

التاريخ : 2024/07/24 م

تعديل كراسة عطاء رقم RFQ-H-11708

توريد مولد كهرباء عدد 2 لمشروع مستشفى النجاح الوطني الجامعي - نابلس - فلسطين

السادة الشركات المتخصصة والراغبة بالمشاركة في العطاء المحترمين.

تحية طيبة وبعد ،،،

يعن مستشفى النجاح الوطني الجامعي عن رغبته بطرح العطاء رقم RFQ-H-11708 "توريد مولد كهرباء عدد 2 لمشروع مستشفى النجاح الوطني الجامعي" ، على السادة الشركات المتخصصة والراغبة في المشاركة بالعطاء التوجه إلى دائرة اللوازم والمشتريات بالمستشفى لاستلام نسخة من العطاء مع ضرورة مراعاة الشروط الآتية:

- 1- تلتزم الشركة المتقدمة للعطاء بتزويدنا بالسيرة الذاتية بالإضافة إلى تقديم شهادة تسجيل الشركة لدى الدوائر والوزارات المختصة وشهادة خصم مصدر سارية المفعول، ورخصة المهن.
- 2- على الشركة المتقدمة للعطاء الالتزام بالجدول والمواصفات المرفقة بكراسة العطاء.
- 3- تتم ترسية العطاء بناءً على مجموع نقاط التقييم الفني والمالي، وعليه فإن المستشفى غير ملزمة بالترسية على أقل الأسعار ودون إبداء الأسباب .
- 4- تكتب الأسعار بالشيكل الإسرائيلي وشاملاً لقيمة الضريبة المضافة بشكل واضح وفي المكان المخصص وحسب الجداول المرفقة بالعطاء.
- 5- ثمن نسخة العطاء (750 شيكل) غير مستردة تدفع في الدائرة المالية - مبنى الإدارة-الطابق الأول.
- 6- كفالة دخول العطاء بقيمة (3000 دولار) ثلاثة آلاف دولار أو ما يعادلها سارية المفعول لمدة ثلاثة شهور تأميناً نقدياً أو كفالة بنكية أو شيكاً مصدقاً، وفي حال عدم تقديم الكفالة لا ينظر في عرض السعر.
- 7- رسوم الاعلان بالصحف المحليه على من يرسو عليه العطاء.
- 8- أن تكون الأجهزة المعروضة جديدة وليست مجددة .
- 9- يتم تقديم كفالة حسن تنفيذ بنسبة 10% من قيمة الإحالة لمدة 3 شهور تأميناً نقدياً أو كفالة بنكية أو شيكاً مصدقاً وتستبدل بكفالة صيانة بنسبة 5% من قيمة الجهاز وذلك حال الترسية .
- 10- يحدد موعد لزيارة الموقع لاحقاً وبالتنسيق مع مدير دائرة المشاريع .
- 11- على الشركات الراغبة بالحصول على نسخة من وثائق العطاء مراجعة دائرة اللوازم والمشتريات - مستشفى النجاح الوطني الجامعي - نابلس وذلك ابتداءً من يوم الأربعاء الموافق 2024/07/24م من الساعة 10:00 صباحاً حتى الساعة 03:00 عصرأ.
- 12- آخر موعد لتقديم عرض السعر هو يوم الأحد الموافق 2024/08/04م الساعة الثالثة عصرأ 03:00 PM .
- 13- لأية استفسارات متعلقة بالعطاء المذكور أعلاه، يرجى التواصل مع مدير اللوازم والمشتريات بالمستشفى هاتف رقم 09.2389687 تحويلة رقم 6400، أو من خلال البريد الإلكتروني tender3@najah.edu.

مدير دائرة اللوازم والمشتريات
إياد مكاي





طرح عطاء

يعلن مستشفى النجاح الوطني الجامعي عن طرح عطاء رقم RFQ-H-11708 وانماض بتوريد مولد كهرباء عدد 2 خاص بمشروع مستشفى النجاح الوطني الجامعي على الشركات المتخصصة والرغبة بالمشاركة في العطاء مراجعة دائرة اللوازم والمشتريات للحصول على نسخة من وثائق العطاء .

#	رقم العطاء	موضوع العطاء	ثمن نسخة العطاء	موعد الطرح	تاريخ الإغلاق	الساعة
1	RFQ-H-11708	توريد مولد كهرباء عدد 2 خاص بمشروع مستشفى النجاح الوطني الجامعي - نابلس - فلسطين	750 شيكل غير مستردة	23-07-2024	04-08-2024	P.M 03:00

حسب الشروط التالية:

1. رسوم الاعلان على من يرسو عليه العطاء .
2. ثمن نسخة العطاء 750 شيكل غير مستردة .
3. كفاية دخول عطاء بقيمة (3000 دولار) ثلاثة آلاف دولار .


