SPECIFICATIONS FOR
3.3 KV, 550 KVA STATIONERY DIESEL ENGINE DRIVEN GENERATOR SET

SCOPE:

These Technical Specifications cover the equipment and materials for the DG Sets, their testing and inspection, delivery at site, all preparatory works, assembling, installation and adjustments, commissioning, final testing, putting into operation and handing over of the complete system along with required permissions and AMC for 2 years after warranty. Tenderer may visit SCCL site before submitting their tender.

1. DIESEL DRIVEN PRIME MOVER (DIESEL ENGINE):

The engine shall be of standard design of the original manufacturers, operating with High Speed diesel oil corresponding to IS-1460-1995 up to latest amendment. It should be 4 stroke cycles, 12 Cylinder, water cooled, naturally aspirated/ turbo charged (as per IS standard), developing suitable BHP for giving a power rating as per ISO 8528- Part-1 in KVA at the load terminals of alternator at 1500 rpm at actual site conditions.

The engine shall be capable for delivering specified Prime Power rating at variable loads for PF of 0.8 lag with 10% overload available in excess of specified output for one hour in every 12 hours. The average load factor of the engine over period of 24 hours shall be 0.85 (85%) for prime power output.

The engine shall conform to IS:10000/ ISO 3046/ BS:649/ BS 5514 amended up to date.

The engine shall be fitted with following accessories subject to the design of the Manufacturer and as per IS standards (delete whichever is not applicable) :

(i) Dynamically balanced Fly wheel
(ii) Necessary flexible coupling and guard for alternator and engine.
(iii) Air cleaner (dry/ oil bath type) as per manufacturer standard.
(iv) An electronic governor to maintain engine speed at all conditions of load.
(v) Diesel tank (Internal)
(vi) Dry exhaust manifold with suitable exhaust residential grade silencer to reduce the noise level.
(vii) Suitable self-starter of 24 V DC.
(viii) Battery charging alternator unit and voltage regulator, suitable for starting batteries, battery racks with interconnecting leads and terminals.
(ix) Necessary gear driven oil pump for lubricating oil, priming of engine bearing as well as fuel systems as per IS recommendations.
(x) Naturally aspirated/ turbo charger (as per manufacturer standard)
(xi) Lubrication oil cooler
(xii) Lubrication oil filters with replaceable elements
(xiii) Crank case heater as per standards.
(xiv) Fuel injection: Engine should have suitable fuel injection system in order to achieve low fuel consumption.

(xv) Fuel control solenoid

(xvi) Fuel pump with engine speed adjustment

(xvii) Engine Control Panel

(xviii) All moving parts of the engine shall be mechanically guarded in such a manner that a human finger cannot touch any moving part.

(xix) Radiator/ Heat Exchanger System

(xx) Any other item not included/ specified but is a standard design of the manufacturer and as per IS standards.

Governor:

Electronic governor of class A1 , as per ISO 3046/ BS 5514 with actuator shall be provided. Governor shall be a self contained unit capable of monitoring speed to enable the engine speed to be adjusted from the local control panel.

Frequency Variation:

The engine speed shall be so maintained that frequency variation at constant load including no load shall remain within a band of 1% of rated frequency.

Fuel System:

Fuel Tank: A minimum capacity of not less than 900ltrs fuel tank shall be provided. Design shall be capable of preventing accidental spilling of fuel and hand pump feeding on emergencies is possible.

It shall be fed through engine driven fuel pump. A replaceable element of fuel filter shall be suitably located to permit easy servicing. The daily service tank shall be complete with necessary supports, gauges, connecting pipe work etc. Pipe sealant should be used for sealing for all connections.

Lubricating Oil System

Necessary priming pump for the lub. oil circuit as per IS shall be installed, to keep bearings primed. This pump shall be normally automatically operative on AC/ DC supply available with the set. The lubricating engine oil shall be equivalent to any CPSU oils of India.

Exhaust System:

Exhaust Piping: All M.S. Pipes for exhaust lines shall be conforming to relevant IS.

(a) Exhaust gas piping as per site requirement with silencer (in IS 2002, 6mm thick), running from the exhaust manifold shall be provided with required number of Bends, Flanges, Elbows, rain protection hoods and MS angle supports etc. and shall be insulated with Resin bonded mineral wool / fibre glass and 22 SWG Al sheet Cladding and Exhaust Chimney.

Cooling System:

System should be designed for ambient temperature of 50 Deg.C.

Coolant should be used mixed with additive (in suitable proportion) as per Manufacturer recommendation . Radiator fan flow should be free from any obstruction.

2. ALTERNATOR:

Synchronous Alternator

Self excited, screen protected, self regulated, brush less alternator, Horizontal foot mounted in Double bearing construction suitable for the following:

Rated PF.	:	> 0.8
Rated voltage	:	3.3KV
Rated Output	:	550KVA
Rated frequency	:	50 Hz
No. of Phases	:	3
Degree of protection	:	IP-23 or latest
Ventilation	:	Forced air cooled
Ambient Temperature	:	50° C
Insulation Class	:	F
Temperature Rise	:	Within class F limits at rated load
Voltage Regulation	:	+/- 1%
Voltage variation	:	+/- 5%
Overload duration/capacity	:	10% for one hour in every 12 hours of continuous use.
Frequency variation	:	As defined by the Engine Governor (+/- 1%)

Excitation : Self excitation
Type of AVR : Electronic

Type of Bearing and lubrication arrangement: Anti friction bearings with Permanently Lubricated Sealed Type

Standard : IS 4722 & IEC:34 as amended upto date.

Alternator should be able to deliver output rating at actual site conditions.

Standards

The alternator shall be in accordance with the following standards as are applicable.

(i) IS 4722/ BS 2613 : 1970. The performance of rotating electrical machine.
(ii) IS 4889/ BS 269 rules for method of declaring efficiency of electrical machine

Performance:

Voltage dip shall not exceed 20% of the rated voltage for any step load or transient load as per ISO 8528 (Part-1).

The generator shall preferably be capable of withstanding a current equal to 1.5 times the rated current for a period of not more than 15 seconds as required vide clause 14.1.1 of IS 4722:1992.

The performance characteristics of the alternator shall be as below:

(a) Efficiency at full load 0.8 P.F. : not less than 93.5%

(b) Total distortion factor :Less than 3 %

(c) (i) 10% overload :One hour in every 12 hrs of continuous use.

