					
2.7	WIRING					
	PVC insulated copper conductors drawn into wireways, including waste					
2.7.1	2.5mm ²	m	600			
2.7.2	4mm ²	m	100			
	Bare stranded copper earth wire into wireways, including waste					
2.7.3	2.5mm ²	m	350			
2.8	ACCESSORIES					
	Switches, socket outlets, isolators, etc., complete with cover fixed in outlet or extension box					
2.8.1	Combination 1 x 16A socket outlet c/w 3 -pin switched normal and 2 x 16A unswitched 3-pin Euro Slim Line	No	3			
2.8.2	Single 16A, 3-pin switched socket outlet in power skirting (164-1)	No	12			
2.8.3	Single 16A, 3-pin dedicated switched socket outlet, RED (164-4) in power skirting	No	15			
2.9	EARTHING AND BONDING					
	Checking, testing and reinstatement of earthing conductors, termination points and metal bonding points for the complete electrical installation to comply with SABS 10142 Code of Practice	item	1			
2.10	SLEEVES					
	Supply and install the following HDPE/PVC Sleeves of 6mm thickness					
2.10.1	110mm diameter	m	20			
2.10.2	50mm diameter	m				
2.11	TEST AND COMMISSION					
	Issue of Certificate of compliance as per SANS 10142-1 for the new Distribution Boards as specified	Item	1			
	TOTAL BILL NO. 2 - CARRIED TO SUMMARY					

**DEPARTMENT OF PUBLIC WORKS
 ATTERIDGEVILLE LABOUR CENTRE
 INSTALLATION OF A NEW 40kVA STANDBY POWER GENERATOR AND 2 X 3KVA UPS
 BILL NO.3 - GENERATOR**

ITEM	DESCRIPTION	UNIT	QTY	UNIT RATE	TOTAL
3.1	STANDBY DIESEL GENERATOR				
	Supply, delivery, installation, testing, commissioning and handing over in working condition and maintenance during guarantee period.				
1)	40kVA Open set Generator Enclosed(3Ph) complete with set mounted day tank as specified (Including first fill of all lubrication, oils and diese)	Sum	1		
2)	Electrical Fuel pump	Sum	1		
3)	Control Panel complete with wiring	Sum	1		
4)	Starter Batteries - 24V	Sum	1		
5)	Weatherproof sound attenuated enclosure	Sum	1		
6)	Concrete plinth for Generator set	No	1		
7)	Testing, Inspections and Commissioning	Sum	1		
8)	Maintenance				
	12-Month Guarantee and Maintenance as per the specification. Quarterly (4) service of the plant as per the manufacturer's requirements.	Sum	1		
9)	Warning Notices				
	Supply and install set of warning notices on the container as per SANS and OHS specification	Sum	1		
10)	Manuals				
	Compilation of Maintenance, operational and technical manuals and documentation to the client satisfaction				
	Supply manuals	Sum	1		
11)	PadLocks				
	Supply and install A82 padlocks.	Item	3		
3.2	ELECTRICAL INSTALLATION AND EQUIPMENT MODIFICATION				
1)	Supply, installation and termination of a 25mm ² 4core PVC/PVC/SWA/PVC Cu Cable	m	60		
2)	PVC warning marking tape	m	20		
3)	Concrete Cable Markers	No	1		
4)	Supply, installation and termination of a 16mm ² Black insulated copper conductor	m	60		
5)	Supply, installation and termination of a 2.5mm ² 2core signal cable buried in sleeves	m	50		
6)	Excavations and Trenching for cables – 800mm depth x 300mm wide	cub-m	5		
7)	Breaking and repair of concrete	m			
8)	Import soil for the replacement of high clay content soil removed from excavations	cub-m	5		
	Carried forward				

ITEM	DESCRIPTION	UNIT	QTY	UNIT RATE	TOTAL
	Brought forward				
9)	25mm dia Galvanised steel conduit to SANS, complete with all couplings, bushes, locknuts, Fixing saddles and screws, cutting, threading, reaming, fixing, cleaning for wiring purposes, in roof space, in concrete or brick and surface mounted	m	10		
10)	P8000 trunking complete with all fixing material surface mounted or suspended on in ceiling void	m	10		
11)	Issue of Certificate of compliance as per SANS 10142-1 for the Generator and the additional circuits in the new Main Kiosk as specified	Lot			
3.3 GENERATOR REFUELLING SERVICE					
1)	The supply, delivery/transport and filling of the day tank (set mounted) and bulk tank with 50ppm or 500ppm Diesel fuel as required	Per litre	1		
2)	Transport Diesel fuel as required	per km	1		
3)	Refuelling Preliminaries and General including labour, licence, permits to transport diesel fuel	Lot	1		

TOTAL AMOUNT: R 0.00

**DEPARTMENT OF PUBLIC WORKS
 ATTERIDGEVILLE LABOUR CENTRE
 INSTALLATION OF A NEW 40kVA STANDBY POWER GENERATOR AND 2 X 3KVA UPS
 SUMMARY OF BILL OF QUANTITIES**

ITEM	DESCRIPTION	TENDER AMOUNT
1	PRELIMINARIES AND GENERAL	
2	LV RETICULATION	
3	40kVA GENERATOR	
4	UPS	
	SUBTOTAL - EXCL.VAT	
	ALLOWANCE FOR CONTINGENCIES - 0%	
	SUBTOTAL - EXCL.VAT	
	PLUS 15% VAT	
	TOTAL TENDER AMOUNT INCL.VAT	

CARRIED FORWARD TO FORM OF OFFER AND ACCEPTANCE: DPW-07 (EC)



OHS BILL OF QUANTITIES FOR DEPARTMENT OF EMPLOYMENT AND LABOUR: ATTERIDGEVILLE

No:	DESCRIPTION	UNIT	QUANTITY	RATE	AMOUNT
1.	Supply of Personal Protective Equipment	1			
BARRICADING, EDGE PROTECTION AND SIGNAGE					
2.	Supply, installation & removal of Plastic bar	1			
3.	Hard Solid barricading Guardrail	1			
5.	Temporary Edge Protection Equipment	1			
6.	Mandatory Health and Safety Signage Notices/Posters	1			
7.	Work Separation, Common Areas Demarcation / Protective Screens	1			
OHS TRAINING AND FIRST AID					
8.	First Aid Training and full equipment	1			
9.	OH&S Representative training	1			
10.	Emergency Rescue training	1			
11.	Hazard identification & risk assessment training	1			
12.	Induction training	1			
13.	Working within and near excavations training	1			
14.	Electrical Safety training	1			
15.	On-site training	1			
OHS RESPONSIBILITY STRUCTURE AND WORK ORGANISATION					
16.	Construction Health Safety Officer (SACPCMP Professional Registration required)	1			
17.	Development and implementation of a Health and Safety Plan & File	1			
18.	Development and implementation of Plan plus a Rescue Plan	1			
19.	Hand washing Facilities and Disinfectant Detergents	1			
20.	Changing and Eating Facilities	1			
21.	Waste Management	1			
22.	Other :				
Total OHS Cost					

3.1.2: ELECTRICAL AND STANDBY GENERATOR INSTALLATION

SPECIFICATION FOR THE GENERATOR AND ELECTRICAL INSTALLATION

INDEX TO SPECIFICATION

THIS SPECIFICATION CONSISTS OF THE FOLLOWING DOCUMENTS:

	<u>PAGES:</u>
(A) SPECIFICATION FOR ELECTRICAL WORK (SECTION A)	2 - 8
(B) SPECIFICATION FOR GENERATOR WORK (SECTION B)	9 – 35

SECTION A

SPECIFICATION FOR ELECTRICAL WORK

1. **GENERAL INFORMATION**

The tenderer's attention is drawn to the fact that if the schedules of this specification are not completed his tender cannot be adjudicated and may be disqualified. This applies also to the Bill of Quantities where the unused items are not priced. Items used on the project must be priced and no cost plus items will not be accepted.

The potential bidder must provide the following in order to be evaluated further:

- Proof of CIDB grading (minimum 2 EB)
- CV of installing electrician showing proof of registration with DoEL (Certificate shall be attached)
- Construction Programme

2. **DRAWINGS**

This specification and drawings generally show the character and extent of the generator installation work, and shall not be held as showing every minute detail of the work to be executed.

3. **MAKING GOOD**

The successful tenderer will be responsible for making good in all trades of any damage to buildings or other services which he or his employees may have incurred during the construction of the works.

The Contractor will be responsible for keeping the site clean and tidy and shall remove from the site all rubble and litter resulting from the construction work.

4. **ELECTRICAL EQUIPMENT**

All fittings, material and equipment and component parts thereof are to be in accordance with the attached quality specification and must have the approval of the Department. In addition all equipment shall be designed, manufactured and tested in accordance with the relevant South African National Standards Specification or otherwise the relevant British Standard Specification.

All material and equipment must be suitable for the supply voltage namely 400/230 volt 3PH-4 wire and the necessary pre-cautions shall be taken against corrosion, i.e. exposed metal shall be anti-rust treated to approval and all metalwork to be galvanized or painted.

5. **WORK SEQUENCE AND MAINTENANCE OF ELECTRICAL SUPPLY**

The sequence in which the work must be carried out must be established in consultation with the Department's Representative.

All interruptions of the electrical supply that may be necessary for the execution of the work will be subject to prior arrangements between the Contractor, the user Department, and the Department's Representative.

6. **SUPERVISION**

The work shall at all times, for the duration of the contract, be carried out under the supervision of a skilled and competent representative of the Contractor, who will be able and authorized to receive and carry out instruction on behalf of the Contractor. A sufficient number of workmen shall be employed at all times to ensure satisfactory progress of the work.

7. CERTIFICATE OF COMPLIANCE

A Certificate of Compliance in accordance with the latest issue of the S.A.N.S. 10142, Code of Practice for the Wiring of Premises, shall be completed by the Contractor on completion of the installation. Practical completion will only be taken after the Department has received the certificate.

8. BALANCING OF LOAD

The Electrical Contractor is required to balance the load as equally as possible over the multiphase system.

9. SUPPLY AND CONNECTION

The supplier of electricity to the facility is City of Tshwane Metropolitan Municipality - Energy and Electricity Department. The mains supply to the facility is by means of a 50kVA, 70Amps, 3-phase mains supply from a 2-Door Maximum Demand Meter Box, located on the boundary of the facility. The mains is by means of an underground low voltage PVC cable network from the existing 50kVA,400V pole mounted transformer provided by Tshwane Electricity.

10. EXTENT OF WORK

- Supply and install a new 40 kVA Genset complete with outdoor enclosure.
- Upgrade and modify the Main DB-A to cater for standby mains supply only. See SLD drawings.
- Supply and install a DB-A1 to supply the new **40kVA genset** and the existing DB-B (Normal).
- Mains supply to DB-A to be disconnected and reconnected to the new DB-A1 (Normal DB).
- Supply, delivery, Install and commission 2 x 3kVA double conversion online UPS unit to supply the server and security equipment.
- Make safe and disconnect existing circuits in DB-B and remove the DB for storage at DPW.
- DB-B Upgrade with new surface mounted DB with normal and standby sections and reconnect existing circuits and cater for additional circuits and allow for space capacity.
- Identify normal and standby sections panels in the new DB's as per DPW guidelines – white and red and or purple for UPS panels.
- Check and correct equipment wiring, PSCC and protection rating in the DB – DBA, DB-B and DB-C.
- Supply and Install new Distribution boards and reroute all nonessential loads to new DB's.
- Trace and test all supply and feeder cables.
- Install surge protection devices in the Main DB only.
- Supply and Install legend card holder and label circuit on legend in the existing DB's.
- Electrical bulk capacity and Load calculations – check authorized maximum demand capacity.
- Trace and test all supply and feeder cables.
- Supply and Install surge protection devices in the new Main DB only.
- Install legend card holder and label circuit on legend in the existing DB's.
- Reconnect the essential and non-essential equipment.
- Survey circuits supply areas and balance the existing loads.
- Testing, repair and re-lamping of existing luminaires (Internal and external).

- Checking, labelling and testing of all existing Sub distribution boards to comply with SANS 10142-1.
- Earthing and bonding of all new installation.
- Test reports and issue of certificate of compliance for the entire electrical installation as indicated in the bill of material.
- Issue CoC on works completed and signed off by the Engineer.

10.1 **LOCATION OF SITE**

The project site Atteridgeville Labour Centre is located on the corner of Kalafong Rd & WF Nkomo Str, Tshwane Municipality.

10.2 **SUMMARY OF WORK TO BE DONE**

10.2.1 **EMERGENCY GENERATOR PLANT**

The successful tenderer shall supply, deliver and install a completely single enclosed diesel driven standby generator set of **40kVA 400/230V 3 phase** in a position that will be determined on site. The machine shall be totally enclosed in a 3CR12 stainless steel housing. The exhaust shall be manufactured from stainless steel.

The housing is to be provided on galvanized 3CR12 stainless steel skids so that the generator set can be transported to site and placed in position on a concrete plinth, casted by the successful tenderer. The skids must be of sufficient height to allow for the passage of storm water under the set.

The generating set shall be on standby and fully automatic, i.e. it shall start when the main supply fails, as further detailed in the general technical specification. The automatic mains failure panel shall be installed in the 3CR12 housing.

Only essential and critical loads to be connected to the generator as per Department of Public Works generator policy and as indicated on single line distribution diagram.

10.2.2 **CONCRETE PLINTH**

Concrete plinth to be provided as per generator foundation drawing number EE1918/ES2.

The surface of the concrete plinth shall be 100mm higher than the existing ground level. The thickness and strength of the plinth shall be determined by the contractor before casting and as indicated by the generator manufacturer.

A tap to be provided (not indicated on sketch) to drain all the water that accumulates inside the bund wall. Final position of the tap will be determined on site. It is the engineer's responsibility to ensure plinth design complies with generator dimensions and weights. The bund wall shall contain 110% of the fuel, oil and water capacity of the generator. The bund wall shall not constrain the canopy doors from opening completely.

10.2.3 P.V.C.A. CABLES

The contractor shall allow for the supply, installation and connection of the P.V.C.A. cables as per “Bill of Quantities” and as hereafter specified.

A new 25mm² 4core copper cable complete with a 16mm² black insulated earth cable shall be installed from DB-A1 and reticulated to the new standby diesel generator via a new cable trench. 10mm² 4core from DB-A1 to DB-B normal section.

A new 2.5mm² 2core signal cable shall be installed and buried in sleeves from Generator panel to the Main DB.

Where the cables are positioned underground, they will be installed in a 110mm Upvc sleeve. Where positioned surface, they will be housed in P8000 trunking, and will be mounted into the Upvc sleeve, and will be sealed so as to not allow any water ingress. The trunking will be fixed in pairs at intervals of no further than 500mm spacing.

10.2.4 DISTRIBUTION BOARDS SCHEDULE

All new distribution boards shall be a surface mounted board, complete with lockable doors. They shall be painted purple for UPS supply and Signal red for Standby power as per DPW specification for distribution boards.