للاستفسار يرجى الاتصال على:

دائرة اللوازم والمشتريات في مستشفى النجاح الوطني الجامعي - البريد الالكتروني tender3@najah.edu هاتف +970-09-2331471 فاكس: +970-9-2389685 موبيل: 0592444300 .

مدير دائرة اللوازم والمشتريات

إياد مكساري

AL-NAJAH NATIONAL UNIVERSITY (NNUH)
 AL-NAJAH UNIVERSITY HOSPITAL RADIOTHERAPY
 INTERIOR FINISHING WORK & ELECTRO-MECHANICAL PACKAGE
 SECTION (26) - ELECTRICAL WORK & INSTALLATIONS

Item No.	DESCRIPTION	UNIT	EST. QTY	CONTRACT AMOUNTS	
				RATE	AMOUNT
	SECTION 16231 Engine Generators			0/35	0/15 (USD)
	Supply, install, test & commission the following engine Generator, the price shall include , exhaust, silencer, daily fuel tank, recommended spare parts, concrete base with fork, vibration absorbents and all needed accessories to complete the job as per drawings, specifications and engineer's instructions, Price shall include factory acceptance test.				
D	0.4KV, 1000KVA Prime Power Deisel Gen. Set	No.	1		
E	0.4KV, 1000KVA Prime Power Deisel Gen. Set	No.	1		
					
TOTAL CARRIED TO SECTIONS (26) SUMMARY					

SECTION – 16231 ENGINE GENERATORS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

Diesel electric LV Prime Rated Running Power Generation System as defined by ISO 8528 – 1 2005 for a prime running rated including, but not limited to, daily fuel storage tanks, lubrication system, control panels and all associated devices and equipment.

1.2 REFERENCES

- A. BS British Standards
- B. IEC International Electro - technical Commission
- C. NFPA 101 Safety to Life from Fire in Buildings and Structures.
- D. NFPA 110 Emergency and Standby Power Systems.
- E. ISO 8528-1:2005 Reciprocating Internal Combustion Engine Driven Alternating Current Generating Sets- Part 1: Application, Ratings and Performance.
- F. Local Codes and regulations.

1.3 SYSTEM DESCRIPTION

- A. Description: Engine generator assembly and accessories to provide source of power for Level 1 and 2 applications in accordance with NFPA 110.
- B. System including all ancillary equipment including fuel day tanks, fuel transfer equipment, silencers, attenuator, exhaust, interconnecting cabling and pipe work necessary for the proper functioning of the installation, both mechanically and electrically.

1.4 SUBMITTALS

- A. Submit shop drawings showing plan and elevation views with overall and interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements, and electrical diagrams including schematic and interconnection diagrams.
- B. Submit product data showing dimensions, weights, ratings interconnection points, and internal wiring diagrams for engine, generator, control panel, battery, battery rack, battery charger, exhaust silencer, vibration isolators, fuel tank, sound attenuation, sand filter, radiator, and remote annunciator.
- C. Submit Method statement and manufacturer's installation instructions inside container.
- D. Submit controls systems for auto synchronization of generator sets if specified or shown on the



Drawings.

- E. Submit operation and maintenance data, include instructions for normal operation, routine maintenance requirements, service manuals for engine and fuel tank, oil sampling and analysis for engine wear, and emergency maintenance procedures.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit instructions and service manuals for normal operation, routine maintenance, oil sampling and analysis for engine wear, and emergency maintenance procedures.

1.6 QUALIFICATIONS

- A. Manufacturer's: Firms regularly engaged in manufacture of the generator sets and associated equipment of types, sizes and ratings required, whose products have been in satisfactory use in similar service for not less than 10 years.

1.7 QUALITY ASSURANCE

- A. Generator sets and associated equipment shall comply with the requirements of Local power utility, BS and IEC.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Accept engine generator set and accessories on site in crates and verify damage.
- B. Protect equipment from dirt and moisture by securely wrapping in heavy plastic.

1.9 SPARE PARTS

- A. Supply spare parts in compliance with the contract conditions.

1.10 WARRANTY

- A. Submit written warranty signed by the manufacturer and the contractor for the period of Two years from the date of substantial completion. The warranty shall cover the repair and replacement of defective materials and workmanship as directed by the engineer except where any specific warranty from a supplier or manufacturer extends for a longer time.

1.11 TRAINING

- A. The Contractor shall provide training for Owner staff in compliance with the contract conditions.