(ii) 50% overload :15 seconds.

3. SWITCHGEAR:

3 pole, 3.3 KV, 400 Amps, 500 MVA, 25 kA, Electrically operated Draw-out type Sheet Steel enclosure Vacuum Circuit Breaker with Under Voltage, over-current and short circuit release, 240 volts AC motor, Closing Coil, 24 V DC Shunt Trip Coil with 4 NO + 4 NC Auxiliary contacts with in-built surge suppressors, for DG incoming side, provided with earth leakage relay (to limit and trip at a fault current of 50 amps, Mechanical ON/OFF, push buttons and GENSET ON,/OFF, TRIP on Fault Indication Lamp, TRIP CIRCUIT HEAALTHY - Test Button and indication lamp and RYB indication lamp on the front of the panel.

The circuit breaker shall have distinct positions for 'Connect', 'Disconnect' and 'Test' and all safety features and interlocks to protect the user from Electric Shock and one mechanical EMERGENCY TRIP switch.

4. CONTROL PANEL

Type of control panel :

Electronic Modular Panel - Floor mounted using environmentally sealed, solid state microprocessor based module for engine control and AC metering in 14 SWG (min) CRCA sheet steel enclosure with IP 52 protection or latest.

Features and provisions of the control panel :

The control panel shall be built to have the following provisions and features;

a) Trip / stop LED Indicators for Low Oil Pressure, High Water Temperature, over current, under Voltage, over Voltage, and emergency stop.
b) Energized to run or shutdown fuel control systems.
c) Back lit Display LCD digital readout for Engine oil pressure, engine rpm, system DC volts, Engine running hours, generator AC volts, generator AC amps, and generator frequency, System diagnostic codes.
d) Digital Ammeter, Voltmeter, Kilowatt-hour meter, Power Factor meter of suitable rating.
e) Ammeter – Voltmeter phase selector switch.
f) Emergency - stop push button
g) Indicator / display test switch
h) Voltage adjust potentiometer
i) Four spare inputs for use by the user
j) Speed adjust potentiometer or any latest
k) Electronic Protection relay unit with programmable trip level setting to safe guard against -
   - ® Over-voltage
   - ® Under - Voltage
   - ® Over - frequency
   - ® Under – frequency

® Over current
® Reverse Power
® Battery Over-Voltage
® Battery Under-Voltage

The above functions may be achieved in a single unit or multiple units as per design.

l) Earth fault relay for tripping duly limiting the fault current to 50 amps as per CEA -2010 or latest
m) Alarm module for all faults
n) Synchronizing panel
o) Digital Tachometer, Hour meter
p) Battery charge condition indicator
q) 230V LED lights inside the panel for panel illumination with suitable controls.
r) Door interlock switch for preventing opening of the doors of power module and control panel while power on.
s) Controls, Indications and Push Buttons for
   i. Breaker ON Indication
   ii. Breaker OFF Indication
   iii. Engine START Push Button
   iv. Engine STOP push Button
   v. Fault Accept / Reset Push Button
   vi. Speed Raise / Lower Switch.

5. Manual Transfer Switch (MTS):

The MTS shall comply with IEC or equivalent international standard. The separately mounted generator control cubicle and MTS panel shall be of sheet steel vermin proof with lockable hinged front doors.
A circuit breaker and Manual transfer switch should be provided rated for full load of the current (+ 10% overload).

6. CABLE ENTRY BOXES

The alternator and control panel shall be provided with suitable cable entry boxes (as per SCCL Drawing enclosed) for terminating 3 cores, PVC Double Wired armored cables Alternator terminal box to suit trench / duct layout.

7 . STARTING SYSTEM

1. Starter Motor : 24 Volts DC starter Motor

2. Batteries and battery charger: A set of maintenance free 24 Volts Lead Acid Batteries for smooth starting of the Genset. Static Battery charger with Trickle / boost mode, auto / manual selector switch with DC ammeter and DC voltmeter shall be part of the system.

8. BASE FRAME

The mounting base frame for the generator set shall be of sturdy fabricated welded construction with adequate size MS channel.

9. Common Bed Plate: Engine and alternator shall be directly coupled by means of flexible coupling as per manufacturer standard design and both units shall be mounted on a common bed plate together with all auxiliaries to ensure perfect alignment of engine and alternator with minimum vibrations. The bed plate shall be suitable for installation on suitable anti-vibration mounting system.

10. PAINTING

The surface of the generator set and all other sub-assemblies / Metallic parts shall be painted with Epoxy based paint of sufficient thickness for protection against corrosion after 7 tank pre-treatment.

11. Fire detection

Diesel generators housing shall have fire detection system suitable for use in an area containing diesel fuel. The fire detection system shall cut off the fuel supply from the tank in the event of a fire. The fire detection system shall operate an alarm system. The system shall meet the requirements of fire regulations.

12. CONFORMITY TO STANDARDS

The design, construction and operation of the Genset and components shall conform to / exceed relevant National and International standards.

13. GENERAL ACCESSORIES

a) All power cables with copper conductor between DG and panel and all control cables-30 Mts. Minimum, 40 X 6 mm Copper and 40 X 6 mm GI strips for earthing purpose of about 40 Mts each shall form part of the supply for each DG set.
b) All piping / Hoses between the fuel tank and the DG set. Shall be supplied with each DG set.
c) Hand operated fuel barrel pump shall be part of supply of each DG set.
d) Set of tools with tool box suitable for normal maintenance and repair work for each DG set shall be part of the supply.
e) Anti vibration Mounts shall be provided for each DG set as part of the supply..

14. MAKE OF COMPONENTS

1. Air circuit breakers, contactors, energy meters , panel meters, Selector switches, protective relays, auxiliary relays, power fuses (DIN type), control fuses with bases BS type, push buttons, Indicator lamps (LED cluster type) : L&T / SEIMENS / C&S, ASHIDA/ GE/MIMEC, BCH/LG/ ABB/ MECO.

2. Power Cables : NETCO / Polycab / NICCO / CCI / ICI
3. CTs : KAPPA /AE / PRAGATHI
4. Flexible wires : FINOLEX / NICCO/V GUARD

5.	Piping	:	TATA / JINDAL
6.	Valves	:	AUDCO or any reputed make
7.	Batteries		EXIDE/AMARON/HITACHI/BOSCH/HBL
8.	Battery charger	:	APLAB / JOSHI Industries/ FLAK or any reputed make
9.	Cable Lugs	:	DOWELS / MULTI

15. DOCUMENTATION

The suppliers have to submit all statutory approvals like NOC from Pollution Control Board, Approval of Chief Electrical Inspector to Govt. AP for Installation drawings and Installation work from electricity Board etc. with each DG set.

