AN ISO 9001 & 14001 COMPANY

TENDER DOCUMENT

TENDER No: EPI/WRO/CON/693/0072 31.07.2015

FOR


VOLUME – II

Additional Conditions of Contract (ACC)
Technical Specifications

EXECUTING AGENCY:

ENGINEERING PROJECTS (INDIA) LIMITED
(A GOVT. OF INDIA ENTERPRISE)
6A, 6th Floor, ‘BAKHTAWAR’
Nariman Point, Mumbai – 400 021
TEL NO: 022- 22049230, FAX NO. 022 – 22882177
<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Additional Conditions of Contract</td>
</tr>
<tr>
<td>2</td>
<td>Technical Specifications</td>
</tr>
</tbody>
</table>
ADDITIONAL CONDITIONS

OF

CONTRACT
AN ISO 9001 & 14001 COMPANY

TENDER DOCUMENT

TENDER No:

FOR


VOLUME – II

Additional Conditions of Contract (ACC)
Technical Specifications

EXECUTING AGENCY :
ENGINEERING PROJECTS (INDIA) LIMITED
(A GOVT. OF INDIA ENTERPRISE)
6A, 6th Floor, ‘BAKHTAWAR’
Nariman Point, Mumbai – 400 021
TEL NO: 022- 22049230, FAX NO. 022 – 22882177
<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Additional Conditions of Contract</td>
</tr>
<tr>
<td>2</td>
<td>Technical Specifications</td>
</tr>
</tbody>
</table>
ADDITIONAL CONDITIONS

OF

CONTRACT
ADDITIONAL CONDITIONS OF CONTRACT (ACC)

The following Additional Conditions of Contract shall be read in conjunction with General Conditions & Special Condition of Contract. If there are any provisions in these Additional Conditions of Contract, which are at variance with the provisions of General Conditions/ Special Condition of Contract, the provisions in these Additional Conditions of Contract shall take precedence.

1.0 INTRODUCTION

The site of ITBP is existing in village Tilahari, which is situated at the out skirt of Jabalpur city in Madhya Pradesh. Jabalpur is an important railway station of Central Railway on Allahabad -Itarsi Section.

2.0 SCOPE OF WORK INCLUDED IN THE CONTRACT

The work mainly consist of Supply, installation, testing and commissioning of following Electro mechanical balance works

(1) DG Set
(2) Any other work as required at site for completion of the above work.

Unless otherwise mentioned in the tender documents, the following works shall be done by the contractor and therefore, their cost shall be deemed to be included in their tendered cost-whether specifically indicated in the schedule of work or not.

(i) Minor civil works / foundations / All supports for cables, anti-vibration pads etc necessary for installation of equipments, foundation trench for fuel line & cable, making of opening in walls or in doors and restoring them to their original condition/ finish and necessary grouting etc. as required

(ii) Making good all damages caused to the structure during installation and restoring the same to their original finish.

(iii) All electrical work and neutral earthing, body earthing, providing all pipes, bus trunking and/ or cable connections required for engine & alternator, main board/ control panels, and control wiring including loop earthing, if specified in Schedule of Work.

(iv) POL i.e. HSD oil and lub. oil for diesel engine for testing & commissioning for 12 hours i/c 1hr of 10% overloading at OEA/ OEM works shall be arranged by the contractor.

(v) Painting of all exposed metal surfaces of equipments and components with appropriate colour.

(vi) Clearance/ Approval of the complete installation from CPCB/ State Pollution Control Board, Central Electricity Authority (CEA)/ Local Bodies and other licensing authorities, wherever required.
3.0 QUALIFICATION OF TENDERERS
To be eligible for this tender the bidders should fulfill the requirements for eligibility as mentioned in the Notice Inviting Tender (NIT) and should submit detailed data and credentials set out in Cl 19.0 of ITT & NIT of the Tender.
The Tenderers are required to fulfill all the eligibility criteria as stipulated in NIT and elsewhere in the Tender documents. The price bid of tenderers who fulfill the eligibility criteria as per evaluation of EPI shall only be opened. The decision of EPI in this regard shall be final & binding on the tenderers.

3.1 Order of Precedence: - In the event of any ambiguity or conflict between the contract documents, the order of precedence shall be in the following order.
(i) NIT, Memorandum, BOQ
(ii) Additional Condition Of contract (ACC).
(iii) Technical Specifications & Drawings
(iv) General Condition of Contract (GCC)

4.0 CONTRACTOR confirms that they have read and understood and have copies of the ‘Tender Documents’ and have visited the site and their offer is based on the ‘tender Documents’ and caters to all the works, requirements, etc.thereof.

5.0 DISQUALIFICATION
The tenderers may note that they are liable to be disqualified and not considered for the opening of Price Bid if;
a) Representation in the forms, statements and attachments submitted in the pre-qualification document are proved to be incorrect, false and misleading.

b) They have record of poor performance during the past 10 years such as abandoning the work, rescinding of contract for which the reasons are attributable to the nonperformance of the contractor, inordinate delay incompletion, consistent history of litigation / arbitration awarded against the contractor or any of its constituents or financial failures due to bankruptcy etc. in their on going / past projects.

c) They have submitted incompletely filled in formats without attaching certified supporting documents and credentials to establish their eligibility to participate in the Tender.

d) If the tenderers attempt to influence any member of the committee. EPI reserves its right to take appropriate action including disqualification of tenderer(s) as may be deemed fit and proper by EPI at any time without giving any notice to the contractor in this regard. The decision of EPI in the matter of disqualification shall be final and binding on the Tenderers.
6.0 SPECIFICATIONS
6.1 The works detail specifications are as per Bill of quantities & enclosed technical specifications provided in tender documents. The work is to be carried out as per Specifications. The Technical Specifications for the work can be seen at Vol-II technical specifications.
6.2 The reinforcement steel used shall be corrosion resistant (CRS Steel). Thermo mechanically Treated bars conforming to IS: 1786, Fe 500 grade as required, from approved manufacturers viz SAIL/RINL/TISCO/ equivalent as approved by client shall be used.
6.3 Ordinary Portland cement/ Blast furnace slag cement/ PPC of Grade43/ Grade53 as per design, manufactured by major & reputed plant shall only be used.
In case contractor uses PPC/slag cement instead of OPC than the cost difference of amount of Rs. 400 per MT shall be recovered from contractor

7.0 Taxes and Duties:
The contractor shall be responsible for the payment of all Taxes, Duties Statutory levies such as VAT, WCT, Labour Cess, Other Cess, Octroi, Entry Tax, Royalties, Turn over Tax, Service Tax, and other expenses etc. Labour cess @ 1% shall be deducted from each RA bill. TDS shall be deducted as per statutory rates as applicable. Income Tax will also be deducted from bills as per rule.

7.1 Mobilization Advance: - No mobilization advance shall be paid.

7.2 Secured Advance against non perishable material: - No Secured Advance shall be paid.

7.3 Mode of Payment: - All payments will be made through RTGS/NEFT to the contractor’s account.

8.0 All men, materials, machinery, tools and plants, infrastructure etc. as required for execution of “Works” shall be provided and arranged by CONTRACTOR for their portion of work. All transportation charges including for cartage of issue material, electricity and water charges and for all expenses such as site offices expenses, labour camp, bank guarantee charges, EPF/CPF/ Statutory contributions preparation of all required design & detailed engineering and all required drawings etc., facilities and other expenses whatsoever, incurred on execution, completion and maintenance of the “Works” as per ‘Tender Documents’, and their own overheads and profit etc. shall unconditionally abide by all conditions for execution of “Works” as per terms, conditions specifications, drawings, documents etc. given in the ‘Tender Documents’ for the completion, handing over, maintenance period etc. for the project.