Item	DB Name	Fed From	Scope of Works
1	DB-A1 (New)	M D Box	New Main – Normal
			Install a DB-Main (New) as per SLD No: EE9718/D5.
2	DB -A	DB-A1 (New)	Main Emergency DB as per SLD No: EE9718/D6
			Upgrade existing DB-A to emergency
3	DB-B	DB-Main (New)	Remove existing Normal DB and replace with New Normal and Emergency DB
			New Normal and Emergency DB as per SLD No: EE9718/D7
4	DB-C	DB-B - EMERGENCY	Convert to DB-C mains supply to emergency
			Emergency section c/w load shedding relay as per SLD No: EE9718/D8

All Distribution boards shall be checked, tested and labelled as indicated on the drawings and listed in table above. All distribution boards shall comply with the latest SANS 10142-1 wiring code of premises.

10.2.5 LOW VOLTAGE CABLE SCHEDULE

Item	Cable Fed From	Cable Fed To	Cable
1	MD Box	DB-A1	existing cable to be disconnected and re connected to new DB-A1
2	DB-A1 (New)	40kVA Generator	25mm ² 4c Cu, PVC, SWA, PVC + 16mm ² BCEW
3	Generator	DB-A	25mm ² 4c Cu, PVC, SWA, PVC + 16mm ² BCEW
4	DB-A	DB-B Emergency Section	existing cable to be re-used - 35mm ² , 4core
5	DB-A1	DB-B Normal Section	10mm ² 4c Cu, PVC, SWA, PVC + 10mm ² BCEW
6	DB-B - Emergency	DB-C	cable existing

10.2.6 ROOM SCHEDULE

No	Description	Existing Equipment				New Equipment			
		Power Skirting		SSO		Power Skirting		SSO	
		Norm	Ded	Norm	Ded	Norm	Ded	Norm	Ded
1	Entrance	0	0	0	0	-	-	-	-
2	Vacant Room 4	0	0	2	1	1	1	-	-
3	Office 5	8	9	7	0	-	-	-	-
4	Office 6	0	0	2	1	1	1	-	-
5	Office 7	0	0	2	1	1	1	-	-
6	Office 8	1	1	1	1	-	-	-	-
7	Office 9	0	0	3	1	1	1	-	-
8	Office 12 (Server)	0	0	4	0	-	-	-	2
9	Office 16	0	0	5	0	1	1	-	1
10	Passage	0	0	2	0	-	-	-	-
11	Kitchen	0	0	4	0	-	-	1	-
12	Boardroom	2	2	5	0	3	3	2	-
13	Store room	0	0	2	0	-	-	-	-
14	Frontline Room 18	27	19	2	0	-	-	-	-
15	Clients Waiting Area	0	0	3	1	4	4	-	-
16	Shower	0	0	0	0	-	-	-	-
17	Clients Toilets	0	0	0	0	-	-	-	-
18	Staff Toilets	0	0	0	0	-	-	-	-
19	Garage	0	0	3	0	-	-	-	-

10.2.6 EARTH CONTINUITY TEST

The contractor shall allow for the supply and installation of a complete earthing system as indicated below.

The contractor shall install an earthing system in the concrete plinth. The contractor shall install two (2) earth studs 1.8 meters long on opposite corners of the concrete plinth into the ground. The earth studs shall be connected by means of a 70mm² bare copper earth wire to the main earth bar in the control panel. The earth conductor shall be connected to the earth bar, canopy, bass, skid and earth bar by means of suitably crimping lugs and brass bolts.

11 **MATERIAL SCHEDULE**

This schedule must be completed and returned with the tender.

Only one manufacturers name to be inserted next to each item:

	MATERIAL	MAKE OR TRADE NAME	IS MATERIAL TO SPECIFITION	COUNTRY OF ORIGEN
1.	P.V.C. conductors			
2.	P.V.C.SWA /ECC . cables			
3.	Circuit breakers			
4.	Distribution Boards			
5.	Joint Kits			
6.	Terminations			
7.	P8000 Trunking and accessories			

NOTE:

Tenderers are to note that under no circumstances may materials be installed other than offered in the above Material Schedule, which has been approved and accepted by the Department.

Should the successful tenderer wish to supply materials other than that originally offered, prior written approval must be obtained from the:

Director-General
Department of National Public Works
Private Bag X65
Pretoria
0001

Before any orders are placed.

TENDERERS SIGNATURE

SECTION B

SPECIFICATION FOR GENERATOR WORK

INDEX

<u>CLAUSE</u>	<u>DESCRIPTION</u>	<u>PAGE</u>
1.	GENERAL	11
2.	DELIVERY	11
3.	OUTPUT AND VOLTAGE	11
4.	CONSTRUCTION	11
5.	OPERATION	12
6.	ENGINE	12
7.	ALTERNATOR	15
8.	SWITCHBOARD	16
9.	INSTALLATION	20
10.	WARNING NOTICES	20
11.	DRAWINGS	20
12.	INFORMATION REQUIRED	20
13.	GUARANTEE	20
14.	MAINTENANCE	21
15.	TESTS	22
16.	ENCLOSURE	22
17.	PROGRAMMABLE CONTROLLER	24
18.	SITE CONDITIONS	27
19.	OUTPUT AND VOLTAGE	27
20.	THE ALARM DEVICE	27
21.	FUEL DRIP TRAY	27
22.	SPECIFIED GENERATOR SET	27

SPECIFICATION FOR THE SUPPLY, INSTALLATION AND COMMISSIONING OF DIESEL/ALTERNATOR GENERATING SETS

1. GENERAL

This section covers the Standard Specification for the supply, delivery and complete installation on site in full working order of diesel/alternator generating sets.

Full particulars, performance curves and illustrations of the equipment offered, must be submitted with the Tender. Tenderers may quote for their standard equipment, complying as closely as possible with this Specification, but any deviations from the specification must be fully detailed.

Supply, install, commission, test and maintain an emergency generating set at magistrate court. The generator set must be installed in a separate canopy/enclosure.

Note: The tenderer to note that the position of the emergency set is provisional and the final position of the enclosure will be determined on site with the successful tenderer and the Department's Representative.

2. DELIVERY

The successful Tenderer shall inform the Regional Representative of the Department, when the set is ready for installation.

3. OUTPUT AND VOLTAGE

The set shall have a site output and voltage as specified.

4. CONSTRUCTION

The engine and alternator of the set shall be built together on a common frame with anti-vibration mountings and contained in a 3CR12 canopy as specified. A galvanized or 3CR 12 drip tray must be fitted under the engine. The tray must be large enough to catch a drip from any part of the engine.

The frame must be of the "DUPLEX" type.

5. **OPERATION**

The set is required to supply the essential loads in the case of a mains power failure.

The set shall be fully automatic i.e. it shall start when any one phase of the main supply fails or get switched and shall shut down when the normal supply is re-established. In addition it shall be possible to manually start and stop the set by means of pushbuttons on the switchboard.

The automatic control shall make provision for three consecutive starting attempts. Thereafter the set must be switched off, and the start failure relay on the switchboard must give a visible and audible indication of the fault.

To prevent the alternator being electrically connected to the mains supply when the mains supply is on and vice versa, a safe and foolproof system (mechanical or electrical interlocking) of suitably interlocked contactors shall be supplied and fitted to the changeover switchboard.

Important Note

The Tenderer must submit, together with his offer, the design of the control system to comply with the requirements for automatic starting, stopping, interlocking and isolation as specified.

6. **ENGINE**

6.1 General

The engine must comply with the requirements laid down in SANS 8528 and must be of the atomized injection, compression ignition type, running at a speed not exceeding 1500 r.p.m. The engine must be amply rated for the required electrical output of the set, when running under the site conditions. The starting period for either manual or automatic switching-on until the taking over by the generating set, in one step, of a load equal to the specified site electrical output, shall not exceed 15 seconds. This must be guaranteed by the Tenderer.

Turbo-charged engines will only be accepted if the Tenderer submits a written guarantee that the engine can deliver full load within the specified starting period.

Curves furnished by the engine makers, showing the output of the engine offered against the speed, for both intermittent and continuous operation as well a fuel consumption curves when the engine is used for electric generation, must be submitted with the Tender.

6.2 Rating

The set shall be capable of delivering the specified output continuously under the site Conditions, without overheating. The engine shall be capable of delivering an output of 110% of the specified output for one hour in any period of 12 hours consecutive running in accordance with SANS 8528.

6.3 De-rating

The engine must be de-rated for the site conditions as set out in the Detail Specification, Clause 18 of this document.

The de-rating of the engine for site conditions shall be strictly in accordance with SANS 8528 as amended to date. Any other methods of de-rating must have the approval of the Department and must be motivated in detail. Such de-rating must be guaranteed in writing and proved by the successful Tenderer at the site test.

6.4 Starting and Stopping

The engine shall be fitted with an electric starter motor and be easily started from cold, without the use of any special ignition devices under summer as well as winter conditions.

6.5 Starter Battery

The set must be supplied with a fully charged lead-acid type battery, complete with necessary electrolyte. The battery must have sufficient capacity to provide the starting torque stipulated by the engine makers. The battery capacity shall not be less than 120 Ah and shall be capable of providing three consecutive start attempts from cold and thereafter a fourth attempt under manual control of not less than 20 seconds duration each. The battery must be of the heavy duty "low maintenance" type, housed in a suitable battery box.

6.6 Cooling

The engine may be either of the air or water cooled type. In the case of water-cooling, a built-on heavy duty, tropical type pressurized radiator must be fitted. Only stand-by sets that are water cooled shall have electric heaters.

For either method of cooling, protection must be provided against running at excessive temperatures. The operation of this protective device must give a visual and audible indication on the switchboard. Water-cooled engines shall in addition be fitted with a low water cut-out switch, installed in the radiator, to switch the set off in the event of a loss of coolant. The protection shall operate in the same way as the other cut-outs (eg. low oil pressure). All air ducts for the cooling of the engine are to be allowed for. The air shall be supplied from the cooling fan cowling/radiator face to air outlet louvers in the enclosure.

6.7 Lubrication

Lubrication of the main bearings and other important moving parts shall be by forced feed system. An automatic low oil pressure cut-out must be fitted, operating the stop solenoid on the engine and giving a visible and audible indication on the switchboard.

6.8 Fuel Pump

The fuel injection equipment must be suitable for operation with the commercial brands of diesel fuel normally available in South Africa.

6.9 Fuel Tank

The fuel tank shall be an integral part of the base frame of the generator set. The tank shall have sufficient capacity for standby sets to run the engine on full load for a period of 24 hours.

The diesel fuel storage system / tank which will be provided with the standby generator installation must be fitted with a fuel filtration and water separation system (filter & separator) which is entirely separate from the fuel supply line and line filter to the engine. This filtration

and water separation system must be dedicated to purifying the content of the storage system / tank by way of the cleaning processes which are applied while circulating the fuel through the filter & separator unit.

The filtration system must be able to handle diesel fuel of “high” and of “low” sulphur content for an indefinite period. The suction line of the system must be connected to the lowest part of the storage system / tank. The return line must be connected in the top section of the storage system / tank in such a position and in such a way that the flow of fuel within the storage system / tank between the fuel return point and the fuel suction point will induce scouring of the bottom of the system / tank to effectively capture sediment and water in the to be filtered fuel.

The filtration unit must filter the diesel fuel, removing suspended particles of effective diameters down to 5 micron. In addition, it must separate all water from the fuel and the fuel storage system and automatically dispose of / dump such water into an open, removable receptacle for disposal at the installation or in a suitable position outside the building. Separation of the fuel and water must be sufficiently effective that the discharged water will meet the standard required for it to be disposed of into a municipal drain and sewer system.

The filter and water separator unit must draw its power from the DC batteries used to power the relevant generator set. The circulating pump shall be provided with a controller programmed to switch the pump through not more than three complete on and off cycles of equal time (i.e. 50% on; 50% off) , per hour, with a deviation of not more than 10 % ±. The pump must be capable of a duty cycle of not less than 60% running time. The flow rate through the circulating pump must be between 1 L/min and 1.25 L /min.

The filter cartridge of the filter and water separator unit must be replaceable, and, in normal operational conditions, not require replacement within periods shorter than three months. The replacement units must be readily available.

The filtration & separator system may be mounted against the wall of the plant room or on the inside of a container, which may house the installation as may be specified elsewhere in this document.

The tank shall be fitted with a suitable filter, a full height gauge glass, “low fuel level” alarm, giving an audible and visible signal on the switchboard as well as a low-low fuel level cut-out.

An electrically operated pump with sufficient length of oil resistant hose to reach 2m beyond the door of the canopy/container, shall be supplied, for each set for filling the fuel tank/s from 200 litre drums.

The interconnection fuel piping shall consist of copper tubes and the connection to vibrating components shall be in flexible tubing with armoured covering.

The contractor shall allow for the supply and installation of a fuel shut off fusible link in the container. The fusible link shall shut off the fuel at a temperature of 130 degrees in an event of a fire in the self-contain enclosure. The fusible link shall be mounted above the engine and coupled to the shut off valve by means of a 2mm stainless steel cable. The cable shall be installed to the shut off valve without any possibility of kinking the cable which may cause malfunctioning of the protection device.

6.10 Fusible Fuel shut off link

The contractor shall allow for the supply and installation of a fuel shut off fusible link in the container. The fusible link shall shut off the fuel at a temperature of 130 degrees in an event of a fire in the self-contain enclosure. The fusible link shall be mounted above the engine and coupled to the shut off valve by means of a 2mm stainless steel cable. The cable shall be installed to the shut off valve without any possibility of kinking the cable which may cause malfunctioning of the protection device.

6.11 Governor

The speed of the engine shall be controlled by a governor in accordance with ECM of SANS 8528 if not otherwise specified in the Detailed Specification.

The permanent speed variation between no load and full load shall not exceed 4,5% of the nominal engine speed and the temporary speed variation shall not exceed 10%. External facilities must be provided on the engine, to adjust the nominal speed setting by $\pm 5\%$ at all loads between zero and rated load.

6.12 Flywheel

A suitable flywheel must be fitted, so that lights fed from the set will be free from any visible flicker.

The cyclic irregularity of the set must be within the limit laid down in SANS 8528.

6.13 Exhaust Silencer

It is essential to keep the noise level to 65dB at 5m from the unit. An effective stainless steel exhaust silencing system of the residential type must be provided and housed inside the containerized unit and shall be constructed of 304 stainless steel.

The exhaust system shall be installed in such a way that the expelled exhaust fumes will not cause discomfort to the public. The exhaust pipe must be flexibly connected to the engine to take up vibrations transmitted from the engine, which may cause breakage. The exhaust piping and silencer shall be lagged to reduce the heat and noise transmission in the generator enclosure.

Outside of the container, the exhaust to be protected to prevent the ingress of rain, installed at an angle of 45 degrees and extent 500mm above canopy.

6.14 Accessories

The engine must be supplied complete with all accessories, air and oil filters, 3 instruction manuals, spare parts lists, the first fill of all lubricating oils and diesel fuel etc.