PART 2 PRODUCTS

2.1 GENERAL

- A. Supply of LV Diesel electric LV Prime Rated Running Power Generation System as defined by ISO



8528 – 1 2005 for a Prime Running operation, with ancillary equipment including fuel day tanks, fuel transfer equipment, silencers, attenuator, exhaust, acoustic treatment to the generator room, interconnecting cabling and pipe work necessary for the proper functioning of the installation, both mechanically and electrically.

- B. LV Emergency power diesel generator set shall be skid mounted and located in an acoustically treated space to reduce noise level and annoyance to residents within the locations.
- C. For remote monitoring/controls, comply with the requirements given in the applicable sections.
- D. LV Emergency power diesel generator set with acoustic enclosure shall incorporate the following basic design criteria:

Output power rating	The generator(s) shall have RATINGS AS SHOWN ON DRAWINGS, prime moving as per ISO 8528 – 1 2005 after taking into account all relevant derating factors and power consumed in auxiliaries.
Nominal Output Voltage	400V 3Ph/ 230V 1Ph.
Frequency	50 Hz.
Speed	1500 r.p.m.
Automatic Voltage Regulation	± 1.5% (from no-load to 100% load and from 0.8 p.f. lagging to unity p.f.).
Total Harmonic Distortion AC Waveform	Less than 4% at full load.
Noise Criteria	75 dbA at 1.0 m in any direction from external gen room walls.
Maximum Starting Time	15 seconds.

In addition, full account shall be taken of the nature of the loads particularly motor loads such as air conditioning, fans, pumps, etc. that are likely to be connected to the generator.

2.2 RATING

- A. Set shall be rated taking into consideration the site climatic conditions (altitude, temperature, etc.) as given in Section 16052. The rating of the generator sets as shown on the Drawings and Schedules is minimum and subject to the submittal and approval of the final load calculations considering the approved electrical and mechanical equipment fed from the emergency supply to justify the rating of the generator.

2.3 MECHANICAL DETAILS

- A. Lifting eyes are required on all items of equipment over 25 kg in weight which may need removal.
- B. No critical speed of the complete shaft assembly shall be within 15% of rated speed. All moving live parts are to be adequately guarded to prevent injury to personnel.



- C. Fresh air supply attenuator feeding to generator must be sized and installed at inlet shaft/opening to room
- D. Where hot air is ejected by radiator fan through duct connection must cater for sound attenuator of appropriate size, pressure drop and length

2.4 ALTERNATOR

- A. The alternator shall be synchronous type and as per BS and IEC requirements with Class "F" insulation, screen protected, drip proof, rotating field, brushless type, driven through a solid half coupling and bolted direct to the engine flywheel or driving motor as applicable.
- B. The AC exciter and rotating rectifier unit shall be overhung on the non-driven end of the alternator.
- C. The alternator shall be capable of giving an output at 0.80 pf lagging at the system rated voltage specified earlier.
- D. Steady state voltage shall be maintained to $\pm 2.5\%$ under any condition from cold start to maximum working temperature, from zero load to 100% full load, and from unity p.f. to 0.8 p.f. lagging.
- E. After a load change from 0 to 35% rated load the voltage shall not change by more than $\pm 1\%$ and shall recover to 100% of rated value within 15 seconds.
- F. Harmonic distortion shall not exceed 5%.
- G. Windings shall be connected in "star". The ends of the windings and neutral shall be brought out to a suitable terminal box.
- H. The machine shall be of the two bearing type, generously rated, grease lubricated and efficiently sealed.
- I. The automatic voltage regulator shall be provided with an adjustment for setting the level of the controlled voltage to within $\pm 5\%$ of the normal voltage and shall be capable of maintaining its adjustment for long periods without attention once the set is running.
- J. The alternator shall be capable of withstanding a short circuit current of 300% F.L.C. for 3 seconds.
- K. The alternator shall have a main circuit breaker with all required accessories, furnished as an integral part of the unit and installed as close as possible to the main terminals of the alternator from top side (top side connection) using busway or cables as shown on the drawings. Price of the generator including all needed accessories for busway/ cable connections from the alternator outgoing circuit breaker.

2.5 ENGINE

- A. Engine may be naturally aspirated or turbo charged but must be capable of accepting full load within the required time limitation of 15 seconds.
- B. The operating speed shall not exceed 1500 r.p.m.
- C. Governing shall be in accordance with manufacturer's recommendations, except that speed drop shall be limited to $\pm 2\%$.
- D. Manual adjustment shall be provided for $\pm 5\%$ rated speed.