9.0 The contractor shall take insurance cover at its own cost towards Workman Compensation Act for its own workers, employees and for the plant & Equipment deployed by the contractor at the project site and shall furnish documentary proof of the same to failing which no payments shall be
released to the contractor against work done. The contractor shall assist EPI in follow up with insurance company in case of any claim related to contractor scope of work. EPI is not liable to pay any claim of the contractor if it is not paid by insurance company due to any reasons whatsoever.

10.0 In the event of award of “works”, contractor shall submit to EPI Bank Guarantees from a Scheduled Bank towards performance, retention money, security deposit etc. (if applicable) as required by EPI/Client/local authorities as per conditions of the ‘Tender Documents’ (in the prescribed proforma of EPI) for contractor’s portion of work.

11.0 The contractor shall be fully responsible to complete the “Works” in workmen like manner to the satisfaction of the Client and EPI by maintaining high standard of quality and precision as per ‘Tender Documents,’ Agreements, Terms & Conditions, Specifications, Drawings etc. within contractual completion period and within their quoted rates/amount.

12.0 In case contractor is awarded the “Works”, they will submit detailed work programme in Bar chart/MS Project within 07 days of issuance of LOI/W.O. If they fail to execute as per agreed schedule of progress of work and as per specified quality and/or lags behind in activities required for timely completion of “works”, as determined by EPI/Client, then EPI shall give 15 days written notice to contractor to achieve the specified quality and/or to deploy adequate to the satisfaction of EPI for timely completion of “Works”, then EPI shall have option to withdraw the remaining work partly or in full from contractor and get the same executed at the risk and cost of the contractor from alternative agency/agencies besides encashment of the guarantees submitted by the contractor to EPI. The decision of EPI in this regard shall be final and binding on the contractor.

13.0 In case the project execution is delayed beyond the contractual scheduled completion period due to any reason attributable to the Contractor, the staff and site office expenses of EPI for extended period shall be paid by the Contractor to EPI at the rate of Rs. 100000/- per month. This shall be in addition to the Liquidated Damages/ Compensation for delay/Penalties etc. if any, levied by Client.

14.0 The CONTRACTOR shall be responsible for timely completion of the “Works” within the contractual completion period. Total Liquidated Damages and Compensation for delay, shall be applicable as per GCC and shall be recovered from CONTRACTOR’s bills or other dues.

15.0 The CONTRACTOR shall have EPF Code number, CST-TIN, Service Tax, VAT –TIN/ Sales tax on Works contract number, Service tax registration number, PAN (Permanent Account Number of Income Tax) etc. and shall be responsible for depositing EPF subscription and contribution for labour and staff employed by it on the “Works” and Service tax, other taxes, duties and dues etc. as per statutory requirements and documentary evidence of same shall be provided to EPI. The Contractor shall also be responsible for labour
welfare and for arranging labour and other licenses/permits/clearance etc. for the project at their own. In case EPI has to take labour license or and other licenses, all expenditure towards the same shall also be borne by the Contractor. The Contractor shall comply with all the requirements as per labour laws/acts. All the records in this regard shall be maintained by Contractor as per statutory requirements and rules and shall be produced by the Contractor on demand if required.

16.0 The CONTRACTOR shall be responsible for obtaining all approvals from Client with regard to quality of materials & workmanship and measurements etc. for their portion of work. All such approvals shall be in the name and title of EPI. The Contractor shall be responsible for reconciliation of issued material, if any. Any shortfall in issue materials shall be made good/recovered from Contractor at actual expenditure plus financing and handling charges @ 10%

17.0 The Contractor will not deal directly with Client and all the correspondence in matters regarding bills, claims, interpretation of the specifications, conditions and all matters related to the contract with Client, Client’s Consultants, all other agencies including Government and Statutory bodies etc. shall be done through EPI only. Contractor shall prepare and submit expeditiously all bills, claims, details, clarifications, documents, information, etc. as required by EPI /Client for proper execution and successful completion of the “Works”

18.0 If desired by EPI, Contractor shall be available/associate with EPI in meetings with Client for its portion of work. Contractor shall furnish all information and clarifications as and when required by EPI/Client.

19.0 The Contractor shall plan and execute the “Works’ in his scope of work in such a manner that the other works, connected with the “Works” of the Contractor, but not included in the Contractor’s scope of work, do not get affected/delayed.

20.0 The Contractor shall deploy sufficient plant & equipment of the required and in good working condition for completion of the works in stipulated time with required quality, the equipment should either be owned by the Contractor or hired/leased. The deployment of equipment by Contractor shall be as decided by EPI and the same shall not be less than the minimum deployment stipulated by the Client, if any for execution of “Works” and as per schedule agreed with EPI. The Contractor shall make arrangement for regular maintenance including preventive and breakdown maintenance and maintain stock of essential spares at site/near to site so as to ensure minimum breakdown time of equipment. The equipment once brought to site shall not be allowed to be removed without the consent of EPI. In case the Contractor fails to deploy sufficient equipment to the satisfaction of EPI or in case of prolonged breakdown of equipment, EPI at its sole discretion shall arrange the required equipment and debit all the related costs including ten percent overheads of EPI and shall recover the same from the
due payments of Contractor, including from its bank guarantees available with EPI.

21.0 Contractor shall ensure compliance with all Central, State and Local Laws, Rules, Regulations etc. as applicable or may be applicable during the course of execution, maintenance etc. of the “Works” and shall indemnify against any claim or damages whatsoever on such accounts. The Contractor shall keep EPI indemnified at all times against infringement of any Patent or Intellectual Property rights.

22.0 EPI is an ISO: 9001 and ISO: 14001 Company. The conditions of the ISO as applicable should be followed by the Contractor for implementation & maintaining the established procedures of EPI for this purpose. Following documents have been provided by EPI to CONTRACTOR & CONTRACTOR confirms receipt of the same:
   a. Quality & Environmental Policy
   b. Objectives & Targets.
   c. Operational control procedures
   d. Operational Control Procedures
   e. Noise.
   f. Wastage

23.0 The work executed by Contractor shall be subject to audit and quality control checks from Quality Control Division &Technical audit of EPI, Client Inspecting Agency of the Client and Chief Technical Examiner of Central Vigilance Commission, Govt. of India. In the eventuality of any defect/sub standard works as brought out in the report or noticed otherwise at any time during execution, maintenance period etc., the same shall be made good by the Contractor without any cost to EPI. In case CONTRACTOR fails to rectify the defect/sub- standard work within the time period stipulated by EPI, shall get it rectified at the risk and cost of Contractor and shall recover the amount from the dues of the Contractor All documents required to be submitted to these agencies for the scope of work of contractor will be provided on demand of EPI .The contractor shall properly maintain records of all documents related to approvals, material & test records, labour attendance and all other statutory requirements for any time inspection by the above agencies.

24.0 In case, at a later stage, it is found that the Contractor has submitted incorrect, false details and credentials resulting in apprehensions on the capabilities of Contractor with regard to quality & timely completion of works, financial capabilities etc. EPI can terminate this agreement solely at its option. In this eventuality the Contractor shall be liable for the losses suffered by EPI and further Contractor shall have no claim on EPI, whatsoever.