7. ALTERNATOR

The alternator shall be of the self-excited brushless type, with enclosed ventilated drip-proof housing and must be capable of supplying the specified output continuously with a temperature rise not exceeding the limits laid down in SANS 60034-1 for rotor and stator windings.

The alternator shall be capable of delivering an output of 110% of the specified output, for one hour in any period of 12 hour in any period of 12 hours consecutive running.

Both windings must be fully impregnated for tropical climate and must have an oil resisting finishing varnish.

7.1 Regulation

The alternator must preferably be self-regulated without the utilisation of solid state elements. The inherent voltage regulation must not exceed plus or minus 5% of the nominal voltage specified, at all loads with the power factor between unity and 0,8 lagging and within the driving speed variations of 4,5% between no-load and full load.

7.2 Performance

The excitation system shall be designed to promote rapid voltage recovery following the sudden application of the full load. The voltage shall recover to within 5% of the steady state within 300 milli-seconds following the application of full load and the transient voltage dip shall not exceed 18%.

7.3 Coupling

The engine and alternator must be directly coupled by means of a high quality flexible coupling, ISO 9001:2000 approved and must be designed and manufactured to this quality system.

8. **SWITCHBOARD**

A switchboard must be supplied and installed to incorporate the equipment for the control and protection of the generating set and battery charging.

The switchboard must conform to the specification as set out in the following paragraphs.

8.1 Construction

The switchboard shall be enclosed in the steel enclosure.

All equipment, connections and terminals shall be easily accessible from the front and the front panels may be either hinged or removable with studs and chromium-plated cap nuts. Self-tapping screws shall not be used in the construction of the board.

All pushbuttons, pilot lights, control switches, instrument and control fuses, shall be mounted on hinged panels with the control wires in flexible looms.

The steelwork of the boards must be thoroughly de-rusted, primed with zinc chromate and finished with two coats of signal red quality enamel, or a baked powder epoxy coating. Suitably rated terminals must be provided for all main circuits and the control and protection circuits. Where cable lugs are used, these shall be crimped onto the cable strands. Screw terminals shall be of the type to prevent spreading of cable strands. All terminals shall be clearly marked.

For the control wiring, each wire shall be fitted with a cable or wire marker of approved type, and numbering of these markers must be shown on the wiring diagram on the switchboard. Control wiring shall be run in PVC trunking. The trunking shall be properly fixed to the switchboard steelwork. Adhesives shall not be acceptable for the fixing of trunking or looms.

The automatic control and protection equipment shall be mounted on a separate easily replaceable small panel with printed circuits. The equipment shall mainly be the "solid state" type. After mounting the equipment on the panel, the rear of this panel shall be sealed with epoxy-resin. However, other proven control systems may also be considered, but must be described in detail.

All equipment on the switchboard, such as contactors, isolators, busbars etc., shall have ample current carrying capacity to handle at least 110% of the alternator full load current.

8.2 Protection and Alarm Devices

All switchboards shall be equipped with protection and alarm devices as described below.

A circuit breaker and an adjustable current limiting protection relay must be installed, for protection of the alternator. The protection relay shall be of the type with inverse time characteristics. The relay shall cause the contactor to isolate the alternator and stop the engine.

Protection must be provided for overload, high engine temperature, low lubricating oil pressure, overspeed, start-failure, low water level.

Individual relays with reset pushes are required, to give a visible signal and stop the engine when any of the protective devices operate. In the case of manual operation of standby sets, it shall not be possible to restart the engine.

The indicators and re-set pushes must be marked in ENGLISH.

"OVERLOAD"

"TEMPERATURE HIGH"

"OIL PRESSURE LOW"

"OVERSPEED"

"START FAILURE"

"LOW WATER LEVEL"

In addition two relays with reset pushes must be fitted giving an audible and visible flashing signal, when:

- (a) The fuel level in the service tank is low. The reset push of this relay must be marked "FUEL LOW".

In addition, a low-low level sensor must be provided. At this level the engine must stop to prevent air entering the fuel system.

- (b) The battery charger failed. The reset push of this relay must be marked "CHARGER FAIL".

This is also applicable to the engine driven generator/alternator.

All relays must operate an alarm hooter. A pushbutton must be installed in the hooter circuit to stop the audible signal, but the fault indicating light on the control panel must remain lit until the fault has been rectified.

An on/off switch is not acceptable. After the hooter has been stopped, it must be re-set

automatically, ready for a further alarm.

The hooter must be of the continuous duty and low consumption type. Both hooter and protection circuits must operate from the battery.

Potential free contacts from the alarm relay must be brought down to terminals for remote indication of alarm conditions.

A test pushbutton must be provided to test all indicator lamps.

8.3 Manual Starting

Each switchboard shall be equipped with two pushbuttons marked "START" and "STOP" for manual starting and stopping of the set.

8.4 Battery Charging Equipment

Each switchboard shall be equipped with battery charging equipment.

The charger shall operate automatically in accordance with the state of the battery and shall generally consist of an air-cooled transformer, a full wave solid state rectifier, and the necessary automatic control equipment of the constant voltage system.

The charger must be fed from the mains. An engine driven alternator must also be provided for charging the battery while the set is operational. Failure of this alternator must also activate the battery charger failure circuit.

8.5 Switchboard Instruments

Each generating set shall have a switchboard equipped as follows:

- (a) One flush square dial voltmeter, reading the alternator voltage, scaled as follows:
 - (i) 0-300V for single phase generators
 - (ii) 0-500V for three phase generator. In this case a six position and off selector switch must be installed for reading all phase to phase and phase to neutral voltages.
- (b) A flush square dial combination maximum demand and instantaneous ampere meter for each phase, with re-settable pointer suitably scaled 20% higher than the alternator rating. A red arc stripe above the scale markings from 0-20A and a red radial line through the scale at full-load current shall be provided. This instrument shall be supplied complete with the necessary current transformer.
- (c) One flush square dial vibrating type frequency meter, indicating the alternator frequency.
- (d) A six digit running hour meter with digital counter, reading the number of hours the plant has been operating. The smallest figure on this meter must read 1-10th hour.
- (e) Fuses or m.c.b.'s for the potential circuits of the meters.
- (f) One flush square dial ampere meter suitably scaled for the battery charging current.
- (g) One flush square dial voltmeter with a spring-loaded pushbutton or switch for the battery voltage.

8.6 Markings

All labels, markings or instructions on the switchgear shall be in ENGLISH.

8.7 Earthing

An earth bar must be fitted in the switchboard, to which all non-current carrying metal parts shall be bonded. The neutral point of the alternator must be solidly connected to this bar by means of a removable link labeled "EARTH". Suitable terminals must be provided on the earth bar for connection of up to three earth conductors, which will be supplied and installed by others.

8.8 Operation Selector Switch

A four position selector switch must be provided on the switchboard marked "AUTO", "MANUAL", "TEST" and "OFF".

With the selector on "AUTO", the set shall automatically start and stop, according to the mains supply being available or not.

With the selector on "TEST", it shall only be possible to start and stop the set with the pushbuttons, but the running set shall not be switched the load.

With the selector on "MANUAL", the set must take the load when started with the pushbutton, but it must not be possible to switch the set on to the mains, or the mains onto the running set.

With the selector on "OFF", the set shall be completely disconnected from the automatic controls, for cleaning and maintenance of the engine.

8.9 Automatic Change-over System

A fully automatic change-over system must be provided to isolate the mains supply and connect the standby set to the outgoing feeder in case of a mains failure and reverse this procedure on return of the mains.

The contactors for this system must be electrically and mechanically interlocked.

As the main Automatic mains fail panel will be located in the new kiosk, the generator will have its own change over panel which would monitor when there is a mains or failure, and start or stop the generator, but all load switching will be carried out in the AMF panel.

8.10 Bypass switch and Mains Isolator

The switchboard shall be equipped with an on-load isolator to isolate the mains and a manually operated on-load 4 pole 4 position by-pass switch, which shall switch the connected loads as follows: NORMAL: will allow for the normal connection i.e. connects the incoming mains to the automatic control gear or directly to the outgoing feeder. In the GEN BY-PASS position the switch will disconnect the automatic changeover control gear, and will connect the municipal mains directly to the essential supply busbar which will allow for the maintenance of either or both the generator and the automatic changeover equipment. MAINS BY-PASS switching position would allow the generator to be connected directly to the essential supply busbar. This is when there is a problem with the automatic changeover equipment and there

is no municipal power available.

The final position is an OFF position which will remove all power downstream of this switch.

It is required that this by-pass switch and mains isolator be mounted away from the automatic control gear, in a separate compartment, either on the side or in the lower portion of the switchboard cubicle, and that the switches are operated from the front of the compartment. Contractor to note: The by-pass and mains isolator switch shall also break the main neutral.

8.11 Start Delay

Starting shall be automatic in event of a mains failure. A 0-15s adjustable, start delay timer shall be provided to prevent start-up on power dips or very short interruptions.

8.12 Stop delay

A stop delay with timer is required for the set, to keep the set on load for an adjustable period of one to sixty seconds after the return of the mains supply, before changing back to the supply. An additional timer shall keep the set running for a further adjustable cooling period of 5 to 10 minutes at no-load before stopping.

9. INSTALLATION

The tenderer will be responsible for tracing the main incoming cable. The contractor will then cut into this cable and with jointing will re-route these cables to the new main kiosk. He will then also be required to install the cable from the generator as well as the control cable from the main kiosk, including all terminations of all these cables. He will also have to supply and install the new main kiosk to be located in the new free standing C3R12 enclosure, and all the fixing thereof.

The connecting of the cable and control cabling to the generator and the control terminals in the LV board remains the responsibility also forms part of this tender.

10. WARNING NOTICES

Notices, in ENGLISH, must be installed on the outside of the steel enclosures.

The notice shall be made of a non-corrodible and non-deteriorating material, preferable plastic, and must read as follows:

DANGER: This engine will start without notice. Turn selector switch on control board to "OFF" before working on the plant.

11. DRAWINGS

The successful Tenderer must, as soon as possible after receipt of the order, submit detailed drawings and wiring diagrams of the plant and the switchgear. One diagram shall be contained in a metal pouch on the side of the switchboard.

12. INFORMATION REQUIRED FOR GENERATOR AND CANOPY

Tenderers must furnish detailed descriptions and illustrations of the equipment offered and must complete the questionnaire following this specification. This includes drawings of the switchboard layouts and control diagrams.

Failure to submit any of the information asked for, may disqualify the tender.

13. **GUARANTEE**

The successful Tenderer will be required to guarantee the complete plant for a period of 12 months from the date it has been taken over by the Department in running order.

If during this period the plant is not in working order, or not working satisfactorily owing to the faulty material, design or workmanship, the Contractor will be notified and immediate steps shall be taken by him to rectify the defects and/or replace the affected parts on site, at his own expense.

14. **MAINTENANCE**

14.1 **Initial Maintenance**

The successful Tenderer will be required to maintain the plant in good running order for a period of twelve months after the plant has been taken over by the Department. The full cost of this maintenance must be included in the tender price, inclusive of overheads and travelling fees. Apart from the consumables as detailed below, the department shall not acknowledge any cost claims additional to this maintenance cost as tendered.

However, should the Contractor fail to hand over the plant in good working order on expiry of the specified twelve months, the Contractor will be responsible for further monthly maintenance until final delivery is taken.

Under the agreement the Contractor will undertake at intervals as per the manufactured recommendations for a visit to the plant by a qualified member of his staff, who shall:

- (a) *Report to the Person-in-Charge, keeping the maintenance records, and enter into a log book the date of the visit, the tests carried out, the adjustments made, any further details that may be required.*
- (b) Grease and oil moving parts, where necessary.
- (c) Check the air filter and, when necessary, clean the filter and replace filter oil.
- (d) Check the lubricating oil and top-up when necessary
- (e) After the plant has run one oil change for the number of hours stipulated by the manufacturers, drain the sump and refill with fresh lubricating oil. The reading of the hour meter on the switchboard will be taken to establish the number of hours run by the plant.

Under this heading only the cost of the actual oil used, shall be charged as an extra on the monthly account.

- (f) Clean the lubricating oil filter and/or replace the filter element at intervals recommended by the engine manufacturer, the cost of a new filter element to be charged as an extra on the monthly account.
- (g) Check and when necessary adjust the valve settings and the fuel injection equipment.
- (h) Check the battery and top-up the electrolyte when necessary.
- (i) Test-run the plant for 0,5 hour and check the automatic starting with simulated faults on

the mains, the proper working of all parts, including the electrical gear, the protective devices with fault indicators, the changeover equipment and the battery charger. Make the necessary adjustments.

- (j) Report to the Department and to the contractor on any parts that become unserviceable through fair wear and tear, or damaged by causes beyond the control of the Contractor.
- (k) Advise the Department when it has become necessary to decarbonise the engine and submit a quotation for this service.
- (l) Top up the water of the radiator, if applicable.
- (m) Clean the plant and it's components.

14.2 Maintenance Agreement

- (a) After the lapse of the abovementioned 12 month period, the Contractor may be required to enter into a maintenance agreement, as described under Clause 14.1, initially for one year with a possible yearly renewal.
- (b) Acceptance of the tender shall not bind the Department to accept this maintenance service.

14.3 Instruction of Operator

After completion of the installation and when the plant is in running order, the successful Tenderer will be required to instruct an attendant in the operation of the plant, until he is fully conversant with the equipment and the handling thereof. The person will be identified by the Department's Regional Representative on site.

Three copies of a maintenance fault-localising and operating manual are to be handed over to the Department's representatives on site.

15. **TESTS**

The following tests are to be carried out:

- (a) At the supplier's premises, before the generating set is to be delivered to site. Representatives of the Department must be present during the test to satisfy themselves that the generating set complies with the specification and delivers the specified output. The test must be carried out in accordance with SANS 8528. The department must be advised timeously of the date for the test.
- (b) At the site after completion of the installation, all tests in (a) above shall again be carried out.

The dummy resistance for the load and all instruments which may be required for the tests have to be provided by the successful tenderer.

Test reports of both tests as specified under (a) and (b) are to be submitted to the Department.

16. **ENCLOSURE**

The standby set is a free standing unit and shall be mounted in an enclosure as detailed below:-

16.1 General

The enclosure, shall be completely vermin-proof, removable from the set and shall be constructed of 3CR12 stainless steel or equally approved of a minimum thickness of ± 1.5 mm.

The enclosure shall allow easy access to the engine, alternator, radiator filler cap and control cubicle for maintenance purposes.

The door shall be flush with the rest of the canopy and of the side opening type. A minimum of four doors are required i.e. two on either side.

The door hinges and locking bars shall be of a heavy duty type and be manufactured of an alloy or mild steel which is hot dip galvanized and shall be fitted with a grease nipple.

The doors and panels shall be suitably braced and stiffened to ensure rigidity and to prevent bending and warping.

Suitable door restraints shall be fitted to all the doors, enclosure including the control panel to prevent wind damage. The restraint shall consist of a steel rod in a steel groove or slide with a spring loaded catch, which is to be manually reset to close the door.

No flexible restraints will be accepted.

The diesel fuel level indicator and alternator rating plate shall be clearly visible with the doors open.