General arrangement drawings of control panel, battery charger along with foundation plans, overall dimensions, front view etc. Fuel tank drawing with mounting arrangement.

Schematic wiring diagram for the control panel, battery charger along with the complete bill of materials (makes, rating, range, size, accuracy class etc. and control cable details.

4 (Four) sets of Maintenance and instruction manuals covering operation, maintenance, spares part numbers & test certificates and also one set of soft copy of complete documentation shall be supplied along with each generator set.

16. INSTALLATION AND COMMISSIONING

The supplier has to depute their Technical representatives for Installation and commissioning of the DG sets.

17. WARRANTY

The Generator sets and all the accessories shall be guaranteed for a period of 24 months from the date of commissioning.

18. PRE-DESPATCH INSPECTIOON:

The supplier give two weeks advance intimation to enable the SCCL to depute representative for witnessing the acceptance and routine tests.

19. COMPREHENSIVE MAINTENANCE CONTRACT(CMC):

The tender shall include terms and conditions for Annual Maintenance Contract for a period of 2 years commencing immediately after the initial Warranty Period of 24 months. **Tenderer shall quote separately for CMC charges value of which will be considered for evaluation. L1 status for each generator set shall be attained by taking combined value of price of each generator and its CMC.**

SCOPE OF AMC:

a. Firm's Service Engineer will make 12 visits in a year at site at intervals each not exceeding 40 days.

b. During service visit the service engineer will inspect the DG set and carry out various checks and adjustments.

c. During CMC all parts except engine oil and diesel will be in the firm's scope.

d. All necessary skilled and un-skilled Labour, Tools, Stores, Lifting and Moving facility for completion of the job will be provided by SCCL

e. In addition to carrying out normal checking, adjustment and minor repairs, firm's service engineer should acquaint SCCL technical staff, responsible for the normal operation and maintenance of the engine, with Dos and Don'ts of correct operation and maintenance and the watch points for trouble-shooting.

f. Services offered under this contract will be in accordance with the Original manufacturer's standard service instruction practice to maintain the DG Set in healthy operating condition.

g. First fill engine oil is to be supplied by firm.

h. All visits should be acknowledged by signing the service report on the same day.

i. Payment terms: CMC payment will be done monthly on satisfactory service letter issued by the user.

20. The Tenderer should submit following along with quotation:

a) Detailed drawings and dimensions of the unit offered	
b) List of previous supplies executed and performance reports from actual users.	
c) One set of catalogue for each unit.	
d) Schedule of Technical particulars (Annexure-1) with signature.	

GM(E&M) WSs&EM

ANNEXURE -I

Schedule of Technical particulars to be submitted by Tenderer

I. Engine

1. Make
2. Model/ISS reference
3. No. of cylinders
4. Rated R.P.M.
5. Method of Starting
6. Aspiration Method
7. BHP
8. Lub. Oil recommended
9. Lub. Oil pressure
10. Qty. of lub. oil required
11. Time required for starting
12. Lub. oil sump capacity
13. Nos. of exhaust pipe required.
14. Dia. of exhaust pipe
15. Whether meets CPCB norms for Emission
16. i) Fuel Consumption at 25% Load
    ii) Fuel Consumption at 50% Load
    iii)Fuel Consumption at 100% Load
17. Any other data.

II. Alternator

1. Make
2. Enclosure Details
3. Full Load output in KVA
4. Full Load output in KW at 0.8 PF
5. Designed over load capacity at max. ambient temp.
6. Efficiency at full load
7. Class of Insulation of rotor
8. Class of Insulation stator

III. General:

1. Overall Length of DG set L x W x H
2. Overall Weight of DG set
3. Noise Level of DG Set at one Metre with Acoustic Enclosure

IV. MTS Switch

1. Make
2. Type

V. Generator Control Panel:

1. Make

VI. Acoustic Enclosure:

1. Make
2. Size
3. Details of Acoustic lining Material & Make

Signature of Tenderer

SPECIFICATIONS FOR
3.3 KV, 750 KVA STATIONERY DIESEL ENGINE DRIVEN GENERATOR SET

SCOPE:

These Technical Specifications cover the equipment and materials for the DG Sets, their testing and inspection, delivery at site, all preparatory works, assembling, installation and adjustments, commissioning, final testing, putting into operation and handing over of the complete system along with required permissions and AMC for 2 years after warranty. Tenderer may visit SCCL site before submitting their tender.

1. DIESEL DRIVEN PRIME MOVER (DIESEL ENGINE):

The engine shall be of standard design of the original manufacturers, operating with High Speed diesel oil corresponding to IS-1460-1995 up to latest amendment. It should be 4 stroke cycles, 12 Cylinder, water cooled, naturally aspirated/ turbo charged (as per IS standard), developing suitable BHP for giving a power rating as per ISO 8528- Part-1 in KVA at the load terminals of alternator at 1500 rpm at actual site conditions.

The engine shall be capable for delivering specified Prime Power rating at variable loads for PF of 0.8 lag with 10% overload available in excess of specified output for one hour in every 12 hours. The average load factor of the engine over period of 24 hours shall be 0.85 (85%) for prime power output.

The engine shall conform to IS:10000/ ISO 3046/ BS:649/ BS 5514 amended up to date.

The engine shall be fitted with following accessories subject to the design of the Manufacturer and as per IS standards (delete whichever is not applicable) :

(i) Dynamically balanced Fly wheel
(ii) Necessary flexible coupling and guard for alternator and engine.
(iii) Air cleaner (dry/ oil bath type) as per manufacturer standard.
(iv) An electronic governor to maintain engine speed at all conditions of load.
(v) Diesel tank (Internal)
(vi) Dry exhaust manifold with suitable exhaust residential grade silencer to reduce the noise level.
(vii) Suitable self-starter of 24 V DC.
(viii) Battery charging alternator unit and voltage regulator, suitable for starting batteries, battery racks with interconnecting leads and terminals.
(ix) Necessary gear driven oil pump for lubricating oil, priming of engine bearing as well as fuel systems as per IS recommendations.
(x) Naturally aspirated/ turbo charger (as per manufacturer standard)
(xi) Lubrication oil cooler
(xii) Lubrication oil filters with replaceable elements
(xiii) Crank case heater as per standards.
(xiv) Fuel injection: Engine should have suitable fuel injection system in order to achieve low fuel consumption.