25.0 All other terms and conditions shall be as per the Tender documents of Client and the same shall be applicable between EPI and the Contractor on mutatis mutandis basis. The above terms and conditions shall supersede the terms and conditions contained in the Tender Documents of the Client.
in case of variance in any condition. However, if EPI is granted some concession or exempted from certain obligations by client, by virtue of EPI being a Public Sector Company, the same concessions/exemptions shall not be applicable to the Contractor. The decision of EPI in this regard including interpretation of terms & conditions shall be final & binding on CONTRACTOR.

26.0 PRIORITY OF WORK
The contractor has to deploy resources and plan the work accordingly and nothing extra shall be payable to the contractor on this account. The contractor has to ensure safety of the occupants and sufficiently barricade the area so as to avoid any hazard to occupants.

27.0 The relevant and required documents in respect of VAT assessment / service tax assessment for EPI for availing exemption / deductions by EPI are to be submitted along with each RA bill failing which the VAT Tax levied / suffered by EPI is to be borne by the contractor and will be recovered from the forthcoming bills. The bills are to be submitted in the format required under the respective tax acts indicating input tax.

28.0 The final bill payment to the PARTY shall be made when PARTY submits VAT clearance certificates, EPF clearance certificate, all other clearances, approvals, certificates etc. as per agreement of EPI with the client for the “Works” and as per statutory requirement.

29.0 The final bill will be submitted by the contractor within 90 days from the date of acceptance of completion of work accompanied by the following documents:
   a) Completion certificate issued by the Engineer-in-Charge specifying the handing over of the work including list of inventories (fittings & fixtures).
   b) Computerized stage wise payment schedule.
   c) No claim certificate by the contactor.
   d) No claim certificate from the sub-agencies / vendors engaged by the contractor.
   e) As built’ drawings.
   f) Periodical services and measurement books.
   g) Drawings for layout of underground cables and details showing location of sluice valves, electric cable joints etc.
   h) All operation and maintenance manuals.
   i) All statutory approvals from various state / central govt. local bodies, if required for completion & handing over of the work as included in scope of Contractor.
   j) Manufacture’s guarantee of various machines / equipments installed as part of works.
   k) NOC from labour department, PF Department.

30.0 In case of any discrepancy between the downloaded tender and the approved hard copy, the approved hard copy shall hold good for contractual as well as legal purposes.
31.0 The tenderer shall furnish a declaration to this effect that no addition/deletion/corrections have been made in the downloaded tender document being submitted by him and it is identical to the tender document appearing on the Web-Site and with the Standard DRAFT Tender Document available in the officer of the office inviting the tenders.

32.0 If any tenderer withdraws his tender before the said period or issue of letter of acceptance/intent, whichever is earlier, or makes any modifications in the terms and conditions of the downloaded tender which are not acceptable to the EPIL, then the EPIL shall, without prejudice to any other right or remedy, be at liberty to forfeit entire amount of Earnest Money as aforesaid.
TECHNICAL SPECIFICATION FOR DG SET

2.1 SCOPE
This section deal with unloading procedures, location, standard capacities and climatic conditions for DG set installation.

2.1.1.1 Gen sets without Acoustic Enclosure

2.1.1.1.1 Genset should not be lifted from engine and alternator hooks. These are designed for lifting individual items only. Normally, provision for Genset lifting is provided on base-rails. The Genset should be unloaded from base rail by lifting with proper Genset lifting tackle or nylon sling/steel rope of suitable capacity and crane so as to ensure no damage to oil sump, air cleaner, radiator pipes etc.

2.1.1.1.2 Genset should be covered with polyethylene or tarpaulin during installation to ensure that water does not enter inside.

2.1.1.1.3 Spreader bar/ spacer plate of suitable size may be required to avoid damages to Genset components.

2.1.1.2 DG set with Acoustic enclosures are provided with lifting hooks.

2.1.2 Location

2.1.2.1 DG Sets with Acoustic Enclosure
DG sets up to 1000 KVA capacity are required to be supplied with acoustic enclosure as per CPCB norms. DG Set with acoustic enclosure shall preferably be installed outside the building (including terrace subject to structural feasibility) & location should be finalized in consultation with the Architect. However, DG set should be as near to the substation as possible i.e. as near to Essential LT Panel as possible. Associated AMF panel/ Electrical panel of the DG Set can be located inside the acoustic enclosure or outside the acoustic enclosure as per manufacturer standard. In case, AMF/ Electrical panel has to be installed outside the acoustic enclosure, location of room to house AMF/ Electrical panel should be decided in consultation with the Architect so that it shall be as near to the acoustic enclosure as possible. Specially, in case of connection through bus trunking, care should be taken for aesthetics.

2.1.2.2 DG Sets without Acoustic Enclosure

2.1.2.2.1 In case of DG Sets beyond 1000 KVA capacity i.e. when DG set is supplied without acoustic enclosure, room of appropriate size should be provided to house the DG Set. The
DG set room should be as near to the substation as possible (i.e. as near to Essential LT Panel as possible). While deciding the room layout, typical 2-meters free space around Genset is recommended for proper heat dissipation and ease of service. However, to avoid hot air re-circulation, radiator cooled engines should have maximum possible space in the front. Minimum 1.5 meter free space is must.

2.1.2.2
As far as possible, installation of DG Set should be avoided in basement. In cases where installation of D.G. Set in basement is unavoidable, due care of supply of adequate amount of air required for proper operation of D.G. Set shall be taken.

2.1.3
Nominal ratings of DG Sets; DG Sets are normally available in following standard capacities:

<table>
<thead>
<tr>
<th>Ratings in KVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.5</td>
</tr>
<tr>
<td>75</td>
</tr>
<tr>
<td>415</td>
</tr>
</tbody>
</table>

Capacity output of DG Set should be specified in tender in terms of “Prime Power Rating at 0.85 load factor” as per Clause 13.3.2 of ISO-8528 (Part-1), titled ‘Reciprocating internal combustion engine driven alternating current generating sets: Part-1: Application, ratings and performance’ (See Appendix ‘I’). However, depending upon the particular application & use, ‘Continuous’ or ‘Standby’ rating can be specified.

2.1.4
Climatic Conditions
The output of DG Set shall be specified in tender documents under actual site conditions. The tenderer has to certify that the engine & alternator meets the capacity requirement after de-ration as per IS/ BIS.

2.1.5 DG Set upto 1000 KVA capacity should be type tested for Noise and Emission norms/standards as per CPCB as per Appendix ‘II’ and Appendix ‘III’.

2.2 DIESEL ENGINE Scope
This section covers engine rating, standard components of a diesel engine including exhaust piping.

2.2.1 Diesel Engine
2.2.1.1 Engine Rating
The engine shall be of standard design of the original manufacturers. It should be 4-stroke cycles, water cooled, naturally aspirated/ turbo charged (as per manufacturer standard), diesel engine 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 testing procedure shall be as mentioned in para 1.15. The engine shall conform to IS:10000/ISO 3046/BS:649/BS 5514 amended up to date.

2.2.1.2
Necessary certificate indicating the compliance of the above capacity requirement for the engine model so selected along with compliance of Noise and Emission norms as per latest CPCB guidelines for DG set capacity up to 1000 KVA, should be furnished from the manufacturers along with the technical bid. (Refer Appendix ‘II’ for noise norms and Appendix ‘III’ for emission norms). However above 1000 KVA DGset, manufacturers shall furnish certificate that the Engine for the DG set complies with the CPCB Emission norms.