Unless specified the silencers shall be mounted within the enclosure.

Perforated sheeting shall be fitted over all the insulating material inside the canopy of all soundproof sets.

Rubber seals on doors shall be equal to or similar to rubber pinch weld, wind lace. (Max-nortons.).

16.2 Design

The enclosure shall be designed to be weather-proof and sound-proofing as specified. Rivets or self-tapping screws will under no circumstances be allowed for fixing the various sections of the enclosure. Only cadmium coated nuts and bolts are acceptable.

16.2 Roof

The roof of the enclosure shall be constructed for proper drainage of water as per the drawing.

16.4 Lamp fitting

A lamp fitting and its associated on/off door switch shall be provided inside the enclosure for illumination of the control panel.

The power for the lamp shall be obtained from the starter battery.

16.5 Sound-proofing

The sound-proofing on canopy engine sets shall be such that the maximum noise level generated by the set under any load condition shall not exceed 65 dB measured in any direction at a distance of 5m from the center of the set with the doors closed.

The supply and discharge air paths will require separate attenuators on soundproof sets.

16.6 Padlock and keys

The contractor shall supply padlocks and keys for all the doors of the enclosure. The padlock shall be off the “Viro A82 keyed alike with stainless steel shackles” type.

Suitable brass metal plates shall be installed behind each lock for the protection of the enclosure against scratching or damaging, where the locks are hanging.

17 PROGRAMMABLE CONTROLLER

- **Control Equipment Requirement**

The programmable controller shall be an electronic unit to match those of the other programmable controllers and of a high quality i.e Levato, Deep Sea Electronics, Circom.

- **Logging of Events**

All events relating to the status of the generator set shall be logged with date and time in a non-volatile memory (which can retain information for a period of 6 months in the absence of power to the controller) and the user shall be able to contain a hard copy on site.

Buffer erased on	97/04/17 at 07 H 44.34
Mains on load	97/04/17 at 07 H 44.29
Unit switched ON	97/04/17 at 06 H 30.55
Unit switched OFF	97/04/16 at 23 H 26.55
Low Fuel Level	
Alternator on load	97/04/16 at 21 H 44.53
Start attempts = 01	97/04/16 at 21 H 44.21
Mains phase 3 low	97/04/04 at 09 H 59.21
Mains on load	97/04/04 at 09 H 59.17
Unit Mode = Auto	97/04/04 at 09 H 50.00
Manual Stop	
Start attempts = 03	97/04/04 at 08 H 53.10
Manual Start	97/04/04 at 08 H 53.03
Unit Mode = Manual	
Alt phase 1 min = 221	
Alt phase 2 min = 224	
Alt phase 3 min = 222	
Alt phase 1 max = 236	
Alt phase 2 max = 237	
Alt phase 3 max = 238	97/03/27 at 10H 31.03
Alternator off	97/03/27 at 10 H 29.03
Mains on load	97/03/27 at 10 H 06.14
Alternator on load	
Start attempts = 02	

- **User Programmable**

The controller will be user programmable on site via a menu system with clear prompts for the required data and shall incorporate the following parameters:

Enter the user access code
#

System configuration for Unit no 1111	97/08/14 at 10H 27.58
Current time is:	(0 = No 1 = Yes)
Is this a service	(0 = No 1 = Yes)
Change this unit ID code?	(02.0 – 50.0V)
Low Battery crank level	(08.0 - 50.0V)
Low Battery standby level	(08.0 - 50.0V)
High Battery standby level	
Mains Low Voltage sense level	
Mains High Voltage sense level	
Alt Low Voltage sense level	
Alt High Voltage sense level	(0001 – 4900 rpm)
Engine Under speed RPM	(0001 – 4900 rpm)
Engine Over speed RPM	(0 = RPM, 1= Alt)
Speed Input	(001 – 180)
Number of Flywheel Teeth	(0 =NO, 1 = NC)
Spare Sensor No 1	(0 =NO, 1 = NC)
Spare Sensor No2	(0.5 to 60 seconds)
Start/Pre Heat Delay	(0.5 to 30 seconds)
	(1 – 20)
Crank Time/Delay	
Number of attempts to Start	(0.5 to 30 seconds)
Run up Delay	(0.5 to 60 seconds)
Load Transfer Delay	(0.5 to 30 minutes)
Mains Return Timer	(0.5 to 30 minutes)
Run on Timer	(0 =NO, 1 = NC)
High Engine Temp. Sensor	(0 =NO, 1 = NC)
Low Oil Pressure Sensor	(0 =NO, 1 = NC)
Heater Fault Sensor	(0 =NO, 1 = NC)
Low Fuel Sensor	(0 =NO, 1 = NC)
No Fuel Sensor	(0 =NO, 1 = NC)
Manual Start switch	(0 =NO, 1 = NC)
Manual Stop switch	(0 =NO, 1 = NC)
Emergency Stop switch	(0 =NO, 1 = NC)
Alternator Charge Sensor	(0 = Single, 1 = Three)
Phase Fault Check	(0 = No, 1 = Yes)
Set the Date and Time	(0 = No, 1 = Yes)
Change Unit Access Code	

NO for normally open and NC for normally closed contracts.

- **CONTROL SYSTEM DC SUPPLY VOLTAGE**

The control system must be able to operate with a minimum DC supply voltage of 4 volts (without making use of either an internal or an external auxiliary battery) to allow cranking and starting under conditions of low battery capacity. Control cables between the set and the control panel shall be fitted with sockets for ease of undoing in the event the set has to be removed.

- **RS 232 SERIAL PORT**

The control unit shall have an RS 232 serial port allowing various options to be added as listed below.

Equipment connected at each end of the RS 232 cable shall be adequately protected against transient over-voltages, lightning effects (particularly if the set and remote alarms are in separate buildings), switching surges, power system surges or mains and alternator borne noise/interference.

- **REMOTE ALARMS**

The Contractor shall provide a remote alarm mimic panel and the associated control wiring for the set. The panel shall be installed in the duty/security room at the entrance to the building approximately 70m from the generator set position.

The mimic panels must fit into furniture and blend with the design. Before manufacture, the Contractor shall submit and obtain the approval, from the Engineer, for the mimic panel.

The remote alarm must have potential free relay contacts which shall indicate the following on each set:

1. Mains on/off
2. Alternator running
3. Common fault alarm
4. Buzzer which can only be reset at the generator panel
5. Fuel low

The cable between the remote alarms is to be a signal cable with a screen and this option must be able to operate from a 12 / 24 V dc supply so that it can be powered from the generator set batteries.

A facility to originate a fault message should a warning or shutdown fault occur.

This option must be capable of operating at a maximum distance of 50 m from the set.

- **COMPUTER MODEM REMOTE CONTROL**

The facility shall be provided a remote control system which can be interrogated and controlled from a remote computer using a modem connected to a Telkom telephone line or cell phone modem. This modem shall be a Wavecom "fast track" modem.

Real time status of the control system including any fault conditions, mains voltages on all phases, battery voltage and if the set is running alternator voltages on all phases and set RPM/frequency.

A facility to download the event log.

A facility to allow the mode of the control system to be changed to any of the four modes to allow the set to be run from a remote location.

A facility to originate a call to the control cellular and to transfer a fault message should a warning or shutdown fault occur.

18. **SITE CONDITIONS**

The site conditions are as follows:-

- | | | | |
|-----|---------------------------------------|---|--|
| (a) | Altitude above sea level | : | 1399m (To be verified on site by contractor) |
| (b) | Maximum temperature | : | 45°C |
| (c) | Relative humidity at this temperature | : | 60% (To be verified on site by contractor) |

19. **OUTPUT AND VOLTAGE**

After the de-rating factors for the engine and generator due to site conditions have been taken into account, the set must have a site output and voltage as follows:-

- | | | | |
|-----|------------------|---|-------------------|
| (a) | Voltage | : | 400/230V/ 3 phase |
| (b) | Rating (standby) | : | 40 kVA |
| (c) | Power factor | : | 0.9 |
| (d) | Frequency | : | 50Hz |

The generating set shall be capable of accepting 70% of the specified site electrical output within 10 seconds after the starter motor is energized and the remaining 30%, 5 seconds thereafter, i.e. 100% load acceptance shall not exceed 15 seconds.

20. **THE ALARM DEVICE**

The audible alarm and red light shall be of the weatherproof type and shall be installed on the exterior of the enclosure.

21. **FUEL DRIP TRAY**

A galvanized or 3CR12 drip tray approximately 100mm deep shall be mounted below the fuel tank and must be large enough to collect any fuel that drips from the tank accessories. The drip tray shall be manufactured from mild steel. The thickness of the drip tray sheet steel shall not be less than 2mm.

22.1 **SPECIFIED GENERATOR SET**

22.1.1 Engine

- Compact and extremely smooth running
- Low emission levels
- Quiet running – low noise levels
- Fast and easy all weather starting
- Convenient “one side” maintenance for easy economical servicing
- Direct injection system

22.1.2 Alternator

- Brushless
- Self exciting
- Automatic voltage regulation
- High motor starting capacity
- Excellent wave form for sensitive loads
- Full load recovery in less than 0.3 seconds

22.1.3 Units

- Compact sturdy skid base
- Large fuel tank integrated into base
- Circuit breaker protected alternator
- Compact for easy transport
- Custom designed panel
- Twelve month warranty on complete unit

22.2 **GENERATOR SET SPECIFIED**

ALTERNATOR	
Type	
Power factor - %	
Voltage regulation	
Insulation	
AC volts	
Phase	
Frequency	
Standby power kVA	
Prime power kVA	
ENGINE	
Type	
Cooling system	
Lubrication system	
Starting system	
Air cleaner	
Instrumentation	
No. of cylinders	
Cylinder - Bore x stroke - mm	
Displacement – cm ³	
Standby power – kW	
Prime power – kW	
UNIT (approximate)	
Fuel tank capacity – liters	
Fuel consumption – l/hr.	
Continuous operating hours per fuel tank (rated)	
Dry mass - kg excluding enclosure	
Dimensions (l x w x h) - mm	

22.3 **GENERATOR SET OFFERED**

SCHEDULE OF INFORMATION

(To be completed by Tenderer)

A. ENGINE

NO.	ITEM	REMARKS
1.	Manufacturer's Name	
2.	Country of Origin	
3.	Manufacturer's model number and year of manufacture	
4.	Continuous sea level rating after allowing for ancillary equipment:	
5.	Percentage derating for site conditions, in accordance with SANS 8528 a) For altitude b) For temperature c) For humidity d) Total derating	
6.	Nett output on site in kW	
7.	Nominal speed in r.p.m.	
8.	Number of cylinders	
9.	Stroke per working cycle	
10.	Stroke in mm	
11.	Cylinder bore in mm	
12.	Swept volume in cm ³	
13.	Mean piston speed in m/min	
14.	Compression ratio	
15.	Cyclic irregularity	
16.	Fuel consumption of the complete generating set on site in l/h of alternator output at: a) Full load b) 3/4 load c) 1/2 load NOTE: A tolerance of 5% shall be allowed above the stated value of fuel consumption	

NO.	ITEM	REMARKS
17.	Make of fuel injection system	
18.	Capacity of fuel tank in liters	
19.	Is gauge glass fitted to tank?	
20.	Is electric pump for filling the fuel tank included?	
21.	Method of starting	
22.	Voltage of starting system	
23.	Method of cooling	
24.	Type of radiator if water-cooled	
25.	Type of heater for warming cylinder heads	
26.	Capacity of heater in kW	
27.	Method of protection against high temperature	
28.	Method of protection against low oil pressure	
29.	Type of governor	
30.	Speed variation in % a) Temporary b) Permanent	
31.	Minimum time required for assumption of full load in seconds	
32.	Recommended interval in running hours for: a) Lubricating oil change b) Oil filter element change c) Decarbonising	
33.	Type of base	
34.	Can plant be placed on solid concrete floor?	
35.	Are all accessories and ducts included?	
36.	Is engine naturally aspirated?	
37.	Are performance curves attached?	

NO.	ITEM	REMARKS
38.	Diameter of exhaust pipe	
39.	Noise level 5m from unit in dB	
40.	Noise level at tail of exhaust pipe in dB	
41.	BMEP (4stroke) at continuous rating (kPA)	
42.	% Load acceptance to SANS 8528, with 10% transient speed droop	

B: ALTERNATOR

NO.	ITEM	REMARKS
1.	Maker's Name and model no.	
2.	Country of Origin and year of manufacture	
3.	Type of enclosure	
4.	Nominal speed in r.p.m.	
5.	Number of bearings	
6.	Terminal voltage	
7.	Sea level rating kVA at 0,8 power factor	
8.	Derating for site conditions	
9.	Input required in kW	
10.	Method of excitation	
11.	Efficiency at 0,8 power factor and: a) Full load b) 3/4 load c) 1/2 load	
12.	Maximum permanent voltage variation in %	
13.	Transient voltage dip on full load	
14.	Voltage recovery on full load application in milli-seconds	

15.	Is alternator brushless?	
16.	Class of insulation of windings	
17.	Is alternator tropicalized?	
18.	Symmetrical short circuit current at terminals in Ampere	
19.	Type of Coupling	

C. SWITCHBOARD

NO.	ITEM	REMARKS
1.	Maker's Name	
2.	Country of Origin	
3.	Is board floor mounted?	
4.	Finish of board	
5.	Make of volt, amp., and frequency meters	
6.	Dial size of meters in mm	
7.	Scale range of voltmeter	
8.	Scale range of ammeters	
9.	Ratio of current transformers	
10.	Make of hour meter	
11.	Range of cyclometer counter	
12.	Smallest unit shown on counter (Item 11)	
13.	Make of circuit breaker	
14.	Type of circuit breaker	
15.	Rating of circuit breaker in Amp and fault level in kA	
16.	Setting range of overload trips	
17.	Setting range of instantaneous trips	
18.	Make of change-over equipment	
19.	Make of voltage relay	
20.	Is control and protection equipment mounted on a small removable panel?	

21.	Type of control equipment	
22.	Make of mains isolator	
23.	Type of indicators for protective devices	
24.	Make of rectifier	
25.	Type of rectifier	
26.	Is battery charging automatic?	

NO.	ITEM	REMARKS
27.	Are volt and ammeters provided for charging circuit?	
28.	Is the alarm hooter of the continuous duty type?	
29.	Rating in Amps of: a) Change-over equipment b) Mains on load isolator c) By-pass switch d) Circuit breaker to outgoing fee	

D. BATTERY

NO.	ITEM	REMARKS
1.	Maker's Name	
2.	Country of Origin	
3.	Type of battery	
4.	Voltage of battery	
5.	Number of cells	
6.	Capacity in cold crank amp.	
7.	Battery Charging Unit. Voltage and Amp rating	

E. DIMENSIONS

NO.	ITEM	REMARKS
1.	Overall dimensions of set in mm	
2.	Overall mass	
3.	Is plant room adequate for the installation of the set, switch board and fuel tank.	