(xv) Fuel control solenoid

(xvi) Fuel pump with engine speed adjustment

(xvii) Engine Control Panel

(xviii) All moving parts of the engine shall be mechanically guarded in such a manner that a human finger cannot touch any moving part.

(xix) Radiator/ Heat Exchanger System

(xx) Any other item not included/ specified but is a standard design of the manufacturer and as per IS standards.

Governor:

Electronic governor of class A1 , as per ISO 3046/ BS 5514 with actuator shall be provided. Governor shall be a self contained unit capable of monitoring speed to enable the engine speed to be adjusted from the local control panel.

Frequency Variation:

The engine speed shall be so maintained that frequency variation at constant load including no load shall remain within a band of 1% of rated frequency.

Fuel System:

Fuel Tank: A minimum capacity of not less than 900ltrs fuel tank shall be provided. Design shall be capable of preventing accidental spilling of fuel and hand pump feeding on emergencies is possible.

It shall be fed through engine driven fuel pump. A replaceable element of fuel filter shall be suitably located to permit easy servicing. The daily service tank shall be complete with necessary supports, gauges, connecting pipe work etc. Pipe sealant should be used for sealing for all connections.

Lubricating Oil System

Necessary priming pump for the lub. oil circuit as per IS shall be installed, to keep bearings primed. This pump shall be normally automatically operative on AC/ DC supply available with the set. The lubricating engine oil shall be equivalent to any CPSU oils of India.

Exhaust System:

Exhaust Piping: All M.S. Pipes for exhaust lines shall be conforming to relevant IS.

(a) Exhaust gas piping as per site requirement with silencer (in IS 2002, 6mm thick), running from the exhaust manifold shall be provided with required number of Bends, Flanges, Elbows, rain protection hoods and MS angle supports etc. and shall be insulated with Resin bonded mineral wool / fibre glass and 22 SWG Al sheet Cladding and Exhaust Chimney.

Cooling System:

System should be designed for ambient temperature of 50 Deg.C.

Coolant should be used mixed with additive (in suitable proportion) as per Manufacturer recommendation . Radiator fan flow should be free from any obstruction.

2. ALTERNATOR:

Synchronous Alternator

Self excited, screen protected, self regulated, brush less alternator, Horizontal foot mounted in Double bearing construction suitable for the following:

Rated PF.	:	≥ 0.8
Rated voltage	:	3.3KV
Rated Output	:	750KVA
Rated frequency	:	50 Hz
No. of Phases	:	3
Degree of protection	:	IP-23 or latest
Ventilation	:	Forced air cooled
Ambient Temperature	:	50° C
Insulation Class	:	F
Temperature Rise	:	Within class F limits at rated load
Voltage Regulation	:	+/- 1%
Voltage variation	:	+/- 5%
Overload duration/capacity	:	10% for one hour in every 12 hours of continuous use.
Frequency variation	:	As defined by the Engine Governor (+/- 1%)

Excitation : Self excitation
Type of AVR : Electronic

Type of Bearing and lubrication arrangement: Anti friction bearings with Permanently Lubricated Sealed Type

Standard : IS 4722 & IEC:34 as amended upto date.

Alternator should be able to deliver output rating at actual site conditions.

Standards

The alternator shall be in accordance with the following standards as are applicable.

(i) IS 4722/ BS 2613 : 1970. The performance of rotating electrical machine.
(ii) IS 4889/ BS 269 rules for method of declaring efficiency of electrical machine

Performance:

Voltage dip shall not exceed 20% of the rated voltage for any step load or transient load as per ISO 8528 (Part-1).

The generator shall preferably be capable of withstanding a current equal to 1.5 times the rated current for a period of not more than 15 seconds as required vide clause 14.1.1 of IS 4722:1992.

The performance characteristics of the alternator shall be as below:

(a) Efficiency at full load 0.8 P.F. : not less than 93.5%

(b) Total distortion factor :Less than 3 %

(c) (i) 10% overload :One hour in every 12 hrs of continuous use.

(ii) 50% overload :15 seconds.

3. SWITCHGEAR:

3 pole, 3.3 KV, 400 Amps, 500 MVA, 25 kA, Electrically operated Draw-out type Sheet Steel enclosure Vacuum Circuit Breaker with Under Voltage, over-current and short circuit release, 240 volts AC motor, Closing Coil, 24 V DC Shunt Trip Coil with 4 NO + 4 NC Auxiliary contacts with in-built surge suppressors, for DG incoming side, provided with earth leakage relay (to limit and trip at a fault current of 50 amps, Mechanical ON/OFF, push buttons and GENSET ON,/OFF, TRIP on Fault Indication Lamp, TRIP CIRCUIT HEAALTHY - Test Button and indication lamp and RYB indication lamp on the front of the panel.

The circuit breaker shall have distinct positions for 'Connect', 'Disconnect' and 'Test' and all safety features and interlocks to protect the user from Electric Shock and one mechanical EMERGENCY TRIP switch.

a. Neutral Grounding Resistor:

One Neutral Grounding resistor designed and rated to restrict the Fault current to 50 Amps shall be provided. The NGR shall be housed in a cubicle and will be Stainless Steel or Cu-Ni alloy. The rating of the NGR shall be for 10 seconds duty with temperature rise limitation of 375^0 C.

4. CONTROL PANEL

Type of control panel :

Electronic Modular Panel - Floor mounted using environmentally sealed, solid state microprocessor based module for engine control and AC metering in 14 SWG (min) CRCA sheet steel enclosure with IP 52 protection or latest.