2.2.1.3
The engine shall be fitted with following accessories subject to the design of the manufacturer:
(i) Dynamically balanced Fly wheel
(ii) Necessary flexible coupling and guard for alternator and engine (applicable only for double bearing alternator)
(iii) Air cleaner (dry/ oil bath type) as per manufacturer standard,
(iv) A mechanical/ electronic governor to maintain engine speed at all conditions of load. (see Clause 2.2.1.4)
(v) Daily fuel service tank of minimum capacity as per Table below, fabricated from M.S. sheet with inlet, outlet connections air vent tap, drain plug and level indicator (gauge) M.S. fuel piping from tank to engine with valves, unions, reducers, flexible hose connection and door mounting pedestals, twin fuel filters and fuel injectors. The location of the tank shall depend on standard manufacturers design.

**Table I: Recommended Minimum Capacity of Daily Fuel Service Tank**

<table>
<thead>
<tr>
<th>S.No</th>
<th>Capacity of DG set</th>
<th>Minimum Fuel Tank Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>i</td>
<td>Upto 25 KVA</td>
<td>100 Litres</td>
</tr>
<tr>
<td>ii</td>
<td>Above 25 to 62.5 KVA</td>
<td>125</td>
</tr>
<tr>
<td>iii</td>
<td>Above 62.5 KVA to 125 KVA</td>
<td>225</td>
</tr>
<tr>
<td>iv</td>
<td>Above 125 KVA to 200 KVA</td>
<td>285</td>
</tr>
<tr>
<td>v</td>
<td>Above 200 KVA to 380 KVA</td>
<td>500</td>
</tr>
<tr>
<td>vi</td>
<td>Above 380 KVA to 500 KVA</td>
<td>700</td>
</tr>
<tr>
<td>vii</td>
<td>Above 500 KVA to 750 KVA</td>
<td>900</td>
</tr>
</tbody>
</table>

(vi) Dry exhaust manifold with suitable exhaust residential grade silencer to reduce the noise level.
(vii) Suitable self-starter for 12 V/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 manufacturer 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 manufacturer recommendations
(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: fitted and having digital display for following:

(b) Start/stop key switch.
(b) Lube oil pressure indication
(c) Water temp. indication
(d) RPM indication .
(e) Engine Hours indications
(f) Battery charging indication
(g) Low lub. Oil trip indication
(h) High water temp.
(i) Over speed indication

(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/ Remote Radiator (delete whichever is not applicable)
(xx) Any other item not included/ specified but is a standard design of the manufacturer

2.2.1.4
Governor
Mechanical governor of class A2 for up to and including 200 KVA capacity and Electronic governor of class A1 for capacity above 200 KVA, as per ISO 3046/BS 5514 with actuator shall be provided as per standard design of manufacturer. Governor shall be a self contained unit capable of monitoring speed.

2.2.1.5
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.

2.2.1.6
Fuel System
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. In case of Top Mounted tanks, non return valves are must in fuel supply and return line of specified value. Pipe sealant should be used for sealing for all connections. No Teflon tape to be used. If piping length is more than 10 meters, detail engineering is required in consultation with OEM/ Manufacturers.

2.2.1.7
Lubricating Oil System
It shall be so designed that when the engine starts after a long shut down lubrication failure does not occur. Necessary priming pump for the lub. oil circuit as per recommendation of manufacturer shall be installed, to keep bearings primed. This pump shall be normally automatically operative on AC/ DC supply available with the set.
2.2.1.8
Starting System
This shall comprise of necessary set of heavy duty batteries 12V/ 24V DC (as per manufacturer standard), and suitable starter motors, axial type gear to match with the toothed ring on the fly wheel. A timer in the control panel to protect the starter motor from excessively long cranking runs shall be suitably integrated with the engine protection system and shall be included within the scope of the work. Battery capacity shall be suitable for meeting the needs of starting system (as three attempt starting), as well as the requirements of control panel, indications and auxiliaries such as priming pump as applicable etc. The scope shall cover all cabling, terminals, including initial charging etc. The system shall be capable of starting the DG set within 20-30 sec., even in winter condition with an ambient temperature down to 0°C.

2.2.1.9
Battery Charger
The battery charger shall be suitable to charge required numbers of batteries at 12V/24 volts complete with, transformer, rectifier, charge rate selector switch, indicating ammeter & voltmeter etc. connections between the battery charger & batteries shall be provided with suitable copper leads with lugs etc.

2.2.1.10
Piping Work
All pipe lines and fittings and accessories requirement inside the room/ enclosure and outside for exhaust piping shall be provided by the contractor. This shall include necessary flexible pieces in the exhaust, fuel, lub. oil and water lines as are necessary in view of the vibration isolation requirement in the installation. Piping of adequate size shall be used for lub. oil of the material as per manufacturer standard. However, only M.S. pipes for the exhaust shall be used. For fuel lines within the acoustic enclosure, PVC braided pipe as per manufacturer recommendations can be used. However, for fuel lines outside the acoustics enclosure only MS pipe be used. The pipe work shall be inclusive of all fittings and accessories required such as bends, reducers, elbows, flanges, flexible connections, necessary hardware etc. The installation shall cover clamps, supports, hangers etc. as are necessary for completing the work. However, the work shall be sectionalized with flanged connections as are necessary for easy isolation for purposes for maintenance of unit as approved by Engineer-in-charge.

2.2.1.11
Common Bed Plate
Engine and alternator shall be directly coupled or coupled by means of flexoplate/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.

2.2.1.12
Exhaust System:(wherever applicable)
2.2.1.12.1

Exhaust Piping:
All M.S. Pipes for exhaust lines shall be conforming to relevant IS. The runs forming part of factory assembly on the engine flexible connections up to exhaust silencer shall be exclusive of exhaust piping item. The work include necessary cladding of exhaust pipe work using 50 mm thick Loosely bound resin(LBR) mattress/ mineral wool/ Rockwool, density not less than 120 kg/m^3 aluminium cladding (0.6 mm thick) for the complete portion. The exhaust pipe work includes necessary supports, foundation etc. to avoid any load & stress on turbocharger / exhaust piping. The exhaust pipe shall be *run along the existing wall of the building duly clamped/*supported on independent structure for which, the design and Drawing for such structure shall be got approved from the Engineer-in-charge.

2.2.1.12.2

(a) Exhaust system should create minimum back pressure.
(b) Number of bends should be kept minimum and smooth bends should be used to minimize back pressure.
(c) Pipe sleeve of larger dia. should be used while passing the pipe through concrete wall & gap should be filled with felt lining.
(d) Exhaust piping inside the Acoustic Enclosure/ Genset room should be lagged with asbestos rope along with aluminium sheet cladding / insulated as per clause 2.2.1.12.1 to avoid heat input to the room.
(e) Exhaust flexible shall have it’s free length when it is installed. For bigger engines, 2 flexible bellows can be used.
(f) For engines up to 500 KVA, only one bellow is required. However, if exhaust pipe length is more than 7 m then additional bellow/ provision for expansion should be provided.
(g) ‘Schedule B’ MS pipes and long bend/elbows should be used.
(h) The exhaust outlet should be in the direction of prevailing winds and should not allow exhaust gases to enter air inlet/ windows etc.
(i) When tail end is horizontal, 45 Degree downward cut should be given at the end of the pipe to avoid rain water entry into exhaust piping.
(j) When tail end is vertical, there should be rain trap to avoid rain water entry. If rain cap is used, the distance between exhaust pipe and rain cap should be higher than diameter of pipe. Horizontal run of exhaust piping should slope downwards away from engine to the condensate trap. Silencer should be installed with drain plug at bottom.

2.2.1.12.3

Optimum Silencer Location:
Location of the silencer in exhaust system has very definite influence on both reduction of noise and back pressure imposed on the system. The preferred silencer locations are given in the Table below, where L is length of the total exhaust system measured from exhaust manifold in meters. Please note that locating the silencer as per optimum silencer location is not mandatory. For high rise buildings, suitable arrangements may have to be provided in consultation with acoustics engineer.