F. DEVIATION FROM THE SPECIFICATION (State briefly)

NO.	DESCRIPTION

G. GUARANTEE

NO.	ITEM	REMARKS
1.	Guarantee period in months	
2.	State conditions of guarantee	

H. SPARE PARTS AND MAINTENANCE FACILITIES

NO.	ITEM	REMARKS
1.	Approximate value of spares carried in stock for this particular diesel engine and alternator	
2.	Where are these spares held in stock	
3.	What facilities exist for the servicing of the equipment offered	
4.	Where are these facilities available	

I. SWITCHBOARD

NO.	ITEM	REMARKS
1.	Is manufacture of switchboard/control panel to be sub-let?	
2.	If yes, state name and address of specialist manufacturer	

4. DRAWINGS

4.1 DRAWING SCHEDULE

Drawing No.	Description	Revision	Remarks
EE 20238/1	Site Location Plan Electrical Layout	C	For Tender
EE 20238/ES1	Standby Generator Concrete Plinth Layout	C	For Tender
EE 20238/ES2	Standby Generator Foundation Layout	C	For Tender
	Existing		
EE 20238/D1	DB - A – Schematic (Main DB)	C	For Tender
EE 20238/D2	DB - B – Schematic (Sub-DB)	C	For Tender
EE 20238/D3	DB - C – Schematic (Sub-DB)	C	For Tender
EE 20238/D4	DB – GH Schematic (Gate House DB)	C	For Tender
	New		
EE 20238/D5	New DB - A 1– Schematic (Main DB)	C	For Tender
EE 20238/D6	DB – A (Upgraded)– Schematic (Main DB)	C	For Tender
EE 20238/D7	New DB - B – Schematic (Sub-DB)	C	For Tender
EE 20238/D8	DB – C (Upgrade) – Schematic (Sub-DB)	C	For Tender

SUPPLY, DELIVERY, INSTALLATION AND COMMISSIONING EMERGENCY GENERATOR SET INCLUDING ELECTRICAL INSTALLATION

4.2 DRAWING ISSUE

Drawing No.	Description	Revision	Remarks
EE 20238/1	Site Location Plan Electrical Layout	C	For Tender
EE 20238/ES1	Standby Generator Concrete Plinth Layout	C	For Tender
EE 20238/ES2	Standby Generator Foundation Layout	C	For Tender
	Existing		
EE 20238/D1	DB - A – Schematic (Main DB)	C	For Tender
EE 20238/D2	DB - B – Schematic (Sub-DB)	C	For Tender
EE 20238/D3	DB - C – Schematic (Sub-DB)	C	For Tender
EE 20238/D4	DB – GH Schematic (Gate House DB)	C	For Tender
	New		
EE 20238/D5	New DB - A 1– Schematic (Main DB)	C	For Tender
EE 20238/D6	DB – A (Upgraded)– Schematic (Main DB)	C	For Tender
EE 20238/D7	New DB - B – Schematic (Sub-DB)	C	For Tender
EE 20238/D8	DB – C (Upgrade) – Schematic (Sub-DB)	C	For Tender

5. BILL OF QUANTITIES

Kalafong Road

Kalafong Road

LEGEND



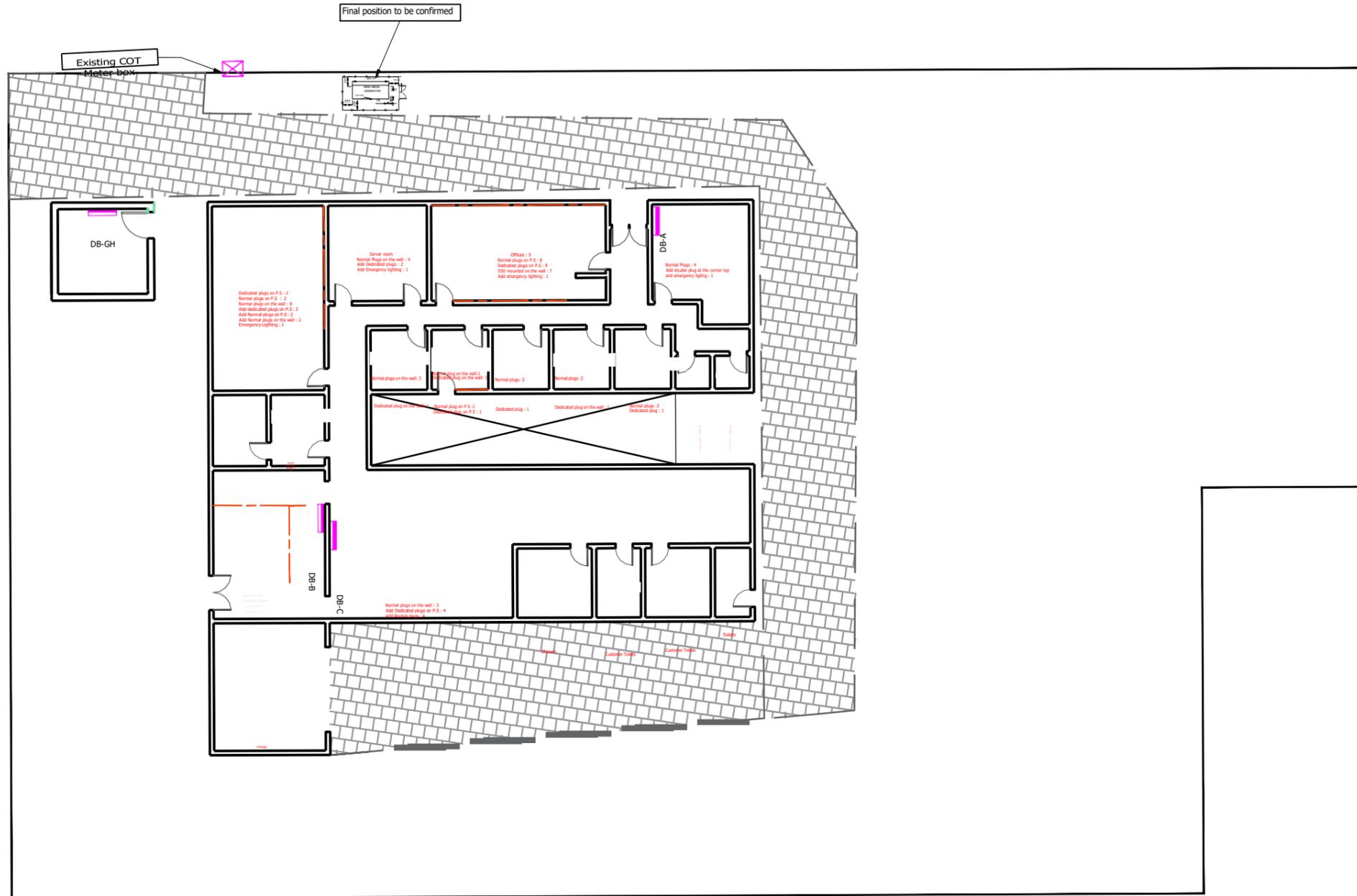
Electrical Distribution Board



Metering Kiosk



Development Boundary



NO.	DATE	AMENDMENT	U.P.N.
TD	18/10/2023	Issued for Tender.	

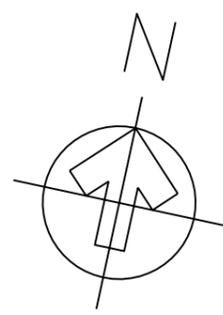
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Discipline

ELECTRICAL

Service

ATTERIDGEVILLE LABOUR CENTRE
STANBY GENERATOR ELECTRICAL
INSTALLATION SERVICES

WCS number

WCS 056746

Drawing Title

SITE LOCATION PLAN
ELECTRICAL LAYOUT

Ref. No

2323

Designed

MP

Scale

1:250

Drawn

MP

Date

04-09-2023

Checked

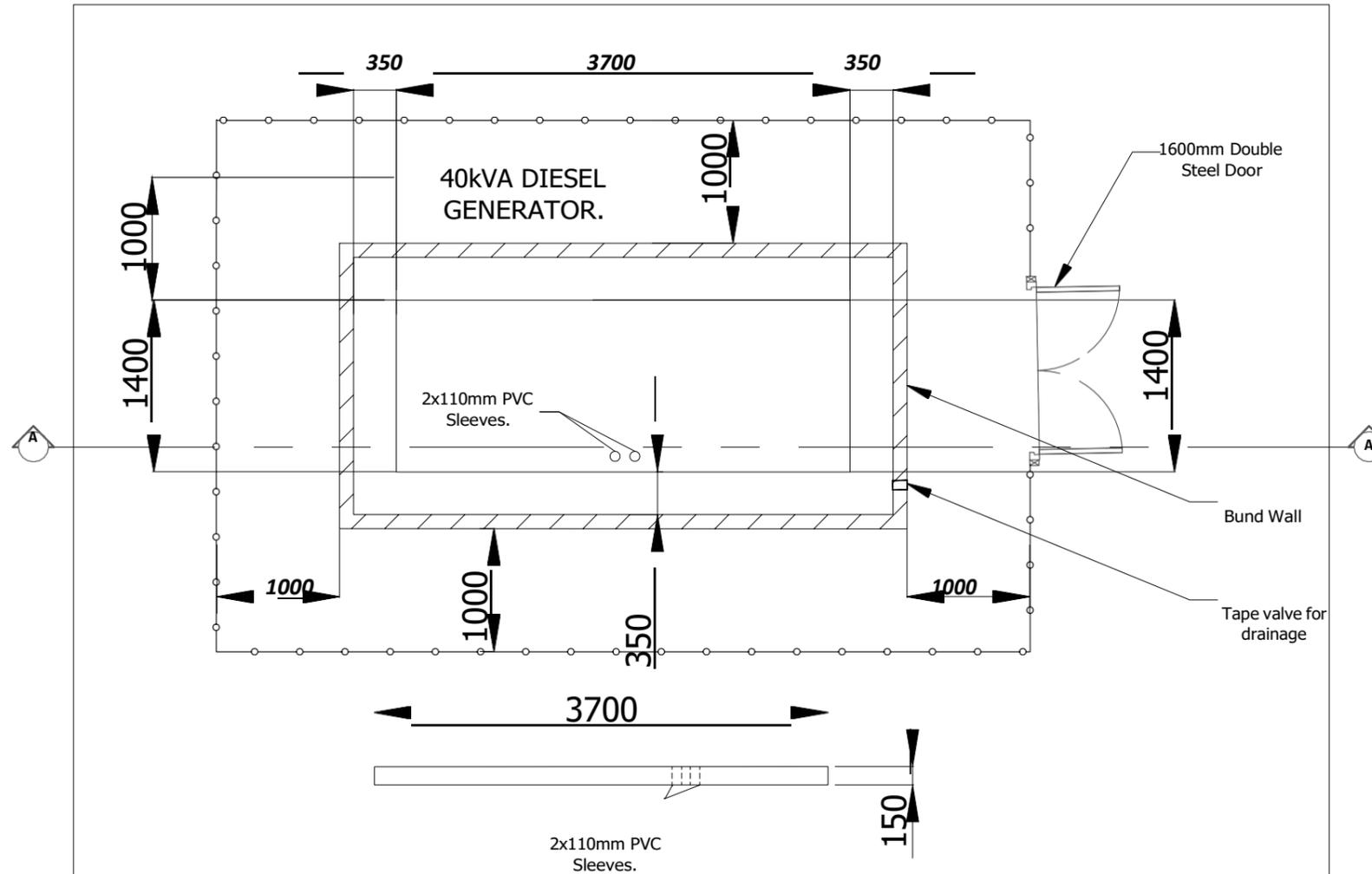
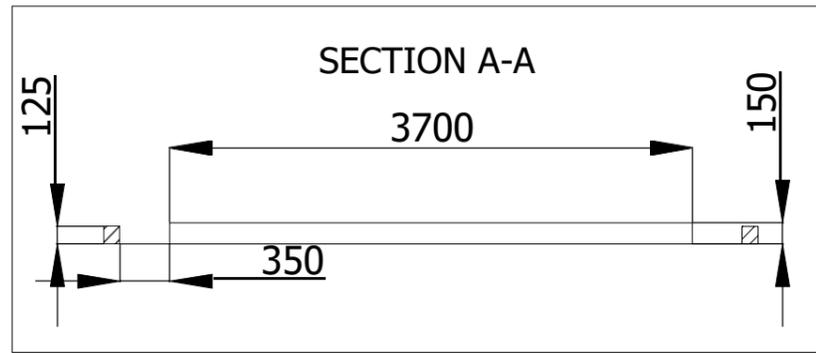
PM

Type Number

Drawing Number

EE 20238/1

Rev.TD



DETAIL 'A'
STANDBY DIESEL GENERATOR
CONCRETE PLINTH

**FINAL POSITION SETTING
OUT ON SITE TO BE
AGREED
WITH ENGINEER ON SITE.**

NO.	DATE	AMENDMENT	U.P.N.
TD	18/10/2023	Issued for Tender.	