- E. Steady load speed band shall not exceed 1% of rated speed.
- F. Engine shall be 4 stroke, direct injection, radiator cooled and with forced lubrication from wet sump with automatic oil make-up system. Full flow oil filters shall be supplied with differential pressure alarm and gauge.
- G. Sufficient reserve shall be allowed in the lubrication system to allow 36 hours running without replenishment. Oil cooling shall be by heat exchanger. Simple oil drainage facilities shall be provided.
- H. Thermostatically controlled jacket water heaters shall be provided. The nominal temperature setting shall be 45 °C but the control should be adjustable between 30 °C and 50 °C. Vee type engines shall be provided with a heater in each bank to ensure uniform heating. Valve seats shall be replaceable.
- I. Five micron dual fuel filters shall be supplied in the fuel line complete with on line changeover facilities. Induction shall be via heavy duty oil bath air filters or suitably rated disposable paper element type.
- J. A fail-safe mechanical over speed trip facility shall be provided, set at 115% rated speed. Suitable means shall be provided for turning the crankshaft and the associated generator by hand.
- K. The following dial or digital type engine instruments shall be provided:-
 1. Engine speed indicating tachometer, reading rev/min.
 2. Lubricating oil pressure, reading kPa.
 3. Cooling water temperature, reading °C.
 4. Service hours counter.
 5. Fuel pressure, reading kPa.

These instruments shall be mounted on a suitable panel fixed to the engine.

2.6 FLYWHEEL

The flywheel shall be dynamically balanced and shall be capable of being rotated at 125% and 95% of rated speed during normal running.

2.7 GOVERNOR

- A. The engine shall incorporate an adjustable isochronous electronic governor.
- B. The governor shall be controlled manually at the engine control panel, from the associated generator switchgear equipment by the governor control switch or automatically.
- C. The governor shall provide adjustable speed settings from 48 to 52 Hz, adjustable speed regulation from 0 to 5%, adjustable load limit from 0 to 125% of unit rating.
- D. The governor shall permit parallel operation of any and all other generating units furnished under this contract and with an infinite bus.
- E. The governor shall be cable of maintaining the frequency constant within $\pm 0.25\%$ for any constant load between 25% and 100% generator rating. After any sudden load change of not more than 25 % of rated load, the governor shall re-establish stable operating conditions in not less than 4



seconds. Surging period shall not exceed 3.6 Hz.

2.8 EXCITER

- A. The exciter shall be a brushless type using a rotating, fused rectifier bridge circuit. The three phase, full wave, rectifying unit shall be mounted on the generator motor shaft. The exciter shall be capable of supplying the field excitation current requirements for the generator and delivering 150 % of its rated current for one minute without being subject to damage. The complete exciter shall be enclosed and protected by a removable cover.
- B. A diode failure detector shall form part of the exciter circuit.

2.9 AUTOMATIC VOLTAGE REGULATOR

- A. The automatic voltage regulator (AVR) shall be of completely solid state design.
- B. A maximum voltage drop of 3 % of rated voltage will be allowed for 0 to 100 % of rated load, but shall be a minimum consistent with the requirements for satisfactory parallel operation. The voltage at any constant load from 0 to 100 % load shall be within a band of 1 % of rated voltage.
- C. Transient voltage dip after a sudden 25 % load stop-change increase and transient voltage rise after a sudden 25 % load decrease shall not exceed 5 % of nominal voltage. For this requirement, the initial load shall be taken to be within the range of 50 to 85 % of actual operating capacity under conditions of any generating set or any combination of generating sets, applicable, operating on the bus.
- D. The voltage shall recover to within 1 % steady-state band specified above, within 1/2 second after initiation of the load changes specified above.
- E. The AVR shall be equipped with cross-current compensation and an adjustable droop range from 0 to 5 % for parallel operation.
- F. The exciter shall be complete with all components necessary to provide the excitation, and shall be designed without the use of electronic tubes or electrolytic capacitors.
- G. The exciter shall utilize a multiphase, amplifier controlled silicon rectifier and a three phase exciter power transformer for receiving the power from the generator output.
- H. Provision shall be made for relay-operated pilot excitation or field flashing that receives its power from the storage battery, or from permanent magnets.
- I. Special provision shall be made to ensure that the silicon rectifiers are not subject to peak inverse voltages in excess of their rating under any condition of system operations, including transient conditions.
- J. The system shall be designed to sustain 300 % of rated current for 3 seconds when a symmetrical short circuit is applied at the generator terminals.
- K. The AVR shall have a ± 10 % voltage adjustment range capable of being controlled automatically or by remotely mounted adjusting devices.
- L. The AVR shall be equipped with a variable control for setting the degree of stability of reactive current during parallel operation. The maximum difference in reactive kVA of one generating unit and that of the average of the units shall not exceed 5 % of the full kVA rating of any one unit. The requirements shall apply under any load condition from 20 to 125 % of combined rating at rated frequency and at any power factor between 0.8 lagging and unity.