<table>
<thead>
<tr>
<th>Optimum Location of Silencer (In meters)</th>
<th>In-line Engine</th>
<th>‘V’ Engine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best</td>
<td>2L/5</td>
<td>(4L – 1.5) / 5</td>
</tr>
<tr>
<td>Second best</td>
<td>4L/5</td>
<td>(2L – 4.5) / 5</td>
</tr>
<tr>
<td>Worst Location of Silencer</td>
<td>L/5 or 3L/5 or at tail</td>
<td>(3L - 10)/ 5 or at the tail</td>
</tr>
<tr>
<td></td>
<td>end of Exhaust piping</td>
<td>end of Exhaust piping</td>
</tr>
</tbody>
</table>
2.2.1.12.4

Exhaust Stack Height:
In order to dispose exhaust above building height, minimum exhaust stack height should be as follows:-
(a) For DG set up to 1000 KVA:
  \[ H = h + 0.2 \text{ KVA} \]
  Where \( H \) = height of exhaust stack \( h \) = height of building
(b) For DG set above 1000 KVA:
  30 m High or 3 m above the building height, whichever is higher

2.2.1.12.5
Care should be taken to ensure that no carbon particles emitted due to exhaust leakage enters and deposits on alternator windings and on open connections.

2.2.1.12.6
Support to Exhaust Piping: Exhaust piping should be supported in such manner that load of exhaust piping is not exerted to turbocharger.

2.2.1.13

Air System
It is preferable to provide vacuum indicator with all engines to indicate choked filter. Maximum air intake restrictions with clean and choked filters should be within prescribed limit as per OEM/manufacturer recommendation for the particular model of the engine. Gen sets should be supplied with medium duty/heavy duty air cleaners (specify one only). (Heavy duty air cleaner should be used for installations in dusty or polluted surroundings.)

2.2.1.14

Cooling System

2.2.1.14.1
System should be designed for ambient temperature of 40 Deg.C.

2.2.1.14.2
Water softening/demineralizing plants should be used, if raw water quality is not acceptable.

2.2.1.14.3
Coolant should be used mixed with additive (in suitable proportion) as per recommendation of OEM/manufacturer for various engine models.

2.2.1.14.4
Radiator fan flow should be free from any obstruction.

2.2.1.14.5
For radiator cooled DG Set, proper room ventilation should be planned at the time of Construction of DG room.
Remote Radiator can be used in case of basement installation where fresh air may not be available. The proper location of remote radiator is very essential for the successful and efficient operation of remote radiator. In this the cooling media is ambient air. So in order to obtain maximum efficiency from remote radiator, it is necessary to get fresh air in its surrounding. The horizontal distance of remote radiator from engine should not exceed 10 Meter.

2.2.1.14.7
For the dusty or polluted surroundings (as radiator gets clogged) and/or bigger capacity Gensets (say 1000 KVA and above), installation of Cooling System with Heat Exchanger system may be used.

2.2.1.14.8 Optional items as under may be included as per site requirement at the discretion of Technical Sanctioning authority:
(i) Cooling System
   (a) Remote Radiator
   (b) Jacket Water Heater
   (c) Crankcase Oil Heater
   (d) After cooler jacket turbo charger electrical pre heat systems.

(ii) Fuel System
   (a) Fuel Water Separator
   (b) Auxiliary Fuel Pump

(iii) Exhaust System
   (a) Industrial Grade Muffler
   (b) Residential Grade Muffler
   (c) Critical Grade Muffler
   (d) Super Critical Grade Muffler

(iv) Start System
   (a) Battery Warmer Plate
   (b) Battery Charger
     - Automatic Float Equalizing
     - Trickle

2.3 ALTERNATOR
Scope:
This section covers technical requirement of the alternator.

2.3.1 Synchronous Alternator
Self excited screen protected, self regulated, brush less alternator, Horizontal foot mounted in single / Double bearing construction (specify one only) suitable for the following:
Rated PF. : 0.8 (lag)
Rated voltage: 415 volts
Rated frequency: 50 Hz
No. of Phases: 3
Enclosure: SPDP
Degree of protection: IP-23
Ventilation: Self ventilated air cooled
Ambient Temperature: 40° C Maximum
Insulation Class: F/H
Temperature Rise: Within class F/H 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 / separately excited (Self excitation up to 750KVA and separately excited system above 750 KVA)
Type of AVR : Electronic
Type of Bearing and : Anti-friction bearings with Grease lubrication
Lubrication arrangement
Standard : IS 4722 & IEC:34 as amended upto date.

2.3.2 Alternator should be able to deliver output rating at actual site conditions.
2.3.3 The alternator above 500 KVA capacity shall be fitted with suitable Nos. Resistance Temperature Device (RTD) & Bearing Temperature Device (BTD) along with space heaters. The terminal of space heaters will be wired to terminal box and the temperature scanner shall be provided in control panel for scaling the winding and bearing temperature.

2.3.4 Excitation
The alternator shall be brushless type and shall be self/ separately excited, self-regulated having static excitation facility. The exciter unit be mounted on the control panel or on the alternator assembly. The rectifier shall be suitable for operation at high ambient temperature at site.

2.3.5 Automatic Voltage Regulators (AVR)
In order to maintain output terminal voltage constant within the regulation limits i.e. +/- 1%, Automatic voltage regulator unit shall be provided as per standard practice of manufacturer.

2.3.6 Fault tripping
In the event of any fault e.g. over voltage/ high bearing temperature/ high winding temperature or an external fault, the AVR shall remove the excitation voltage to the alternator. An emergency trip shall also be provided.

2.3.7 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.

2.3.8 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 winding shall not develop hot spots exceeding safe limits due to imbalance of 20% between any two phases from no load to full load. 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.
   (i) Upto 25 KVA – not less than 82%
   (ii) Above 25 KVA and upto 62.5 KVA – not less than 86%
   (iii) Above 62.5 KVA & upto 250 KVA – not less than 90%
   (iv) Above 250 KVA – 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.

2.3.9 Terminal Boxes
Terminal boxes shall be suitable for U.G. cables/ Bus Trunking. The terminal box shall be suitable to withstand the mechanical and thermal stresses developed due to any short circuit at the terminals.

2.3.10 Earth Terminals
2 Nos. earth terminals on opposite side with vibration proof connections, non-ferrous hardware etc. with galvanized plate and passivated washer of minimum size 12 mm dia. hole shall be provided.

2.3.11 Space Heaters
Alternators of capacity more than 500 KVA shall be provided with suitable space heaters to maintain the winding temperature automatically such that it does not absorb moisture during long idle periods. The heater terminals shall be brought to a separate terminal box suitable for 230 V AC supply and a permanent caution notice shall be displayed.

2.4 MANUAL/ AMF PANEL, BATTERIES AND ELECTRICAL SYSTEM
Scope:
This section covers technical and functional requirements of Manual/ AMF Panel, Battery/ Electrical System.

2.4.1 Location of Panel

2.4.1.1 DG Set with Acoustic Enclosure
Associated AMF panel/ Manual panel of the DG Set can be located inside the acoustic enclosure or outside the acoustic enclosure as per manufacturer’s standard. In case, AMF/ Manual panel has to be installed outside the acoustic panel, location of room to house AMF/ Manual panel should be decided in consultation with the Architect as near to the acoustic enclosure as possible. In case of connection through bus trunking, care should be taken for aesthetics vis-à-vis surrounding.
DG Set without Acoustic Enclosure
In case of DG Set is supplied without acoustic enclosure, Manual/AMF electrical control panel should be located inside the substation building.