Features and provisions of the control panel :

The control panel shall be built to have the following provisions and features;

t) Trip / stop LED Indicators for Low Oil Pressure, High Water Temperature, over current, under Voltage, over Voltage, and emergency stop.
u) Energized to run or shutdown fuel control systems.
v) Back lit Display LCD digital readout for Engine oil pressure, engine rpm, system DC volts, Engine running hours, generator AC volts, generator AC amps, and generator frequency, System diagnostic codes.
w) Digital Ammeter, Voltmeter, Kilowatt-hour meter, Power Factor meter of suitable rating.
x) Ammeter – Voltmeter phase selector switch.
y) Emergency - stop push button
z) Indicator / display test switch
aa) Voltage adjust potentiometer
bb) Four spare inputs for use by the user
cc) Speed adjust potentiometer or any latest

dd) Electronic Protection relay unit with programmable trip level setting to safe guard against -

- ® Over-voltage
- ® Under - Voltage
- ® Over - frequency
- ® Under – frequency
- ® Over current
- ® Reverse Power
- ® Battery Over-Voltage
- ® Battery Under-Voltage

The above functions may be achieved in a single unit or multiple units as per design.

ee) Earth fault relay for tripping duly limiting the fault current to 50 amps as per CEA -2010 or latest

ff) Alarm module for all faults

gg) Synchronizing panel

hh) Digital Tachometer, Hour meter

ii) Battery charge condition indicator

jj) 230V LED lights inside the panel for panel illumination with suitable controls.

kk) Door interlock switch for preventing opening of the doors of power module and control panel while power on.

ll) Controls, Indications and Push Buttons for

- j. Breaker ON Indication
- vii. Breaker OFF Indication
- viii. Engine START Push Button
- ix. Engine STOP push Button
- x. Fault Accept / Reset Push Button
- xi. Speed Raise / Lower Switch.

5. Manual Transfer Switch (MTS):

The MTS shall comply with IEC or equivalent international standard. The separately mounted generator control cubicle and MTS panel shall be of sheet steel vermin proof with lockable hinged front doors.
A circuit breaker and Manual transfer switch should be provided rated for full load of the current (+ 10% overload).

6. CABLE ENTRY BOXES

The alternator and control panel shall be provided with suitable cable entry boxes (as per SCCL Drawing enclosed) for terminating 3 cores, PVC Double Wired armored cables Alternator terminal box to suit trench / duct layout.

7 . STARTING SYSTEM

1. Starter Motor : 24 Volts DC starter Motor

3. Batteries and battery charger: A set of maintenance free 24 Volts Lead Acid Batteries for smooth starting of the Genset. Static Battery charger with Trickle / boost mode, auto / manual selector switch with DC ammeter and DC voltmeter shall be part of the system.

8. BASE FRAME

The mounting base frame for the generator set shall be of sturdy fabricated welded construction with adequate size MS channel.

9. Common Bed Plate: Engine and alternator shall be directly coupled by means of flexible coupling as per manufacturer standard design and both units shall be mounted on a common bed plate together with all auxiliaries to ensure perfect alignment of engine and alternator with minimum vibrations. The bed plate shall be suitable for installation on suitable anti-vibration mounting system.

10. PAINTING

The surface of the generator set and all other sub-assemblies / Metallic parts shall be painted with Epoxy based paint of sufficient thickness for protection against corrosion after 7 tank pre-treatment.

11. Fire detection

Diesel generators housing shall have fire detection system suitable for use in an area containing diesel fuel. The fire detection system shall cut off the fuel supply from the tank in the event of a fire. The fire detection system shall operate an alarm system. The system shall meet the requirements of fire regulations.

12. CONFORMITY TO STANDARDS

The design, construction and operation of the Genset and components shall conform to / exceed relevant National and International standards.

13. GENERAL ACCESSORIES

f) All power cables with copper conductor between DG and panel and all control cables-30 Mts. Minimum, 40 X 6 mm Copper and 40 X 6 mm GI strips for earthing purpose of about 40 Mts each shall form part of the supply for each DG set.
g) All piping / Hoses between the fuel tank and the DG set. Shall be supplied with each DG set.
h) Hand operated fuel barrel pump shall be part of supply of each DG set.
i) Set of tools with tool box suitable for normal maintenance and repair work for each DG set shall be part of the supply.
j) Anti vibration Mounts shall be provided for each DG set as part of the supply..

14. MAKE OF COMPONENTS

4. Air circuit breakers, contactors, energy meters , panel meters, Selector switches, protective relays, auxiliary relays, power fuses (DIN type), control fuses with bases BS type, push buttons, Indicator lamps (LED cluster type) : L&T / SEIMENS / C&S, ASHIDA/ GE/MIMEC, BCH/LG/ ABB/ MECO.

5. Power Cables : NETCO / Polycab / NICCO / CCI / ICI
6. CTs : KAPPA /AE / PRAGATHI
4. Flexible wires : FINOLEX / NICCO/V GUARD

5.	Piping	:	TATA / JINDAL
6.	Valves	:	AUDCO or any reputed make
7.	Batteries		EXIDE/AMARON/HITACHI/BOSCH/HBL
8.	Battery charger	:	APLAB / JOSHI Inductries/ FLAK or any reputed make
9.	Cable Lugs	:	DOWELS / MULTI

15. DOCUMENTATION

The suppliers have to submit all statutory approvals like NOC from Pollution Control Board, Approval of Chief Electrical Inspector to Govt. AP for Installation drawings and Installation work from electricity Board etc. with each DG set.

General arrangement drawings of control panel, battery charger along with foundation plans, overall dimensions, front view etc. Fuel tank drawing with mounting arrangement.

Schematic wiring diagram for the control panel, battery charger along with the complete bill of materials (makes, rating, range, size, accuracy class etc. and control cable details.

4 (Four) sets of Maintenance and instruction manuals covering operation, maintenance, spares part numbers & test certificates and also one set of soft copy of complete documentation shall be supplied along with each generator set.

16. INSTALLATION AND COMMISSIONING

The supplier has to depute their Technical representatives for Installation and commissioning of the DG sets.

17. WARRANTY

The Generator sets and all the accessories shall be guaranteed for a period of 24 months from the date of commissioning.

18. PRE-DESPATCH INSPECTIOON:

The supplier give two weeks advance intimation to enable the SCCL to depute representative for witnessing the acceptance and routine tests.

19. COMPREHENSIVE MAINTENANCE CONTRACT(CMC):

The tender shall include terms and conditions for Annual Maintenance Contract for a period of 2 years commencing immediately after the initial Warranty Period of 24 months. **Tenderer shall quote separately for CMC charges value of which will be considered for evaluation. L1 status for each generator set shall be attained by taking combined value of price of each generator and its CMC.**

SCOPE OF AMC:

i. Firm's Service Engineer will make 12 visits in a year at site at intervals each not exceeding 40 days.

j. During service visit the service engineer will inspect the DG set and carry out various checks and adjustments.

k. During CMC all parts except engine oil and diesel will be in the firm's scope.

l. All necessary skilled and un-skilled Labour, Tools, Stores, Lifting and Moving facility for completion of the job will be provided by SCCL

m. In addition to carrying out normal checking, adjustment and minor repairs, firm's service engineer should acquaint SCCL technical staff, responsible for the normal operation and maintenance of the engine, with Dos and Don'ts of correct operation and maintenance and the watch points for trouble-shooting.

n. Services offered under this contract will be in accordance with the Original manufacturer's standard service instruction practice to maintain the DG Set in healthy operating condition.

o. First fill engine oil is to be supplied by firm.

p. All visits should be acknowledged by signing the service report on the same day.

i. Payment terms: CMC payment will be done monthly on satisfactory service letter issued by the user.