- M. The AVR shall be equipped with a switch selectable (or link) rheostat for field current limiting with an adjustable setting. A time delay shall be included in the circuit so that there is no interference with normal field forcing.
- N. To prevent over fluxing of the machine at low speeds, a frequency fall of circuit shall be included in the AVR to progressively reduce the generator when the frequency falls below 90 % of the nominal. This facility shall be selected by a link on the AVR.
- O. An electronic manual voltage regulator with potentiometer control on the main control panel, shall be provided. A manual/automatic selector switch shall be provided on the main control panel.

2.10 STARTING SYSTEM

- A. Electric starting shall be provided to all machines and shall comprise 24 V equipment including starter motor, alternator and rectifier, lead acid batteries of ample capacity and mains powered constant voltage charging equipment and all connecting wiring.
- B. Batteries are to be mounted on each set and capable of withstanding five 20 second starts in succession in any four hour period, without any derating.
- C. A battery charging panel for each starter battery shall be provided and shall be capable of recharging the battery from discharged state in 6 hours and maintaining it in a charged state when the set is standing idle. The battery of each generator set shall be charged only from the alternator/rectifier of the same generator set, when that particular set is running.
- D. The batteries shall be used to supply auxiliary relays as required whose operation must not be affected whilst supplying starting current. Auxiliary circuits are to be protected by fuses.

2.11 EXHAUST SYSTEM

- A. The exhaust system shall be manufactured in heavy quality steel tubing fitted with suitable robust gas-tight flexible sections close to the engine to allow engine movement and to reduce the transmission of engine vibrations to the remainder of the exhaust system and the surroundings. Bends shall have a minimum radius of three times the diameter of the tube. As far as possible, flexible sections shall be vertical, free from bends and have sufficient length or slack to allow free movement without damage.
- B. Silencers shall be of the heavy duty baffle and absorption, healthcare type, so designed and installed as to reduce noise to the minimum level as per the requirements given in mechanical sections, without appreciably impairing the working efficiency of the engine.
- C. Vibration isolating equipment shall be provided with each silencer for use where they are mounted on structural steelwork in accordance with the requirements given in mechanical sections.
- D. The silencers and exhaust pipework shall be properly and adequately supported clear of fuel and feed pipes and shall be provided with suitable insulation to protect personnel, plant and buildings from excessive heat. Design of exhaust system shall be suitable for site conditions and routing, where shown on layout.
- E. The pipework shall drain away from the exhaust manifold and drain pipes shall be fitted in the low points of the system to avoid accumulation of condensate.
- F. The system shall be so constructed as to enable it to be readily dismantled for maintenance. Provision shall be made to prevent rain water entering the exhaust pipe at its outlet to the



atmosphere.

- G. All exhaust connections shall be made as per BS standards.
- H. All necessary brackets, supports, insulation and protection shall be provided, together with all fixing bolts. Bolts, washers and nuts shall be greased with graphite grease or other suitable heat resisting lubricant during assembly.
- I. The finish of all exhaust silencers exposed to the open air shall be sprayed metallic aluminum by special process complying with the recognized industry practices.
- J. All exhaust piping network including all its parts as stated above and any additional necessary equipment, devices, hangers, supports, insulation, extra piping lengths due to rerouting of exhaust pipes are included in price of the generator.

2.12 COOLING SYSTEM

- A. Engine cooling shall be by a water jacket, with water circulating pump and heavy duty tropical radiator with an electric driven pusher fan.
- B. The radiator shall be fitted with drawing legs.
- C. The fan shall be rated for the climatic conditions given in Section 23 34 00.
- D. The cooling equipment complete with feed and expansion tank and pumps as necessary.
- E. Where necessary to limit the oil temperature, a water cooled lubricating oil temperature stabilizer, shall be incorporated in the engine cooling system. Sufficient corrosion inhibitor shall be added to the cooling water to protect the cooling system from internal corrosion. Thermostatic control shall be incorporated.

2.13 FUEL SYSTEM (REFER TO MECH. WORKS SPECIFICATIONS)

2.14 LUBRICATION SYSTEM

- A. The engine lubricating system shall conform to BS and operate under a predetermined and constant pressure.
- B. The primary lubricating oil pump shall be an engine driven, positive displacement pump.
- C. An electric DC motor driven prestart lubricating oil pump shall be installed as an integral part of the generator set. The control logic shall be designed to stop the electric lubricating oil pumps when the generator set attains sufficient speed to maintain adequate oil pressure through the engine driven mechanical pump.
- D. A sump pump, relief valves and by-pass valves shall be installed if required for proper operation.
- E. One tube type oil cooler arranged for utilizing engine cooling water as the cooling medium shall be furnished for each engine. The cooler may be separately mounted or mounted on the engine. The capacity and construction shall be as recommended by the Engine Manufacturer.
- F. One full flow strainer and one full flow strainer and duplex filter shall be provided in the lube oil line on the discharge side of the lube oil pumps. The strainer shall be of the metal edge or screen type with a maximum spacing of 0.007 inch (80 mesh). The filter shall be of the multiple cleaning and replaceable element type and the filter case shall be compatible with the filter element. A pressure