2.4.2
Type of Control Panel
Control panel shall be either manual type or AMF type as per the requirement of work to be decided by NIT approving authority.

2.4.2.1
Manual Control Panel
The control panel shall be fabricated out of 1.6 mm sheet steel, totally enclosed, dust, damp and vermin proof wall mounted/ free standing floor mounted type with IP-53 degree of protection & front operated.
The Standard control panel shall consist the following instruments:
(a) Composite meter for digital display of:
   (i) Voltage
   (ii) Current
   (iii) Power factor (for 15 KVA and above)
   (iv) Frequency (for 15 KVA & above)
   (v) Energy Meter (for 15 KVA & above)
(b) HRC fuses of suitable rating.
(c) One MCB of suitable rating for DG sets up to 45 KVA rating or Switch Disconnector Fuse Unit (SDFU) for higher ratings.
(d) Push button-switch or ON/ OFF Switch for ON and OFF operation
(e) Pilot lamps one No. in case of single phase DG sets and 3 numbers in case of three phase DG sets.
(f) Battery charger complete with voltage regulator, Voltmeter and Ammeter for charging the battery from external mains. This will be in addition to the battery charging alternator or dynamo fitted on the engine.
(g) Instrument fuses.
All the components in the control panel shall be properly mounted, duly wired and labeled. Suitable terminals are to be provided for panel incoming and outgoing connections.

2.4.2.2
AMF Control Panel

2.4.2.2.1
General Features
The control panel shall be fabricated out of 1.6 mm thick sheet steel, totally enclosed, dust, damp and vermin proof free standing floor mounted type& front operated. It shall be made into sections such that as far as feasible, there is no mixing of control, power, DC & AC functions in the same section and they are sufficiently segregated except where their bunching is necessary. Hinged doors shall be provided preferably double leaf for access for routine inspection from the rear. There is no objection to have single leaf hinged door in the front, all indication lamps, instruments meter etc. shall be flushed in the front. The degree of protection required will be IP-42 conforming to IS 2147.
2.4.2.2
Terminal Blocks and Wiring:
Terminal blocks of robust type and generally not less than 15 Amps capacity, 250/500 V grade for DC up to 100 V and 660/ 1100 volts grade for AC and rest of the junction shall be employed in such a manner so that they are freely accessible for maintenance. All control and small wiring from unit to unit inside the panel shall also be done with not less than 2.5 sq mm copper conductor PVC insulated and 660/ 1100 volts grade. Suitable colour coding can be adopted. Wiring system shall be neatly formed and run preferably, function wise and as far as feasible segregated voltage wise. All ends shall be identified with ferrules at the ends.

2.4.2.2.3
Labeling:
All internal components shall be provided with suitable identification labels suitably engraved. Labels shall be fixed on buttons, indication lamps etc.

2.4.2.2.4
Painting:
The entire panel shall be given primer coat after proper treatment and powder coating with 7 tanks process before assembly of various items.

2.4.2.2.5
Equipment requirements:
The control cubical shall incorporate into assembly general equipment and systems as under:
(a) Control system equipments and components such as relays, contactors, timers, etc. both for automatic operation on main failure and as well as for manual operation.
(b) Equipment and components necessary for testing generating set’s healthiness with test mode and with load on mains.
(c) Necessary instruments and accessories such as voltmeter, power factor meter, KW meter, KWH meter, Ammeter, Frequency meter etc. in one energy analyzer unit with selector switch to obtain the reading of desired parameters.
(d) Necessary indication lamps, fuses, terminal blocks, push buttons, control switches etc. as required.
(e) Necessary engine/generating set shut down devices due to faults/abnormalities.
(f) Necessary visual audio alarm indication and annunciation facility as specified.
(g) Necessary battery charger.
(h) Necessary excitation control and voltage regulating equipment. (Alternatively provided on the Alternator itself).
(i) Necessary overhead bus trunking terminations all internal wiring, connections etc. as required.
(j) Breakers as specified in the schedule of work.

2.4.2.2.6
System Operation:
The above mentioned facilities provided shall afford the following operational requirements.
2.4.2.2.6.1
**Auto Mode:**
(a) A line voltage monitor shall monitor supply voltage on each phase. When the mains supply voltage fails completely or falls below set value (variable between 80 to 95% of the normal value) on any phase, the monitor module shall initiate start-up of diesel engine. To avoid initiation due to momentary disturbance, a time delay adjustment between 0 to 5 second shall be incorporated in start-up initiation.
(b) A three attempt starting facility shall be provided 6 seconds ON, 5 seconds OFF, 6 seconds ON, 5 seconds OFF, 6 seconds ON, if at the end of the third attempt, the engine does not start, it shall be locked out of start, a master timer shall be provided for this function. Suitable adjustment timers be incorporated which will make it feasible to vary independently ON-OFF setting periods from 1-10 seconds. If alternator does not build up voltage after the first or second start as may be, further starting attempt will not be made until the starting facility is reset.
(c) Once the alternator has built up voltage, the alternator circuit breaker shall close connecting the load to the alternator. The load is now supplied by the alternator.
(d) When the main supply is restored and is healthy as sensed by the line voltage monitor setting, both for under voltage and unbalance, the system shall be monitored by a suitable timer which can be set between 1 minute to 10 minutes for the load to be transferred automatically to mains supply.
(e) The diesel alternator set reverts to standby for next operation as per (a), (b) and (c) above.

2.4.2.2.6.2
**Manual Mode:**
(a) In a manual mode, it shall be feasible to start-up the generator set by the operator on pressing the start push button.
(b) Three attempt starting facility shall be operative for the start-up function.
(c) Alternator circuit breakers close and trip operations shall also be through operator only by pressing the appropriate button on the panel and closure shall be feasible only after alternator has built up full voltage. If the load is already on ‘mains’, pressure on ‘close’ button shall be ineffective.
(d) Engine shut down, otherwise due to faults, shall be manual by pressing a ‘stop’ button.

2.4.2.2.6.3
**Test Mode:**
(a) When under ‘test’ mode pressing of ‘test’ button shall complete the start up sequence simulation and start the engine. The simulation will be that of mains failure. Sequence 2.4.2.2.6.1(a) and (b) shall be completed.
(b) Engine shall build up voltage but the set shall not take load by closing of alternator circuit breaker. When the load is on the mains, monitoring of performance for voltage/frequency etc. shall be feasible without supply to load.
(c) If during test mode, the power supply has failed, the load shall automatically get transferred to alternator.
(d) Bringing the mode selector to auto position shall shut down the set as per sequence of 2.4.2.2.6.1(d) provided main supply is ON. If the mains supply is not available at that time, the alternator shall take load as in (c) above.

2.4.2.2.7
Engine shut down and alternator protection equipment: Following shut down and protection system shall be integrated in the control panel.

(a) Engine:
   (i) Low lubricating oil pressure shut down. This shall be inoperative during start up and acceleration period.
   (ii) High coolant (water) temp. shut down.
   (iii) Engine over speed shut down.

(b) Alternator Protection:
Following protection arrangement shall be made:
   (i) Over load
   (ii) Short circuit
   (iii) Earth fault
   (iv) Over voltage

2.4.2.2.8
Monitoring and Metering Facilities:
(a) Necessary energy analyzer unit for visual monitoring of mains, alternator and load voltage, current, frequency, KWH, power factor, etc.
(b) A set of visual monitoring lamp indication for:
   (i) Load on set
   (ii) Load on mains
   (iii) Set on test (Alternator on operation duty, Alternator on standby duty).
   (iv) Set of lamp for engine shut down for over speed, low lub. oil pressure and high coolant water temperature, overload trip of alternator, earth fault trip of alternator, engine lock out and failure to start etc. All these indications shall have an audio and visual alarm. When operator accepts the alarm, the hooter will be silenced and the fault indication will become steady until reset by operating a reset button.