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Discipline
ELECTRICAL

Service
**ATTERIDGEVILLE LABOUR CENTRE
STANBY GENERATOR ELECTRICAL
INSTALLATION SERVICES**

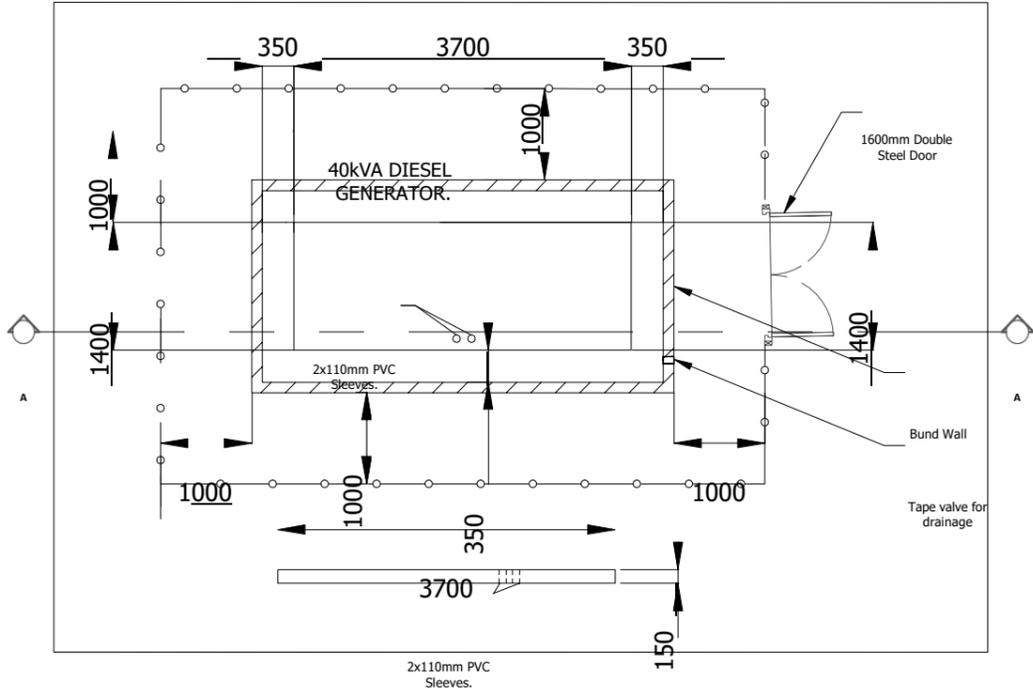
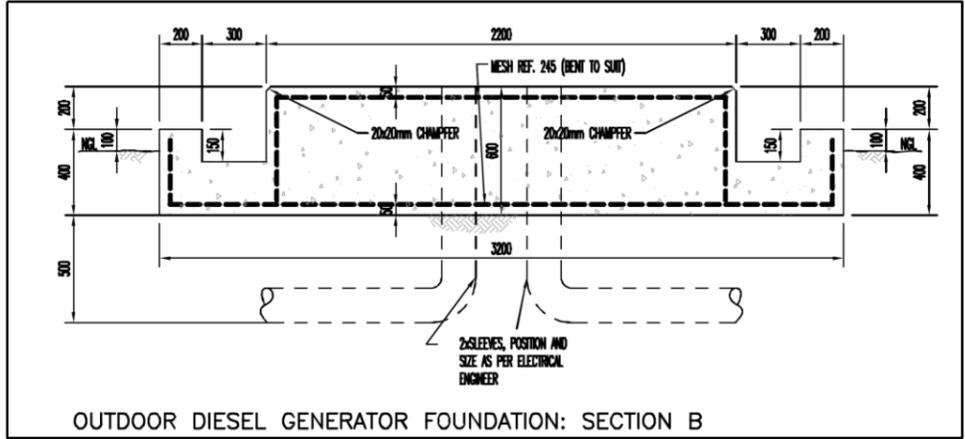
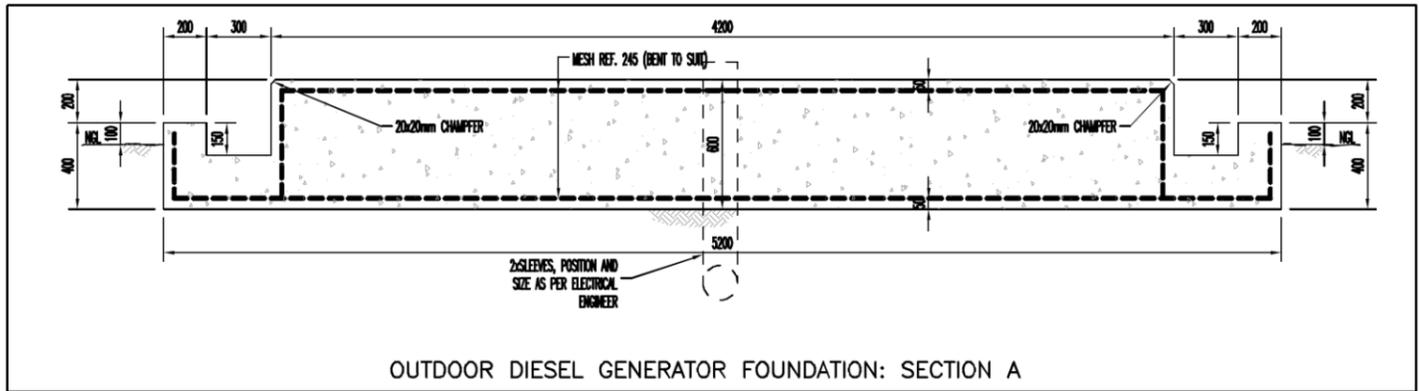
WCS number
WCS 056746

Drawing Title
**STANDBY GENERATOR
CONCRETE PLINTH
LAYOUT**

Ref. No 2323	Designed MP
Scale NTS	Drawn MP
Date 04-09-2023	Checked PM
Type Number	

Drawing Number
EE 20238/ES1

Rev.TD



NOTE:
 1. 25 Mpa CONCRETE/19mm STONE
 2. POLISHED PLASTER FINISH (STEEL FLOAT)
 3. EARTHWORKS:-
 -EXCAVATE 450mm DEEP MINIMUM, TO WASTE OR STOCKPILE
 -RIP AND RE-COMPACT INSITU LAYER TO 90% MODAASHTO
 -IMPORT G5 MATERIAL OR INSITU 150mm LAYERS COMPACTED TO 93% MODAASH TO
 4. A TAP TO BE PROVIDED (NOT INDICATED) TO DRAIN ALL THE WATER THAT ACCUMULATES INSIDE THE BUND WALL.FINAL POSITION OF TAP WILL BE DETERMINED ON SITE
 5. BUND WALL TO BE PROVIDED SHALL CONTAIN 110% OF THE FUEL, OIL AND WATER CAPACITY OF THE GENERATOR. THE BUND WALL SHALL NOT CONSTRAIN THE CANOPY DOORS FROM OPENING COMPLETELY

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Discipline
ELECTRICAL
 Service
**ATTERIDGEVILLE LABOUR CENTRE
 STANBY GENERATOR ELECTRICAL
 INSTALLATION SERVICES**

WCS number
 WCS 056746

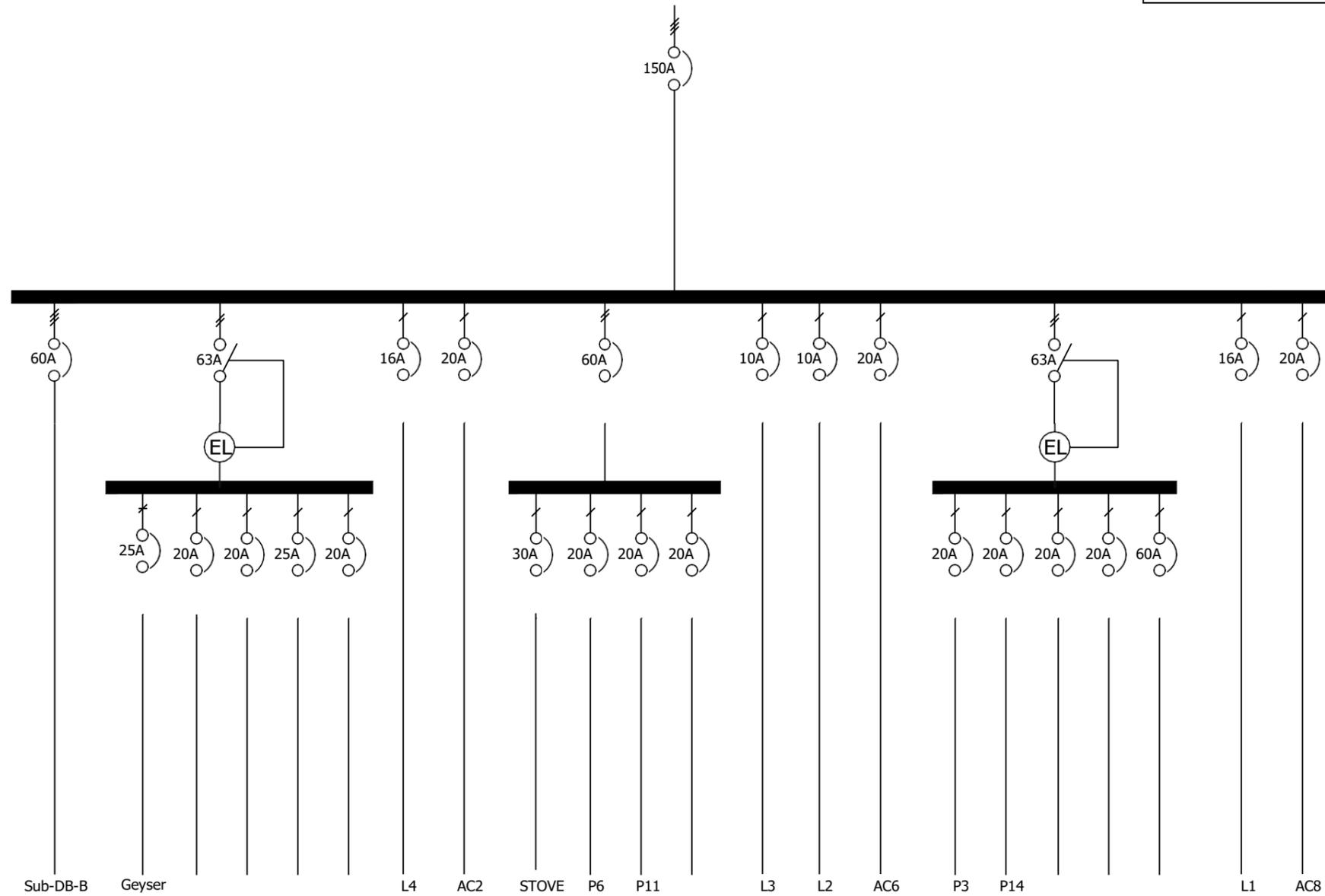
Drawing Title
**TYPICAL FOUNDATION
 DIESEL GENERATOR
 LAYOUT**

Ref. No	2323	Designed	MP
Scale	NTS	Drawn	MP
Date	04-09-2023	Checked	PM
Type Number			

Drawing Number
 EE 20238/ES2
 Rev.TD

EXISTING DB-A

Fed from Council Meter box



ELECTRICAL LEGEND	
	SURGE ARRESTOR
	2 POLE 1PH BREAKER
	1 POLE 1PH BREAKER
	EARTH LEAKAGE UNIT
	3PH ISOLATOR
	3PH BREAKER

NO.	DATE	AMENDMENT	U.P.W.
TD	18/10/2023	Issued for Tender.	

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Discipline: **ELECTRICAL**

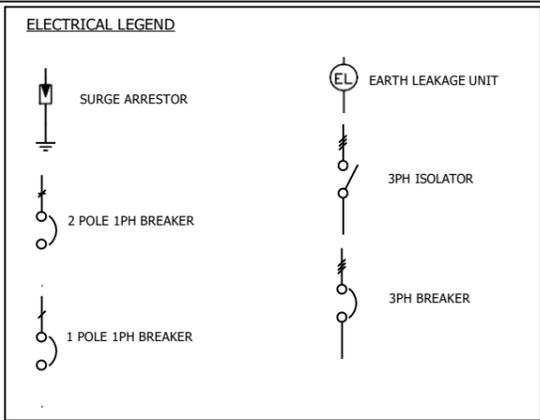
Service: **ATTERIDGEVILLE LABOUR CENTRE STANBY GENERATOR ELECTRICAL INSTALLATION SERVICES**

WCS number: **WCS 056746**

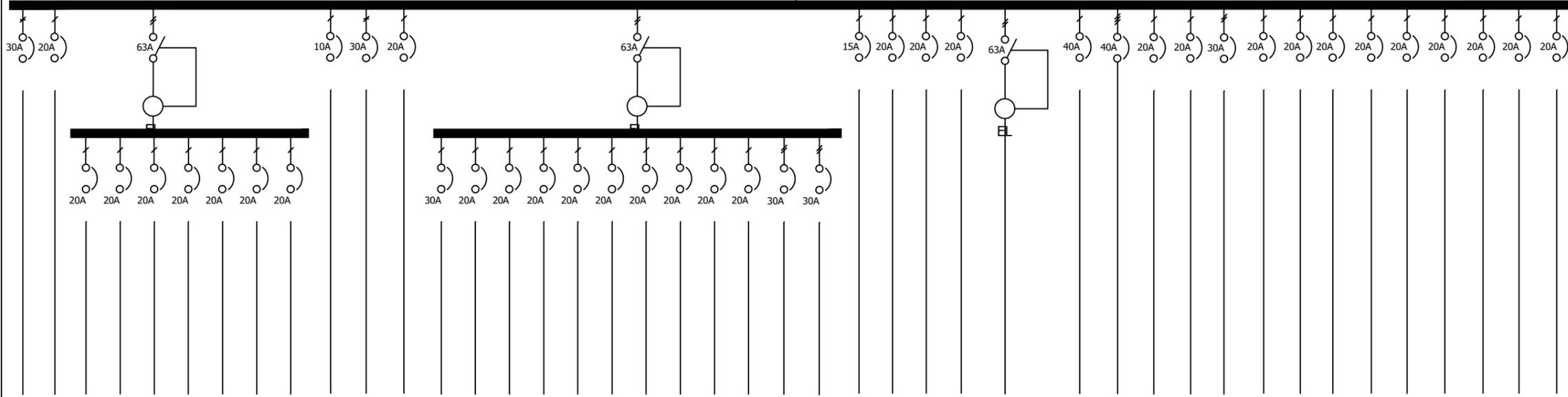
Drawing Title: **EXISTING DB-A SINGLE LINE DIAGRAM**

Ref. No	Designed
2323	MP
Scale	Drawn
NTS	MP
Date	Checked
04-09-2023	PM
Type Number	
Drawing Number	Rev. TD
EE 20238/D1	

EXISTING DB-B



Fed from DB-A

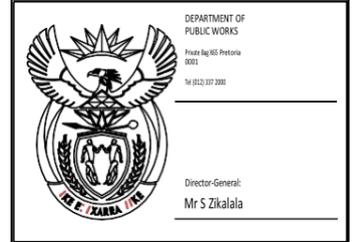


AC1 Spare P3 P7 P1 P10 P14 P14 L3 Spare P1 P1 P6 P5 P11 P15 AC4 P2R P5R DB-GH DB-C AC5 Spare AC3 P3R Toilet AC9 AC8

NO.	DATE	REVISION	BY
TD	08/10/2023	Issued for Tender.	