relief valve shall be provided to relieve if it becomes clogged. An alarm condition shall be annunciated when the relief valve is in the open position. The strainer and filter shall be mounted in accessible locations without disconnecting the piping or other engine equipment when changing the strainer and filter element. Indicating pressure gauges shall be provided to measure the pressure drop across the strainer and filter.

2.15 SAFETY SYSTEM

- A. The generator set shall be equipped with automatic safety devices which shut down the generator set and open the generator circuit breaker in the event of low lubricating oil pressure, high coolant temperature, engine overspeed, high lubricating oil temperature, over load and as specified elsewhere. The stop switch on the engine instrument board may be connected in the circuit if so recommended by the manufacturer.
- B. The safety system shall be equipped with visual and audible devices that become operational before engine shutdown.
- C. Lube oil pressure and cooling water temperature and pre-alarms to be inter-connected to the Building Management System.
- D. Simultaneous activation of the audible signal, activation of the visual signal, stopping the engine, and opening the generator field and main circuit breakers shall be accomplished.
- E. For startup of the engine-generator set, time-delay devices shall be installed bypassing the low lubricating oil pressure alarm during cranking, and the coolant-fluid outlet temperature alarm. The lube-oil time-delay device shall return its alarm to normal status after the engine starts. The coolant time-delay device shall return its alarm to normal status 5 minutes after the engine starts.

2.16 ENGINE INSTRUMENTATION AND ALARMS

- A. An engine instrument panel shall be provided that displays gauges and indicators for proper engine control, surveillance and maintenance. The panel shall be mounted on a bracket welded to the skid. All connections to the engine shall be flexible types providing anti-vibration isolation. All instruments and gauges to be analogue and in metric units, where applicable.
- B. The engine instrument and alarm panel shall contain all the switches, indications, meters, push buttons, displays, etc. for the proper monitoring and control of the operations of emergency power generation system described in this section. As a minimum the following items shall be provided:
 - 1. Coolant-fluid inlet temperature display.
 - 2. Lubricating-oil pressure indicator.
 - 3. Lubricating-oil inlet temperatures display.
 - 4. Red emergency stop (push-button or switch)
 - 5. Run-time meter.
 - 6. Fuel meter display.
 - 7. Fuel-header-pressure display.
 - 8. Tachometer display.
 - 9. Engine start-stop switch.
 - 10. Start-attempt light indicator.
 - 11. Lubricating-oil prelubricating pump start-stop switch.



12. Pyrometer display with selector switch.
 13. Alarms.
- C. All alarms and instrumentation shall be provided and arranged to stop the engine automatically. In the event of an emergency the operation of this safeguard shall at the same time give individual warning of the failure by illumination of an appropriate visual indicator and the sound of a distinctive audible alarm. A self-resetting audible alarm muting switch shall be provided. These safeguards shall operate when any of the following conditions occur irrespective of whether the set is on automatic or manual control:
1. Engine over-speed.
 2. High cooling water temperature.
 3. Low cooling water level.
 4. Low lubricating oil pressure.
 5. High lubricating oil temperature.
 6. Low fuel level (to operate at 10% capacity of fuel tank).
 7. Control circuit fault.
 8. Fail-to-Start.
 9. Generator failure (Set running).
- D. For remote monitoring/controls, comply with the requirements as given in the applicable sections, noting that the genset shall be provided with a communication interface card that is compatible with Modbus and/or BACnet protocols and in compliance with the procured BMS system.

2.17 GENERATOR CONTROL PANEL

- A. The control panel shall be floor mounted, totally enclosed, metal clad cubicle type and shall contain the following equipment together with any other items which are required to ensure a complete and safe installation. The control panel shall comply with the requirements given in Section 16440.
- B. The generator control panel shall provide controls, gauges, meters, etc. to include but not limited to the following:
1. Main circuit breaker (MCCB) with all needed parts for connection to busway.
 2. Four position selector switch with Off-Auto-Man-Test.
 3. A hand operated switch to raise or lower the speed of the engine together with a hand operated voltage trimming rheostat.
 4. All engine controls, relays, indicator lamps, fuses, wiring etc.
 5. Voltmeter with seven position selector switch.
 6. Three Ammeters.
 7. Kilowatt-hour meter.
 8. Power factor meter.
 9. Frequency meter, dial type with a range of 90 to 110 % of rated frequency.
 10. KVA, KVAR, KW, KVARH meters.
 11. DC voltage meter.