20. The Tenderer should submit following along with quotation:

e) Detailed drawings and dimensions of the unit offered	
f) List of previous supplies executed and performance reports from actual users.	
g) One set of catalogue for each unit.	
h) Schedule of Technical particulars (Annexure-1) with signature.	

GM(E&M) WSs&EM

ANNEXURE -I

Schedule of Technical particulars to be submitted by Tenderer

I. Engine

1. Make
2. Model/ISS reference
3. No. of cylinders
4. Rated R.P.M.
5. Method of Starting
6. Aspiration Method
7. BHP
8. Lub. Oil recommended
9. Lub. Oil pressure
10. Qty. of lub. oil required
11. Time required for starting
12. Lub. oil sump capacity
13. Nos. of exhaust pipe required.
14. Dia. of exhaust pipe
15. Whether meets CPCB norms for Emission
16. i) Fuel Consumption at 25% Load
    ii) Fuel Consumption at 50% Load
    iii)Fuel Consumption at 100% Load
17. Any other data.

II. Alternator

1. Make
2. Enclosure Details
3. Full Load output in KVA
4. Full Load output in KW at 0.8 PF
5. Designed over load capacity at max. ambient temp.
6. Efficiency at full load
7. Class of Insulation of rotor
8. Class of Insulation stator

III. General:

1. Overall Length of DG set L x W x H
2. Overall Weight of DG set
3. Noise Level of DG Set at one Metre with Acoustic Enclosure

IV. MTS Switch

1. Make
2. Type

V. Generator Control Panel:

1. Make

VI. Acoustic Enclosure:

1. Make
2. Size
3. Details of Acoustic lining Material & Make

Signature of Tenderer

SPECIFICATIONS FOR
550V, 750 KVA STATIONERY DIESEL ENGINE DRIVEN GENERATOR SET

SCOPE:

These Technical Specifications cover the equipment and materials for the DG Sets, their testing and inspection, delivery at site, all preparatory works, assembling, installation and adjustments, commissioning, final testing, putting into operation and handing over of the complete system along with required permissions and AMC for 2 years after warranty. Tenderer may visit SCCL site before submitting their tender.

1. DIESEL DRIVEN PRIME MOVER (DIESEL ENGINE):

The engine shall be of standard design of the original manufacturers, operating with High Speed diesel oil corresponding to IS-1460-1995 up to latest amendment. It should be 4 stroke cycles, 12 Cylinder, water cooled, naturally aspirated/ turbo charged (as per IS standard), developing suitable BHP for giving a power rating as per ISO 8528- Part-1 in KVA at the load terminals of alternator at 1500 rpm at actual site conditions.

The engine shall be capable for delivering specified Prime Power rating at variable loads for PF of 0.8 lag with 10% overload available in excess of specified output for one hour in every 12 hours. The average load factor of the engine over period of 24 hours shall be 0.85 (85%) for prime power output.

The engine shall conform to IS:10000/ ISO 3046/ BS:649/ BS 5514 amended up to date.

The engine shall be fitted with following accessories subject to the design of the Manufacturer and as per IS standards (delete whichever is not applicable) :

(i) Dynamically balanced Fly wheel
(ii) Necessary flexible coupling and guard for alternator and engine.
(iii) Air cleaner (dry/ oil bath type) as per manufacturer standard.
(iv) An electronic governor to maintain engine speed at all conditions of load.
(v) Diesel tank (Internal)
(vi) Dry exhaust manifold with suitable exhaust residential grade silencer to reduce the noise level.
(vii) Suitable self-starter of 24 V DC.
(viii) Battery charging alternator unit and voltage regulator, suitable for starting batteries, battery racks with interconnecting leads and terminals.
(ix) Necessary gear driven oil pump for lubricating oil, priming of engine bearing as well as fuel systems as per IS recommendations.
(x) Naturally aspirated/ turbo charger (as per manufacturer standard)
(xi) Lubrication oil cooler
(xii) Lubrication oil filters with replaceable elements
(xiii) Crank case heater as per standards.
(xiv) Fuel injection: Engine should have suitable fuel injection system in order to achieve low fuel consumption.

(xv) Fuel control solenoid

(xvi) Fuel pump with engine speed adjustment

(xvii) Engine Control Panel

(xviii) All moving parts of the engine shall be mechanically guarded in such a manner that a human finger cannot touch any moving part.

(xix) Radiator/ Heat Exchanger System

(xx) Any other item not included/ specified but is a standard design of the manufacturer and as per IS standards.

Governor:

Electronic governor of class A1 , as per ISO 3046/ BS 5514 with actuator shall be provided. Governor shall be a self contained unit capable of monitoring speed to enable the engine speed to be adjusted from the local control panel.

Frequency Variation:

The engine speed shall be so maintained that frequency variation at constant load including no load shall remain within a band of 1% of rated frequency.

Fuel System:

Fuel Tank: A minimum capacity of not less than 900ltrs fuel tank shall be provided. Design shall be capable of preventing accidental spilling of fuel and hand pump feeding on emergencies is possible.

It shall be fed through engine driven fuel pump. A replaceable element of fuel filter shall be suitably located to permit easy servicing. The daily service tank shall be complete with necessary supports, gauges, connecting pipe work etc. Pipe sealant should be used for sealing for all connections.

Lubricating Oil System

Necessary priming pump for the lub. oil circuit as per IS shall be installed, to keep bearings primed. This pump shall be normally automatically operative on AC/ DC supply available with the set. The lubricating engine oil shall be equivalent to any CPSU oils of India.

Exhaust System:

Exhaust Piping: All M.S. Pipes for exhaust lines shall be conforming to relevant IS.