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Discipline
ELECTRICAL

Service
ATTERIDGEVILLE LABOUR CENTRE STANBY GENERATOR ELECTRICAL INSTALLATION SERVICES

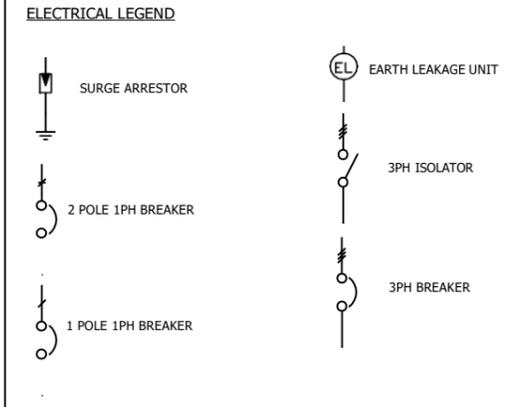
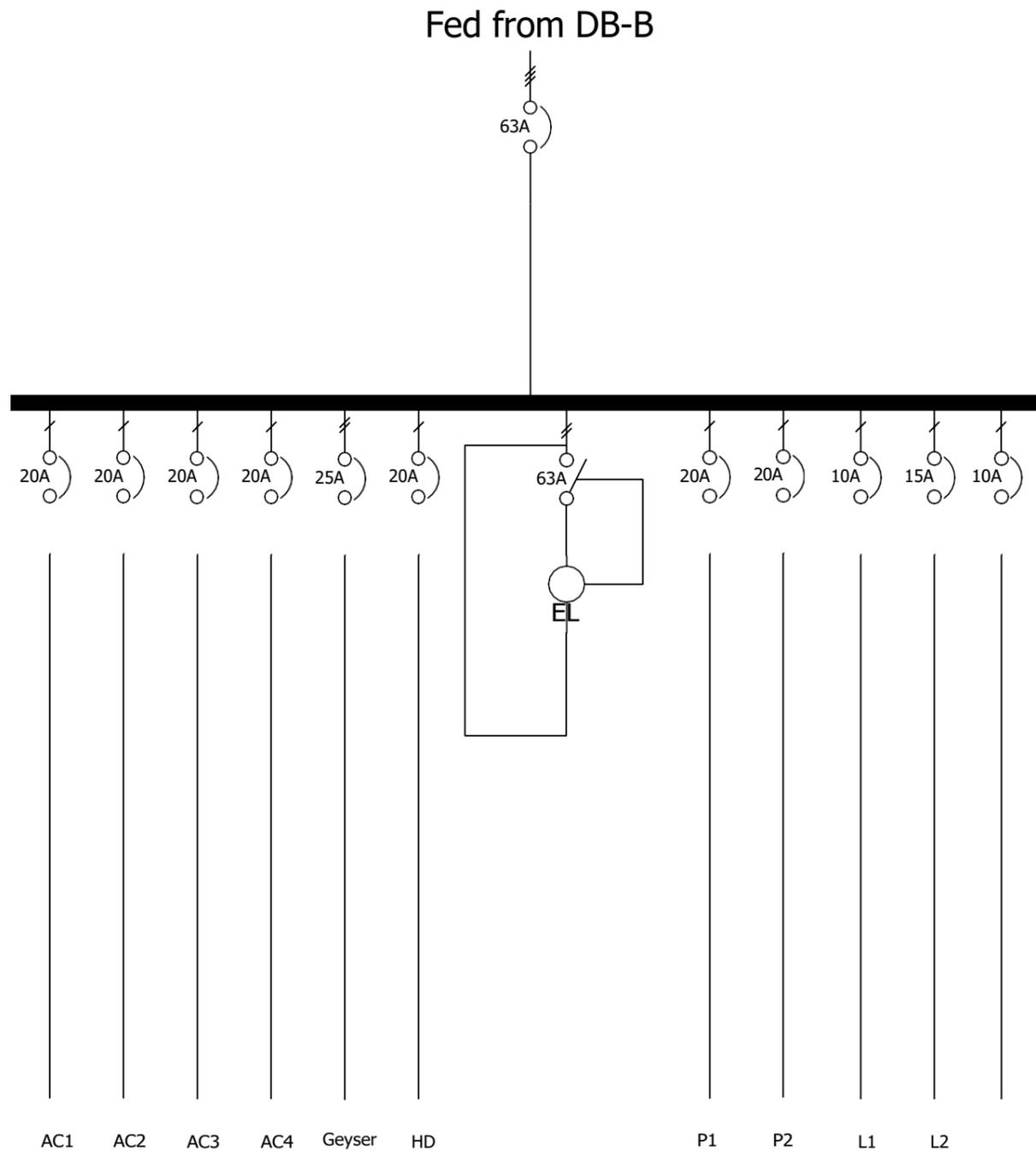
WCS number
WCS 056746

Drawing Title
EXISTING DB-B SINGLE LINE DIAGRAM

Ref. No	Designed
2323	MP
Scale	Drawn
NTS	MP
Date	Checked
04-09-2023	PM

Type Number
Drawing Number
EE 20238/D2 Rev. TD

EXISTING DB-C



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TD	08/10/2023	Issued for Tender.	

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Discipline
ELECTRICAL

Service
**ATTERIDGEVILLE LABOUR CENTRE
 STANBY GENERATOR ELECTRICAL
 INSTALLATION SERVICES**

WCS number
 WCS 056746

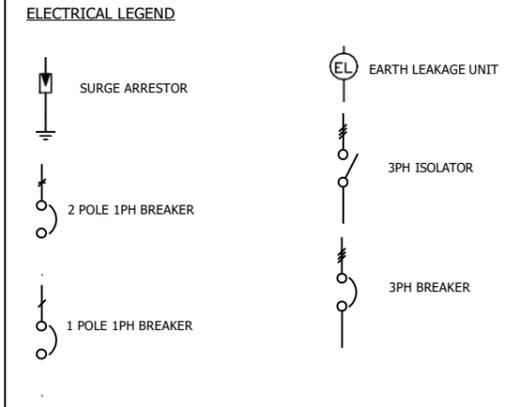
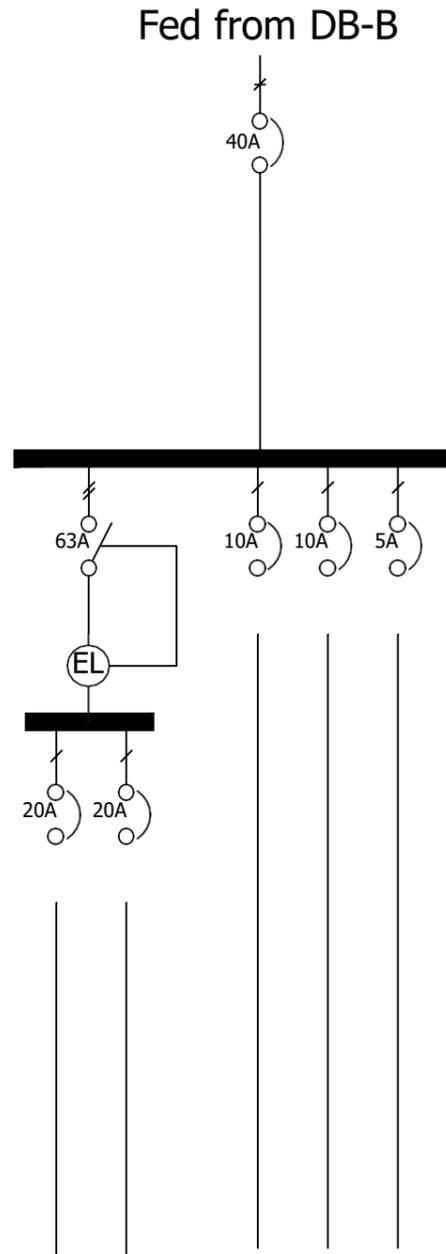
Drawing Title
**EXISTING DB-C
 SINGLE LINE DIAGRAM**

Ref. No	Designed
2323	MP
Scale	Drawn
NTS	MP
Date	Checked
04-09-2023	PM
Type Number	

Drawing Number
 EE 20238/D3

Rev. TD

EXISTING DB-GH



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TD	08/10/2023	Issued for Tender.	

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Discipline
ELECTRICAL

Service
ATTERIDGEVILLE LABOUR CENTRE STANBY GENERATOR ELECTRICAL INSTALLATION SERVICES

WCS number
 WCS 056746

Drawing Title
EXISTING DB GATE HOUSE SINGLE LINE DIAGRAM

Ref. No	Designed
2323	MP
Scale	Drawn
NTS	MP
Date	Checked
04-09-2023	PM
Type Number	

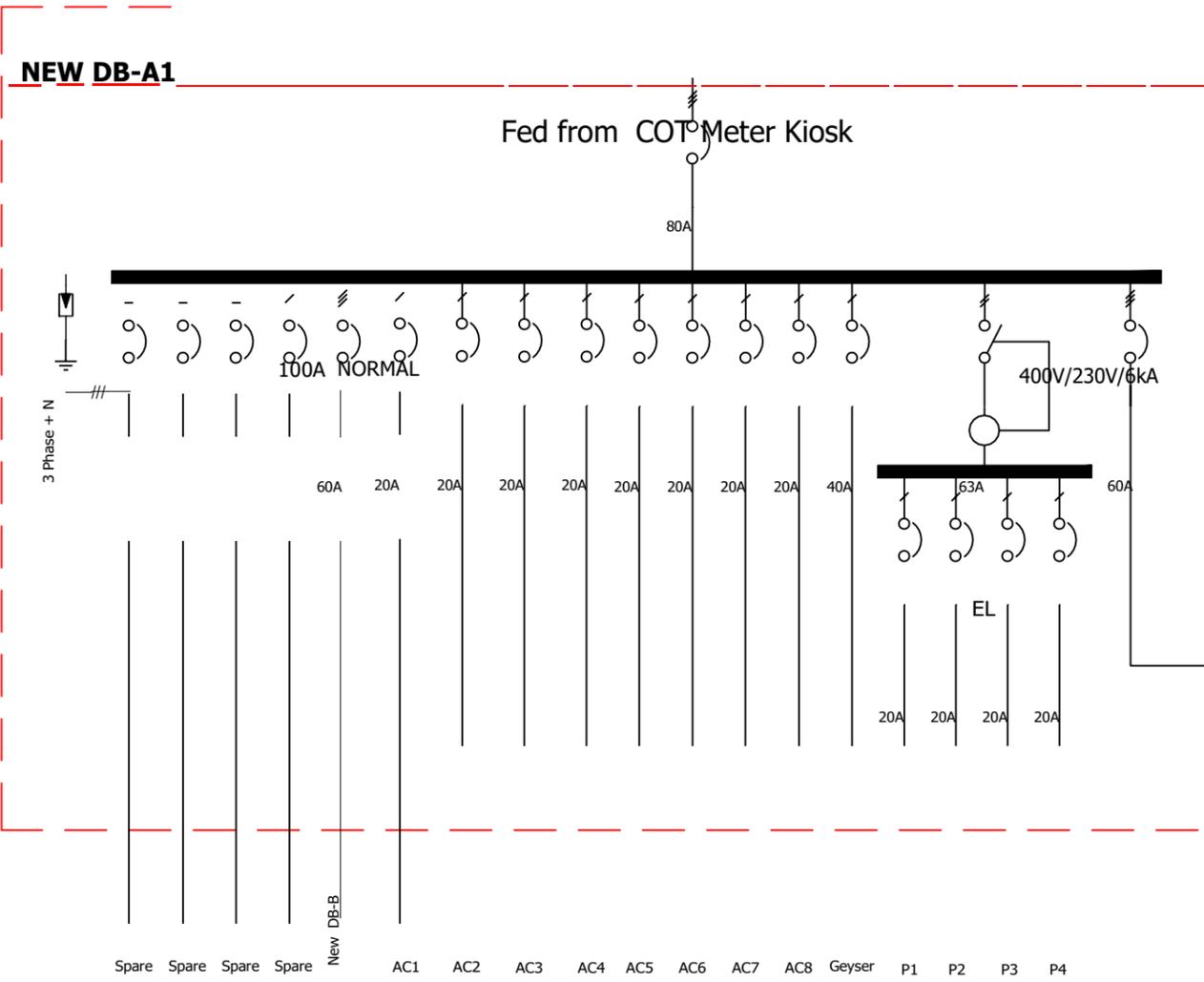
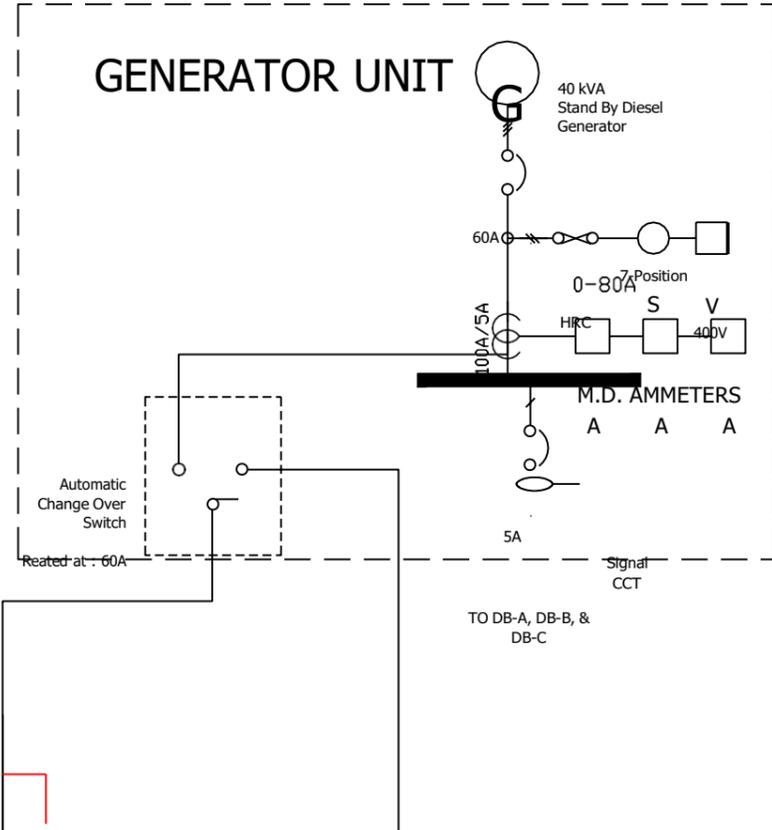
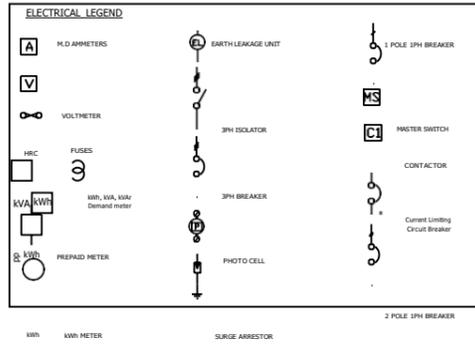
Drawing Number
 EE 20238/D4 Rev. TD

NOTES

Type: Surface mounted with lockable doors.
 Colour: Normal section - Epoxy powder coated
 Electric orange
 Emergency section - Red

Capacity: Provide 25% spare capacity

All equipment to be of the same manufacturer and SABS approved.



TO DB-A EXISTING TO BE UPGRADED TO STANDBY MAINS

NO.	DATE	AMENDMENT	D.P.N.
TD	08/10/2023	Issued for Tender.	