12. Temperature of water.
13. RPM, run hours meters.
14. Phase selector switch.
15. Emergency stop push button.

The instruments shall be 100 mm square, flush mounted, 90 °C scale moving iron type with chromium plated bezel. The kilowatt-hour meter shall be of the digital read-out type, flush mounted. The instruments mentioned above are additional to the instruments specified elsewhere in this specification.

C. Indications

1. Flush type colored indicators illuminated by low voltage lamps for the following:-
Green lamps: Main supply available.
Red lamps: All alarm conditions listed above in clause 2.16 (C).
2. The indicators shall be clearly labeled as to their duty. The "mains supply available" indicator shall be operated from the mains supply.

D. An audible device with reset shall also be provided.

E. Suitable robust protected type spring return push-buttons on the front of the control panel for the following duties:-

1. Start engine (for testing, servicing etc. with control selector switch in 'Manual' position).
2. Stop engine.

F. Test buttons for verifying operation of the alarm conditions listed above in clause 2.16 C.

G. For remote monitoring/controls, comply with the requirements as given in the applicable sections. Additionally provide clean contacts for remote indications, to any other location, of the following conditions:-

1. Mains supply normal.
2. Mains failure, standby running.
3. Generator set under manual control.
4. Fault in control circuit.
5. Low fuel level.
6. Low oil pressure .
7. High water temperature.
8. Fail to start.

H. Provision for connection to a dummy load by means of lugs with butterfly nuts for commissioning purpose.

I. The generator control panel shall include all necessary controls and instructions required for auto-synchronization of two or more generator sets when specified or shown on the Drawings.

2.18 CONTROL OPERATION



- A. The manufacturer shall provide the following switch selectable operational modes on the diesel electric generator control system.
1. Manual Control (Manual start and stop).
 2. Semi-Automatic Control (Auto-start manual return).
 3. Full-Auto control (Auto-start with auto stop when commercial supply returns).
- B. For remote monitoring/controls, comply with the requirements as given in the applicable sections.
- C. In the automatic mode, main failure shall cause a changeover relay to de-energize. This relay shall have an adjustable 0-10 seconds delay before contacts re-set when it is de-energized so that if power is restored within that period no changeover shall take place. If the power is not restored, the changeover relay contacts shall re-set and operate as follows :-
1. The mains contactor control circuit shall be opened. This contactor will already have opened owing to loss of supply.
 2. The engine run relay shall be energized and the standby set run up.
 3. The standby contactor control circuit shall be prepared and complete when the generator voltage and frequency monitors show that the set is up to speed, and the contactor shall close. The generator is required to take over full load within 10 seconds of start up.
 4. When mains power is again available it shall be detected by a reset timer with an adjustable time delay of 0-30 minutes before operation when energized. When the timer operates it shall energize the changeover relay. Energizing the changeover relay shall:
 - a. Open the standby contactor control circuit, dropping out the contactor.
 - b. Close the mains contactor control circuit so that the contactor closes.
 - c. De-energize the engine run relay.
- The relay shall have a time delay adjustable up to 15 minutes before the contacts re-set to allow the engine to continue to run on no load before shutting down.
- D. Coordinate with the requirements of enclosed transfer switches given in Section 16301 and provide controls accordingly.
- E. All necessary controls shall be provided for auto-synchronization of two or more generator sets when specified or shown on the Drawings. The controls shall be in accordance with the latest applicable standards and industry practices and shall be submitted for Engineer's approval.

2.19 MISCELLANEOUS ELECTRICAL ITEMS

- A. Wiring:
1. All cabling and small wiring shall be securely cleated in systematic runs; small wiring shall be multi-strand copper not smaller than 1.0 mm² flexible cord.
 2. Power and small wiring cables interconnecting major components shall be heat and oil resisting.
 3. All cabling and small wiring shall be coded and terminated with lugs or 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.
 4. Barriers shall be fitted to separate control terminals from power wiring terminals.



B. Earthing:

1. All metalwork housing electrical equipment shall be provided with earthing terminals for bonding to the building earthing system. The generator set earthing shall be carried out in accordance with the requirements Section 16061.

C. Contactors:

1. Contactors shall have magnetic circuits designed for AC or DC operation and shall be suitably rated. Four pole contactors shall be fitted for three phase equipment and two pole contactors for single phase equipment. Main and auxiliary contacts shall be silver faced.