(a) Exhaust gas piping as per site requirement with silencer (in IS 2002, 6mm thick), running from the exhaust manifold shall be provided with required number of Bends, Flanges, Elbows, rain protection hoods and MS angle supports etc. and shall be insulated with Resin bonded mineral wool / fibre glass and 22 SWG Al sheet Cladding and Exhaust Chimney.

Cooling System:

System should be designed for ambient temperature of 50 Deg.C.

Coolant should be used mixed with additive (in suitable proportion) as per Manufacturer recommendation . Radiator fan flow should be free from any obstruction.

2. ALTERNATOR:

Synchronous Alternator

Self excited, screen protected, self regulated, brush less alternator, Horizontal foot mounted in Double bearing construction suitable for the following:

Rated PF.	:	≥ 0.8
Rated voltage	:	550V
Rated Output	:	750KVA
Rated frequency	:	50 Hz
No. of Phases	:	3
Degree of protection	:	IP-23 or latest
Ventilation	:	Forced air cooled
Ambient Temperature	:	50° C
Insulation Class	:	F
Temperature Rise	:	Within class F limits at rated load
Voltage Regulation	:	+/- 1%
Voltage variation	:	+/- 5%
Overload duration/capacity	:	10% for one hour in every 12 hours of continuous use.
Frequency variation	:	As defined by the Engine Governor (+/- 1%)

Excitation : Self excitation
Type of AVR : Electronic

Type of Bearing and lubrication arrangement: Anti friction bearings with Permanently Lubricated Sealed Type

Standard : IS 4722 & IEC:34 as amended upto date.

Alternator should be able to deliver output rating at actual site conditions.

Standards

The alternator shall be in accordance with the following standards as are applicable.

(i) IS 4722/ BS 2613 : 1970. The performance of rotating electrical machine.
(ii) IS 4889/ BS 269 rules for method of declaring efficiency of electrical machine

Performance:

Voltage dip shall not exceed 20% of the rated voltage for any step load or transient load as per ISO 8528 (Part-1).

The generator shall preferably be capable of withstanding a current equal to 1.5 times the rated current for a period of not more than 15 seconds as required vide clause 14.1.1 of IS 4722:1992.

The performance characteristics of the alternator shall be as below:

(a) Efficiency at full load 0.8 P.F. : not less than 93.5%

(b) Total distortion factor :Less than 3 %

(c) (i) 10% overload :One hour in every 12 hrs of continuous use.

(ii) 50% overload :15 seconds.

3. **SWITCHGEAR:**

Power Module:

4 Pole, 1250Amps, Electrically operated Draw-out type Air Circuit Breaker with over-current and short circuit release, 240 Volts AC Motor, UV Coil, 24 V DC Shunt Trip Coil with 4 NO+ 4NC Auxiliary Contacts for DG Incoming side, provided with earth leakage relay (to limit and trip at a fault current of 750 milliamps), GENSET ON, LOAD ON, TRIP Indication Lamp, TRIP CIRCUIT HEALTHY -Test Button and indication Lamp and RYB indication Lamp on the front of the panel.

The circuit breaker shall have distinct positions for 'Connect', 'Disconnect' and 'Test' and all safety features and interlocks to protect the user from Electric Shock and one mechanical EMERGENCY TRIP switch.

4. CONTROL PANEL

Type of control panel :

Electronic Modular Panel - Floor mounted using environmentally sealed, solid state microprocessor based module for engine control and AC metering in 14 SWG (min) CRCA sheet steel enclosure with IP 52 protection or latest.

Features and provisions of the control panel :

The control panel shall be built to have the following provisions and features;

mm) Trip / stop LED Indicators for Low Oil Pressure, High Water Temperature, over current, under Voltage, over Voltage, and emergency stop.

nn) Energized to run or shutdown fuel control systems.

oo) Back lit Display LCD digital readout for Engine oil pressure, engine rpm, system DC volts, Engine running hours, generator AC volts, generator AC amps, and generator frequency, System diagnostic codes.

pp) Digital Ammeter, Voltmeter, Kilowatt-hour meter, Power Factor meter of suitable rating.

qq) Ammeter – Voltmeter phase selector switch.

rr) Emergency - stop push button

ss) Indicator / display test switch

tt) Voltage adjust potentiometer

uu) Four spare inputs for use by the user

vv) Speed adjust potentiometer or any latest

ww) Electronic Protection relay unit with programmable trip level setting to safe guard against -

- ® Over-voltage
- ® Under - Voltage
- ® Over - frequency
- ® Under – frequency

® Over current
® Reverse Power
® Battery Over-Voltage
® Battery Under-Voltage

The above functions may be achieved in a single unit or multiple units as per design.

xx) Earth fault relay for tripping duly limiting the fault current to 50 amps as per CEA - 2010 or latest
yy) Alarm module for all faults
zz) Synchronizing panel
aaa) Digital Tachometer, Hour meter
bbb) Battery charge condition indicator
ccc) 230V LED lights inside the panel for panel illumination with suitable controls.
ddd) Door interlock switch for preventing opening of the doors of power module and control panel while power on.
eee) Controls, Indications and Push Buttons for
k. Breaker ON Indication
xii. Breaker OFF Indication
xiii. Engine START Push Button
xiv. Engine STOP push Button
xv. Fault Accept / Reset Push Button
xvi. Speed Raise / Lower Switch.

5. Manual Transfer Switch (MTS):

The MTS shall comply with IEC or equivalent international standard. The separately mounted generator control cubicle and MTS panel shall be of sheet steel vermin proof with lockable hinged front doors.
A circuit breaker and Manual transfer switch should be provided rated for full load of the current (+ 10% overload).

6. CABLE ENTRY BOXES

The alternator and control panel shall be provided with suitable cable entry boxes (as per SCCL Drawing enclosed) for terminating 3 cores, PVC Double Wired armored cables Alternator terminal box to suit trench / duct layout.

7 . STARTING SYSTEM

1. Starter Motor : 24 Volts DC starter Motor

4. Batteries and battery charger: A set of maintenance free 24 Volts Lead Acid Batteries for smooth starting of the Genset. Static Battery charger with Trickle / boost mode, auto / manual selector switch with DC ammeter and DC voltmeter shall be part of the system.

8. BASE FRAME

The mounting base frame for the generator set shall be of sturdy fabricated welded construction with adequate size MS channel.

9. Common Bed Plate: Engine and alternator shall be directly coupled by means of flexible coupling as per manufacturer standard design and both units shall be mounted on a common bed plate together with all auxiliaries to ensure perfect alignment of engine and alternator with minimum vibrations. The bed plate shall be suitable for installation on suitable anti-vibration mounting system.