2.4.2.2.9
Operating Devices:
(a) Master Engine Control Switch: This shall cut off in ‘OFF’ position DC control to the entire panel, thus preventing start-up of engine due to any cause. However, battery charger, lamp test button for testing the healthiness of indication lamps DC volt mater / ammeter etc. shall be operative. It shall be feasible to lock the switch in OFF position for maintenance and shut down purposes.
(b) Operation selector switch OFF/AUTO/MANUAL/TEST position.
(c) Energy analyzer unit for display of various electrical parameters like voltage, current, frequency, KW, power factor, etc.
(d) A set of push button as specified.
(e) Relays, contactors, timers, circuit breakers as required.
(f) Necessary battery charger with boost/ trickle selector, DC voltmeter and DC ammeter.

2.4.2.2.10
Compatibility with ‘Building Management System’ (BMS):
PLC compatibility and required nos. of Input/ Output terminals points should be provided in the AMF control panel.
2.4.3  
**Battery/ Electrical System**

2.4.3.1 Batteries supplied with Genset are generally dry and uncharged. First charging of uncharged batteries is very important and should be done from authorized battery charging centre. Initial charging should be done for 72-80 hours.

2.4.3.2 Batteries should be placed on stands and relatively at cool place.

2.4.3.3 Battery capacity and copper cable sizes for various engine capacity are recommended as indicated in the table below. Cable sizes shown are for maximum length of 2 m. If length is more, cable size should be selected in such a way that voltage drop does not exceed 2 V. However capacity as recommended by manufacturer may be taken.

<table>
<thead>
<tr>
<th>DG Set Capacity</th>
<th>Battery Capacity (AH)</th>
<th>Cable Size (Sq mm)</th>
<th>Electrical System Capacity (Volts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above 500 KVA</td>
<td>360</td>
<td>70</td>
<td>24</td>
</tr>
<tr>
<td>Above 125 KVA upto 500 KVA</td>
<td>180</td>
<td>70</td>
<td>12</td>
</tr>
<tr>
<td>Above 82.5 KVA upto 125 KVA</td>
<td>180</td>
<td>50</td>
<td>12</td>
</tr>
<tr>
<td>Above 62.5 KVA upto 82.5 KVA</td>
<td>180</td>
<td>50</td>
<td>12</td>
</tr>
<tr>
<td>Above 25 KVA upto 62.5 KVA</td>
<td>180</td>
<td>50</td>
<td>12</td>
</tr>
<tr>
<td>Upto 25 KVA</td>
<td>88</td>
<td>35</td>
<td>12</td>
</tr>
</tbody>
</table>

2.4.3.4 For AMF applications, a static battery charger working on mains supply is recommended to keep the batteries charged at all times.

2.4.3.5 1.5 sq.mm copper wire should be used for wiring between junction box and Control Panel.

2.4.4  
**Cabling**

2.4.4.1 Power cabling between alternator and control panel and control panel and changeover switch to mains should be done with recommended cable sizes.

2.4.4.2 Typical cable sizes for 415 V application are provided in Appendix VI.
2.4.4.3 As far as possible, for DG Set of capacity 750 KVA & above connection between alternator to AMF panel & AMF Panel to Essential panel shall be through bus-trunking. For exposed/ outdoor bus trunking protection requirement should be IP-55.

2.4.4.4 If LT panel is part of tender of the DG Set jobs of 500 KVA & above, LT Panel specified, should be one of the reputed brands.

2.4.4.5 Overheating due to loose thimbling / undersize cables causes most of electrical failures, hence correct size of cable and thimbles should always be used, if cable is specified.

2.4.4.6 While terminating cables, avoid any tension on the bolts/ busbars (if cable is specified). While terminating R, Y& B phase notations should be maintained in the alternator and control panel for easy maintenance.

2.4.4.7 Crimped cables should be connected to alternator and control panel through cable glands, if cable is specified.

2.4.4.8 Multi-core copper cables should be used for inter connecting the engine controls with the switchgear and other equipments.

2.4.4.9 For AMF application, multi core 1.5 sq.mm flexible stranded copper cable for control cabling should be used.

2.4.4.10 It is recommended to support output cables on separate structure on ground so that weight of cables should not fall on alternator/ base rail.

2.4.4.11 External wirings, when provided for remote voltage / excitation monitoring/ droop CT etc. shall be screened sheathed type. Maximum length of such wiring shall not exceed 5 meters.

2.4.4.12 Alternator Termination Links

2.4.4.12.1 For proper terminations between links and switchgear terminals, the contact area must be adequate. The following situations should also be avoided as they lead to creation of heat sources at the point of termination:

(i) Point contact arising out of improper position of links with switchgear terminals [Figure 2(i)].

(ii) Gaps between bus bars / links and terminals being remedied by connecting bolt/stud [Figure 2(ii)]. In such cases the bolt will carry the load current. Normally these bolts / studs are made of MS and hence are not designed to carry currents.

2.4.4.12.2 Adequate clearance between bus bars / links at terminals should be maintained (IS 4232 may be referred to for guidelines).

Figure 2(iii) indicates the quality of different configurations.

2.4.4.12.3 Improper termination will lead to local heat generation which may lead to failure.
2.5 FOUNDATION
Scope:
This section covers details of foundations for DG set with or without acoustic enclosures.

2.5.1 Genset with Acoustic Enclosure
(a) For DG Sets installed inside the DG Set Room - A PCC foundation (1:2:4, M-20 grade) of approximate depth 150 mm above the finished Genset Room Floor level is required so as to provide leveled surface for placement of the acoustics enclosure. The length and breadth of foundation should be at least 250 mm more on all sides than the size of the enclosure. Genset should be mounted on AVM’s inside the enclosure.
(b) For DG Sets installed outside in open area - A PCC (1:2:4, M-20 grade) foundation of weight 2.5 times the operating weight of the Genset with enclosure or as recommended by the Genset manufacturer OEM/OEA, whichever is higher, is required to be provided and is included in scope of work for SITC of Genset.300 mm of this foundation height should be above the ground level. The length and breadth of foundation should be at least 250 mm more on all sides than the size of enclosure. Genset should be mounted on AVM’s inside the enclosure. Design of the foundation as recommended by the OEM shall be submitted by the contractor before execution of work along with the drawings as mentioned in section 1.19.

2.5.2 Genset without Acoustic Enclosure

2.5.2.1 Genset should not be installed on loose sand or clay.

2.5.2.2 Foundation should be designed considering safe bearing capacity of soil. Vibration isolators (AVMs) should be provided to reduce vibration transmission to the surrounding structure.

2.5.2.3 Depths of PCC (Plain Cement Concrete) for typical soil condition have been shown in the table below. However structural engineer should be consulted to verify the data depending upon soil condition.