D. Relays:

1. Switching and control devices shall be solid state where possible. Electro-mechanical relays shall be of robust and rugged construction with rolling or wiping contacts. 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.
2. Time delays, if of the pneumatic type, shall operate on filtered air. The thermal type of time delay relay will not be accepted.

E. Fuses:

1. A spare fuse cartridge for each pole shall be mounted inside each equipment.

F. Rectifiers and Capacitors:

1. Rectifiers and capacitors shall be suitable for any transient voltages likely to be encountered during the operation of the equipment and for the internal operating temperature of the enclosures at the specified maximum external ambient temperature.

G. Winding Heaters:

1. Suitably rated heaters for operation on the appropriate voltage shall be provided for every alternator, motor and electrical panel. A separate terminal block shall be provided for the heater supply in each relevant panel.

H. Trunking and Accessories:

1. Trunking runs and connections between trunking and boxes shall be flanged, spigotted and/or provided with coupling pieces with earth bonding continuity straps. Trunking and accessories shall be in accordance with the requirements given in Section 16135.
1. All accessories and fittings shall be manufacturer's proprietary items as far as practical with site fabrication maintained to a minimum. Any site fabrication shall be approved by the Engineer.

2.20 LABELING AND SAFETY

- A. Each major component of the unit shall have the manufacturer's name, address, style, type or catalog number on a place securely attached to the component of the units.

- B. The function or duty of each meter, instrument, indicator, switch, or push buttons or other device for



external control, shall be clearly defined with labels in accordance with the applicable Sections

- C. An instruction notice and first air chart for the proper and safe working of the plant shall be fixed in a position close to where the operation is carried out, in accordance with the applicable specifications.
- D. The engine/generator set shall have a notice fixed in a conspicuous position, with titles at least 25 mm high and remainder 12 mm high, both in Arabic and English and in red color, stating:-

DANGER - KEEP CLEAR

THIS SET IS REMOTELY/AUTOMATICALLY CONTROLLED AND MAY START AT ANY TIME. WRITTEN AUTHORITY MUST BE OBTAINED AND APPROPRIATE SAFETY PRECAUTIONS TAKEN BEFORE ANY WORK IS UNDERTAKEN ON THE SET OR ASSOCIATED CONTROL EQUIPMENT.

- E. Exposed parts that are subject to high operating temperatures or are energised electrically and moving parts which are of such nature or so located as to be a hazard to operating personnel, shall be insulated, fully enclosed, or guarded. Guarding shall be arranged in a manner that will not impair the proper function of these parts.

2.21 PAINTING

- A. Painting shall be in accordance with the appropriate requirements of Section 09 90 00.

PART 3 EXECUTION

3.1 INSPECTION

- A. Verify that surfaces are ready to receive work and field dimensions are as shown on the Drawings.
- B. Verify that required utilities are available in proper location and ready for use.
- C. Beginning of installation means installer accepts existing conditions.

3.2 INSTALLATION

- A. Install in accordance with the manufacturer's written instructions and the requirements of BS, ICE, Local Standards Organization standards and recognized industry practices.
- B. An independent suspended ceiling system inside the generator room composed of 2 layers of 12mm gypsum ceiling boards as a solid backing and 50mm low density fiberglass insulation complete with resilient hanger isolators of elastomer material + 2nd layer of 0.90mm galvanized and perforated sheet steel cladding on 60mm steel track system shall be installed.
- C. Line all 4 walls and ceiling with 50mm thick fiberglass acoustic boards with aluminum facing installed between GS vertical and horizontal tracks and covered with minimum of 0.90mm thick GS perforated sheeting (open area 23-32%). Treatment shall reduce noise build up due to reflections from walls and ceiling and provide an average Noise reduction coefficient of 80% (NRC-0.9) and an approximate value inside room of 6 decibels.
- D. Follow all requirements of the acoustic report guidelines.

3.3 FIELD QUALITY CONTROL



- A. Provide full load test utilizing portable test bank on site, when required, for four hours minimum. During test, record the following at 30 minutes intervals:
1. Kilowatts.
 2. Amperes.
 3. Voltage.
 4. Coolant temperature.
 5. Inside container or room temperature.
 6. Frequency.
 7. Oil pressure.
- B. Test alarm and shut down circuits by simulating conditions.
- C. Test system in case of automatic mode as described in this specification.
- D. Demonstrate adequacy of engine-generator unit to operate as specified in all aspects. Any failure to demonstrate adequacy in any respect shall be corrected to the satisfaction of the Engineer.

3.4 TRAINING

- A. Provide instruction and training to the Owner's staff for the operation and maintenance of the equipment. Provide a minimum of 18 hours training to be divided between classroom and hands-on training as required by the Owner.

END OF SECTION