10. PAINTING

The surface of the generator set and all other sub-assemblies / Metallic parts shall be painted with Epoxy based paint of sufficient thickness for protection against corrosion after 7 tank pre-treatment.

11. Fire detection

Diesel generators housing shall have fire detection system suitable for use in an area containing diesel fuel. The fire detection system shall cut off the fuel supply from the tank in the event of a fire. The fire detection system shall operate an alarm system. The system shall meet the requirements of fire regulations.

12. CONFORMITY TO STANDARDS

The design, construction and operation of the Genset and components shall conform to / exceed relevant National and International standards.

13. GENERAL ACCESSORIES

k) All power cables with copper conductor between DG and panel and all control cables-30 Mts. Minimum, 40 X 6 mm Copper and 40 X 6 mm GI strips for earthing purpose of about 40 Mts each shall form part of the supply for each DG set.

l) All piping / Hoses between the fuel tank and the DG set. Shall be supplied with each DG set.

m) Hand operated fuel barrel pump shall be part of supply of each DG set.

n) Set of tools with tool box suitable for normal maintenance and repair work for each DG set shall be part of the supply.

o) Anti vibration Mounts shall be provided for each DG set as part of the supply..

14. MAKE OF COMPONENTS

7. Air circuit breakers, contactors, energy meters , panel meters, Selector switches, protective relays, auxiliary relays, power fuses (DIN type), control fuses with bases BS type, push buttons, Indicator lamps (LED cluster type) : L&T / SEIMENS / C&S, ASHIDA/ GE/MIMEC, BCH/LG/ ABB/ MECO.

8. Power Cables : NETCO / Polycab / NICCO / CCI / ICI
9. CTs : KAPPA /AE / PRAGATHI
4. Flexible wires : FINOLEX / NICCO/V GUARD

5.	Piping	:	TATA / JINDAL
6.	Valves	:	AUDCO or any reputed make
7.	Batteries		EXIDE/AMARON/HITACHI/BOSCH/HBL
8.	Battery charger	:	APLAB / JOSHI Industries/ FLAK or any reputed make
9.	Cable Lugs	:	DOWELS / MULTI

15. DOCUMENTATION

The suppliers have to submit all statutory approvals like NOC from Pollution Control Board, Approval of Chief Electrical Inspector to Govt. AP for Installation drawings and Installation work from electricity Board etc. with each DG set.

General arrangement drawings of control panel, battery charger along with foundation plans, overall dimensions, front view etc. Fuel tank drawing with mounting arrangement.

Schematic wiring diagram for the control panel, battery charger along with the complete bill of materials (makes, rating, range, size, accuracy class etc. and control cable details.

4 (Four) sets of Maintenance and instruction manuals covering operation, maintenance, spares part numbers & test certificates and also one set of soft copy of complete documentation shall be supplied along with each generator set.

16. INSTALLATION AND COMMISSIONING

The supplier has to depute their Technical representatives for Installation and commissioning of the DG sets.

17. WARRANTY

The Generator sets and all the accessories shall be guaranteed for a period of 24 months from the date of commissioning.

18. PRE-DESPATCH INSPECTIOON:

The supplier give two weeks advance intimation to enable the SCCL to depute representative for witnessing the acceptance and routine tests.

19. COMPREHENSIVE MAINTENANCE CONTRACT(CMC):

The tender shall include terms and conditions for Annual Maintenance Contract for a period of 2 years commencing immediately after the initial Warranty Period of 24 months. **Tenderer shall quote separately for CMC charges value of which will be considered for evaluation. L1 status for each generator set shall be attained by taking combined value of price of each generator and its CMC.**

SCOPE OF AMC:

q. Firm's Service Engineer will make 12 visits in a year at site at intervals each not exceeding 40 days.

r. During service visit the service engineer will inspect the DG set and carry out various checks and adjustments.

s. During CMC all parts except engine oil and diesel will be in the firm's scope.

t. All necessary skilled and un-skilled Labour, Tools, Stores, Lifting and Moving facility for completion of the job will be provided by SCCL

u. In addition to carrying out normal checking, adjustment and minor repairs, firm's service engineer should acquaint SCCL technical staff, responsible for the normal operation and maintenance of the engine, with Dos and Don'ts of correct operation and maintenance and the watch points for trouble-shooting.

v. Services offered under this contract will be in accordance with the Original manufacturer's standard service instruction practice to maintain the DG Set in healthy operating condition.

w. First fill engine oil is to be supplied by firm.

x. All visits should be acknowledged by signing the service report on the same day.

i. Payment terms: CMC payment will be done monthly on satisfactory service letter issued by the user.

20. The Tenderer should submit following along with quotation:

i) Detailed drawings and dimensions of the unit offered	
j) List of previous supplies executed and performance reports from actual users.	
k) One set of catalogue for each unit.	
l) Schedule of Technical particulars (Annexure-1) with signature.	

G.M. (E&M) WSs & EM.

ANNEXURE -I

Schedule of Technical particulars to be submitted by Tenderer

I. Engine

1. Make
2. Model/ISS reference
3. No. of cylinders
4. Rated R.P.M.
5. Method of Starting
6. Aspiration Method
7. BHP
8. Lub. Oil recommended
9. Lub. Oil pressure
10. Qty. of lub. oil required
11. Time required for starting
12. Lub. oil sump capacity
13. Nos. of exhaust pipe required.
14. Dia. of exhaust pipe
15. Whether meets CPCB norms for Emission
16. i) Fuel Consumption at 25% Load
    ii) Fuel Consumption at 50% Load
    iii)Fuel Consumption at 100% Load
17. Any other data.

II. Alternator

1. Make
2. Enclosure Details
3. Full Load output in KVA
4. Full Load output in KW at 0.8 PF
5. Designed over load capacity at max. ambient temp.
6. Efficiency at full load
7. Class of Insulation of rotor
8. Class of Insulation stator

III. General:

1. Overall Length of DG set L x W x H
2. Overall Weight of DG set
3. Noise Level of DG Set at one Metre with Acoustic Enclosure

IV. MTS Switch

1. Make
2. Type

V. Generator Control Panel:

1. Make

VI. Acoustic Enclosure:

1. Make
2. Size
3. Details of Acoustic lining Material & Make

Signature of Tenderer