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Cad File Name

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Discipline
ELECTRICAL

Service
ATTERIDGEVILLE LABOUR CENTRE STANBY GENERATOR ELECTRICAL INSTALLATION SERVICES

WCS number
 WCS 056746

Drawing Title
NEW DB-A1 SINGLE LINE DIAGRAM

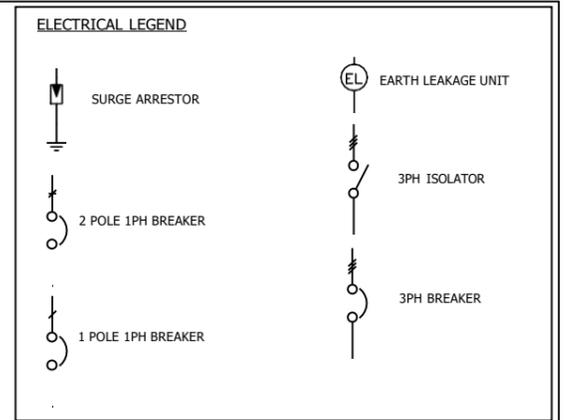
Ref. No	Designed
2323	MP
Scale	Drawn
NTS	MP
Date	Checked
04-09-2023	PM
Type Number	

NOTES

Type: Flush mounted with lockable doors.
 Colour: Emergency section - Red

Capacity: Provide 25% spare capacity

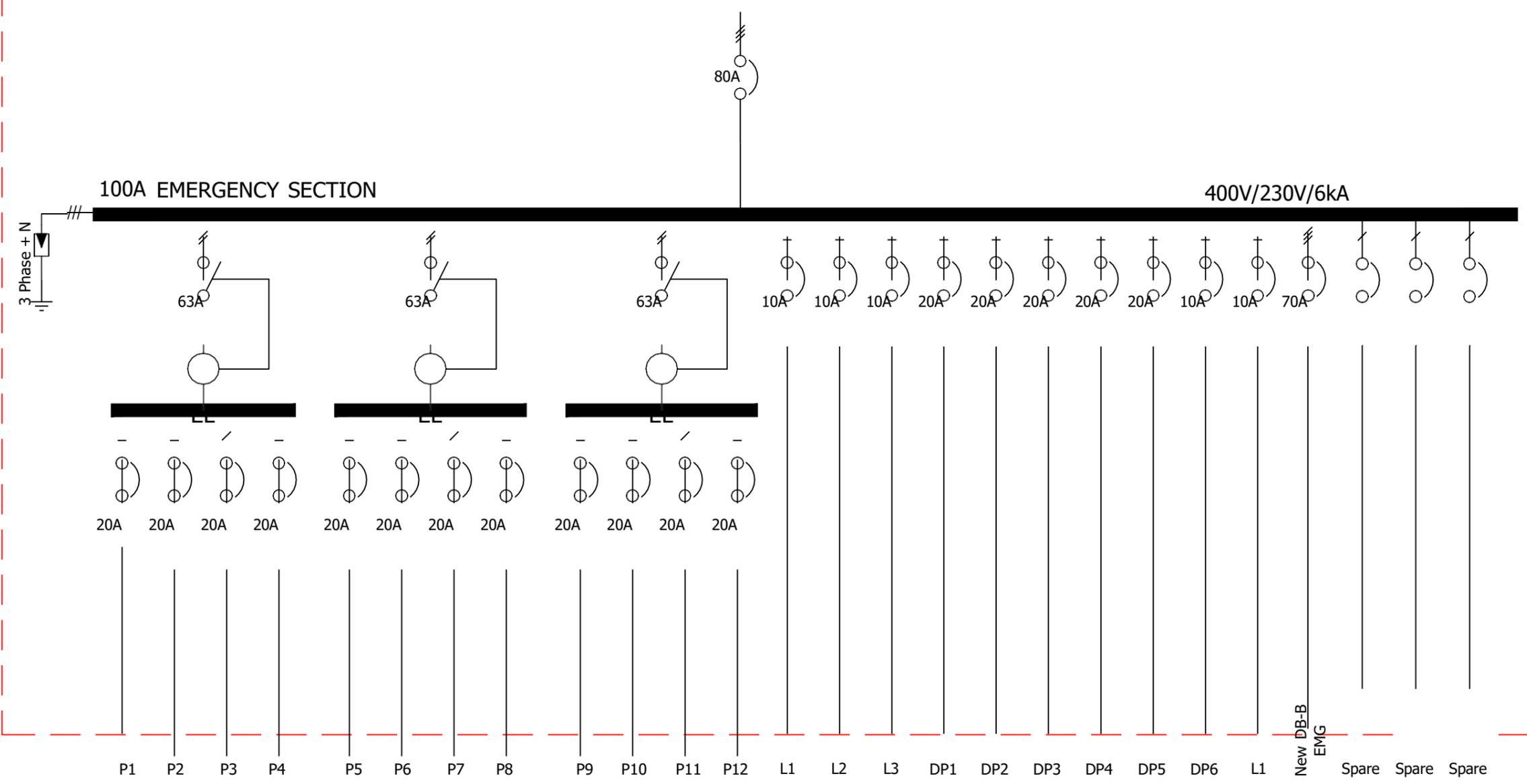
All equipment to be of the same manufacturer and SABS approved.



NO.	DATE	REVISION/AMENDMENT	BY/NO.
TD	18/10/2023	Issued for Tender.	

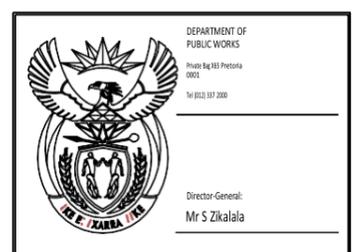
DB-A UPGRADED

Fed from Generator



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Cad File Name



Consultants

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Discipline: **ELECTRICAL**

Service: **ATTERIDGEVILLE LABOUR CENTRE STANBY GENERATOR ELECTRICAL INSTALLATION SERVICES**

WCS number: **WCS 056746**

Drawing Title: **NEW DB-A SINGLE LINE DIAGRAM**

Ref. No: 2323	Designed: MP
Scale: NTS	Drawn: MP
Date: 04-09-2023	Checked: PM

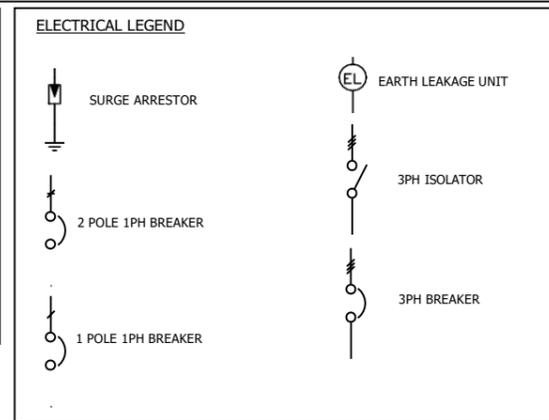
Type Number: EE 20238/D6
 Drawing Number: Rev.TD

NOTES

Type: Surface mounted with lockable doors.
 Colour: Normal section - Epoxy powder coated Electric orange
 Emergency section - Red

Capacity: Provide 25% spare capacity

All equipment to be of the same manufacturer and SABS approved.



NO.	DATE	AMENDMENT	D.P.N.
TD	08/10/2023	Issued for Tender.	

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Cad File Name

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Discipline
ELECTRICAL

Service
ATTERIDGEVILLE LABOUR CENTRE STANBY GENERATOR ELECTRICAL INSTALLATION SERVICES

WCS number
 WCS 056746

Drawing Title
NEW DB-B SINGLE LINE DIAGRAM

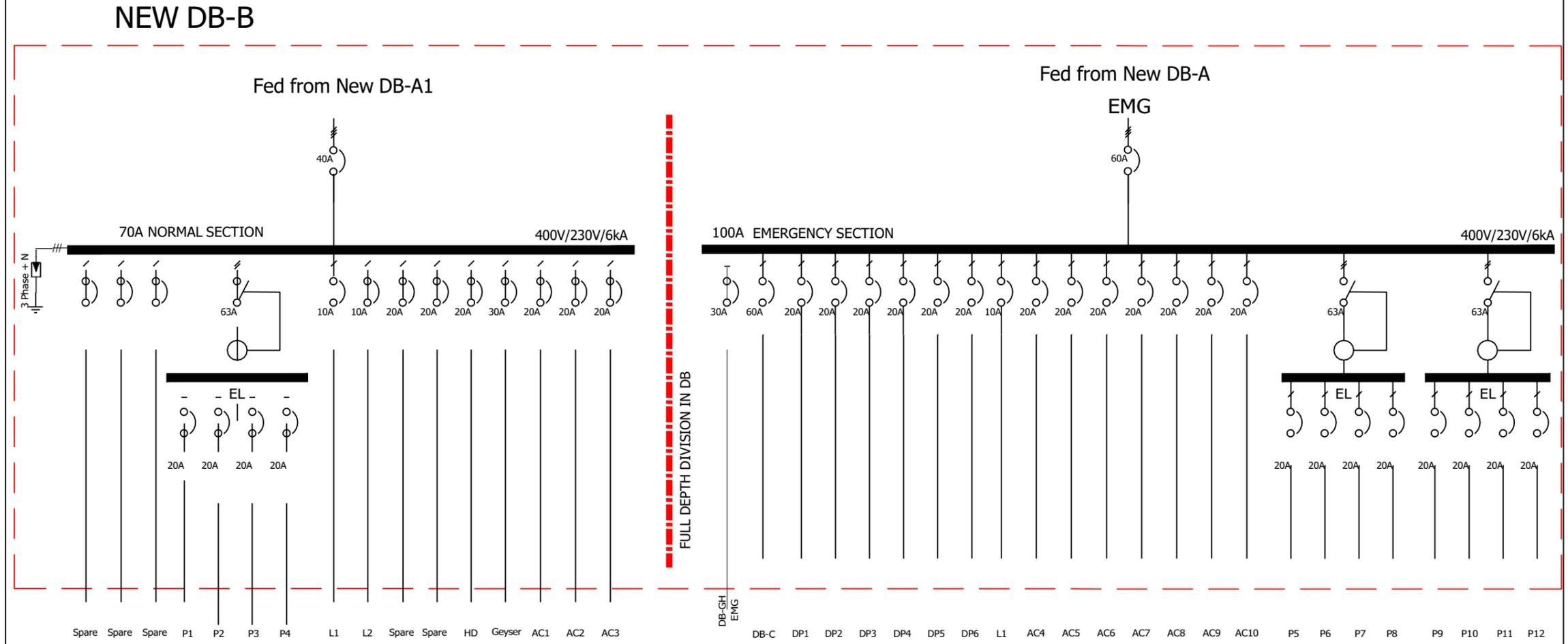
Ref. No
 2323 MP

Scale
 NTS Drawn MP

Date
 04-09-2023 Checked PM

Type Number

Drawing Number



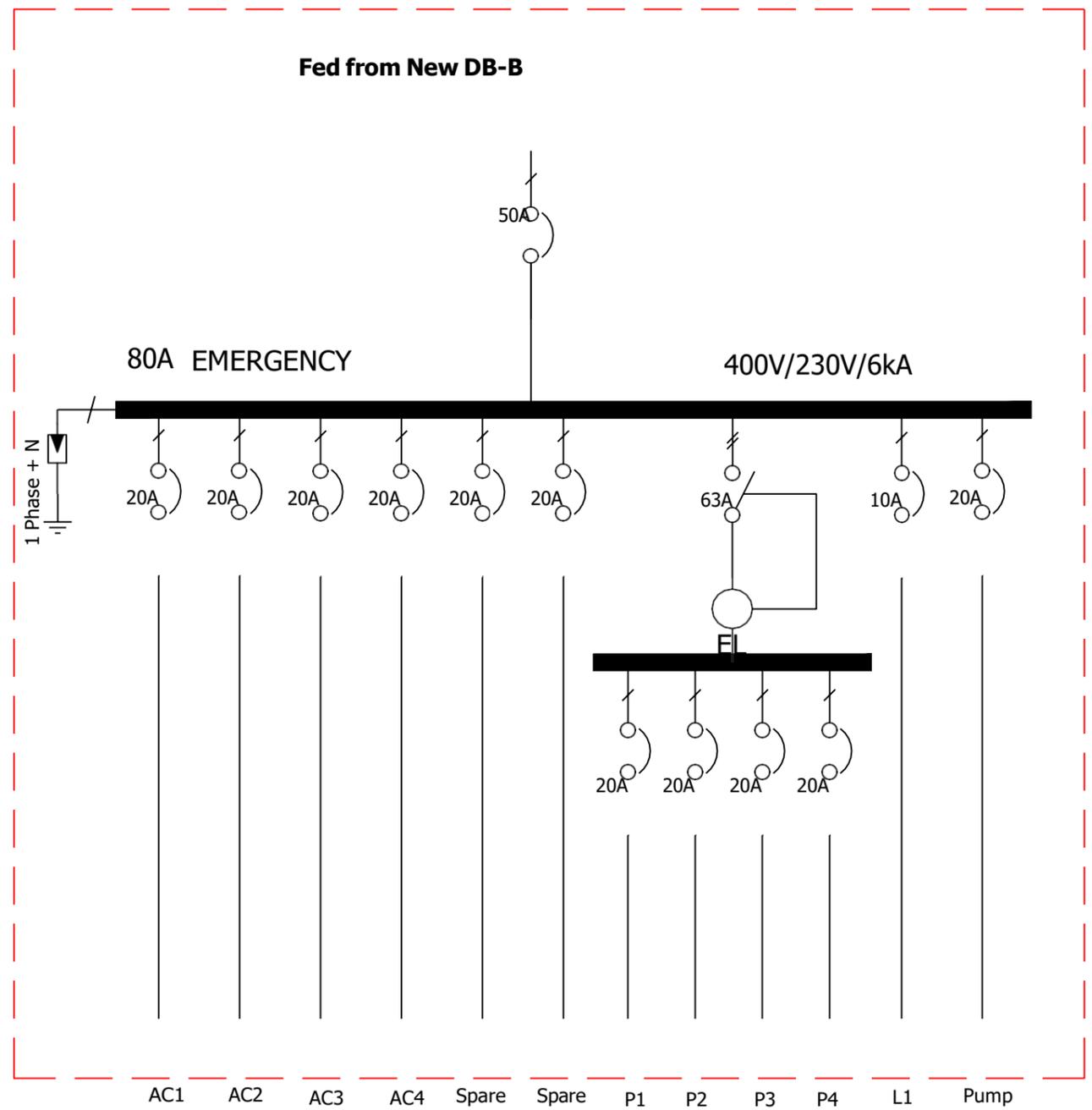
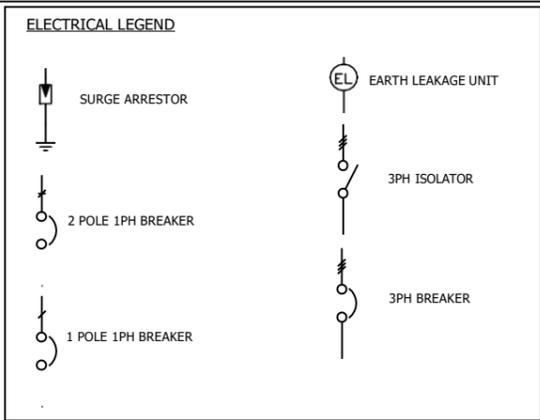
DB-C (Upgrade)

NOTES

Type: Surface mounted with lockable doors.
 Colour: Normal section - Epoxy powder coated Electric orange
 Emergency section - Red

Capacity: Provide 25% spare capacity

All equipment to be of the same manufacturer and SABS approved.



NO.	DATE	REVISION/AMENDMENT	BY
TD	08/10/2023	Issued for Tender.	

Copyright vests in the Department of Public Works

Cad File Name

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 Mr S Zikalala

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Discipline
ELECTRICAL

Service
ATTERIDGEVILLE LABOUR CENTRE STANBY GENERATOR ELECTRICAL INSTALLATION SERVICES

WCS number
 WCS 056746

Drawing Title
EXISTING DB-C UPGRADED SINGLE LINE DIAGRAM

Ref. No	Designed
2323	MP
Scale	Drawn
NTS	MP
Date	Checked
04-09-2023	PM

Type Number

Drawing Number
 EE 20238/D8

Rev. TD