<table>
<thead>
<tr>
<th>DG Set Capacity (KVA)</th>
<th>Typical Depth of PCC Foundation (For soil bearing capacity 5000 kg/sqm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 750-2000</td>
<td>600 mm</td>
</tr>
<tr>
<td>2  625</td>
<td>400 mm</td>
</tr>
<tr>
<td>3 320-500</td>
<td>400 mm</td>
</tr>
<tr>
<td>4 200-320</td>
<td>400 mm</td>
</tr>
<tr>
<td>5 82.5-200</td>
<td>400 mm</td>
</tr>
<tr>
<td>6 Upto 82.5</td>
<td>200 mm</td>
</tr>
</tbody>
</table>

2.5.2.4 Foundation level should be checked diagonally as well as across the length for even flatness. The foundation should be within ± 0.5 Degree (angle) of any horizontal plane.

2.6 ACOUSTIC ENCLOSURE
Scope:
This section covers technical requirements of the acoustic enclosures.
2.6.1 As per CPCB norms, restriction has been imposed for new DG sets upto 1000KVA for noise level (see Appendix ‘II’). Therefore, in terms of these norms, acoustic enclosure should be type tested at the climatic conditions specified in para 2.1.4 through one of the authorized laboratory.

2.6.2 **Installation**
2.6.2.1 Acoustic enclosures are supplied with built in Anti Vibration Mountings (AVMs). As such Genset can be installed directly on the leveled surface.

2.6.2.2 Exhaust piping outlet should not be turned towards window / ventilator of home or occupied building. Provision of rain cap should be ensured.
2.6.2.3 The acoustic enclosure placement should be such that there is no restriction in front of air inlet and outlet from canopy.

2.6.3 **Service Accessibility**
2.6.3.1 Genset / Engine control panel should be visible from outside the enclosure.

2.6.3.2 Routine / periodical check on engine / alternator (filter replacement and tappet setting etc.) should be possible without dismantling acoustic enclosure.

2.6.3.3 For major repairs / overhaul, it may be required to dismantle the acoustic enclosure.

2.6.3.4 Sufficient space should be available around the Genset for inspection and service.

2.6.4 **General Design Guidelines**
2.6.4.1 To avoid re-circulation of hot air, durable sealing between radiator and canopy is must.
2.6.4.2 Ventilation fans are must for the Gensets cooled by heat-exchanger/cooling tower system.
2.6.4.3 Exhaust piping inside the enclosure must be lagged (except bellow).
2.6.4.4 Temperature rise inside the enclosure should not be more than 5°C for maximum ambient above 40°C and it should be below 10°C for ambient below 40°C.
2.6.4.5 There should be provision for oil, coolant drain and fill. Fuel tank should have provision for cleaning.
2.6.4.6 The enclosure should be designed to meet the total air requirement for the D.G. Set at full load at site conditions as recommended by the engine manufacturer.

2.6.5 **Specifications for Acoustic Enclosure**
2.6.5.1 The acoustic enclosure shall be designed and manufactured confirming to relevant standards suitable for outdoor installation exposed to weather conditions, and to limit overall noise level to 75 dB (A) at a distance of 1 mtr. from the enclosure as per CPCB norms under free field conditions.
2.6.5.2 The construction should be such that it prevents entry of rain water splashing into
the enclosure and allows free & quick flow of rain water to the ground in the event of heavy rain. The detailed construction shall conform to the details as under:

2.6.5.3 The enclosure shall be fabricated out the CRCA sheet of thickness not less than 1.6 mm on the outside cover with inside cover having not less than 0.6 mm thick perforated powder coated CRCA sheet.

2.6.5.4 The hinged doors shall be made from not less than 16 SWG (1.6 mm) thick CRCA sheet and will be made air tight with neoprene rubber gasket and heavy duty locks.

2.6.5.5 All sheet metal parts should be processed through 7-tank process.

2.6.5.6 The enclosure should be powder coated.

2.6.5.7 The enclosure should accommodate the daily service fuel tank of the D.G. Set to make the system compact. There should be provision of fuel gauge, which should show the level of the fuel even when the DG Set is not running. The gauge should be calibrated. The fuel tank should be filled from the out side as in automobiles and should be with a lockable cap.

2.6.5.8 The batteries should be accommodated in the enclosure in battery rack.

2.6.5.9 The canopy should be provided with high enclosure temperature safety device.

2.6.5.10 The acoustic lining should be made up of high quality insulation material i.e. rockwool/ glass/ mineral wool/ PU foam of appropriate thickness & density for sound absorption as per standard design of manufacturer’s to reduce the sound level as per CPCB norms. The insulation material shall be covered with fine glass fiber cloth and would be supported by perforated M. S. Sheet duly powder coated / GI sheet/aluminum sheet.

2.6.5.11 The enclosure shall be provided with suitable size & No. of hinged type doors along the length of the enclosure on each side for easy access inside the acoustic enclosure for inspection, operation and maintenance purpose. Sufficient space will be provided inside the enclosure on all sides of the D.G. set for inspection, easy maintenance &repairs.

2.6.5.12 The canopy should be as compact as possible with good aesthetic look.

2.6.5.13 The complete enclosure shall be of modular construction.

2.6.5.14 The forced ventilation shall be as per manufacturer design using either engine radiator fan or additional blower fan(s). If the acoustic enclosure is to be provided with forced ventilation then suitable size of axial flow fan (with motor and auto-start arrangement) and suitable size axial flow exhaust fan to take the hot air from the enclosure complete with necessary motors and auto start arrangement should be provided. The forced ventilation arrangement should be provided with auto stop arrangement to stop after 5 minutes of the stopping of D.G sets.

2.6.5.15 The acoustic enclosure should be suitable for cable connection/connection through bus-trunking. Such arrangements on acoustic enclosure should be water proof &dust-proof conforming to IP-65 protection.
2.6.5.16 The inside of enclosure should be provided with at least two nos. 28 W-T5 fluorescent tube light luminaire controlled by a 5A switch for adequate lighting during servicing etc. of the DG Set. The power supply to this luminaire should be from the load side of the AMF Panel so that it can remain energized under all conditions.
SYNCHRONIZATION (DG SET)

3.1 SCOPE
This section covers synchronization of DG sets as required (to be decided by NIT approving authority) and comprises of running of DG set in parallel i.e. their synchronization on common bus bar, auto load sharing and auto load management.

3.2 PLC PANEL
Operation of DG sets shall be monitored and controlled by PLC panel i.e. Programmable logic controller based logic panel. In case of mains failure, this logic panel shall control auto changeover from mains to DG Sets supply and interlocking of ACBs, auto synchronizing and auto load management functions along with annunciation for alternator control and protection.

The logic panel shall be provided with a total manual over ride facility. There shall be Smooth transfer of DG set operation from PLC to manual system & vice versa without any interruption/tripping. The logic panel shall be complete with all Auxiliary Relays, Timers, Contactors, Programmable logic controller, control wiring, interconnections etc. with 2.5 sq.mm. PVC insulated 1.1 KV grade copper conductor wires.

3.3 CONTROL PHILOSOPHY
3.3.1 Automatic Start & Stop of Engine
The system should come in operation after sensing of grid failure and automatically control the start & stop of engines, depending on the predefined load setting in the PLC. In case engine does not start in the first cranking, two more auto commands should be given with proper intervals. Even then if engine fails to start, indication must appear on MMI (Man Machine interface). In the event the engines are under loaded i.e. load sensed is capable of being catered by less than the capacity of running DG sets then command must be given to stop required number of excess DG sets after running idle for short duration. Provision to select no. of DG sets to be started and synchronised at no load to cope up with sudden load without tripping the DG’s should also be inbuilt into the system.

3.3.2 Automatic Synchronisation
The facility of synchronisation will be available in both Auto & Manual mode. In normal circumstances the auto synchronisation will work, however if due to any reason auto synchronisation fails repeatedly the facility for closure of ACB must be available automatically. In manual mode ACB will be closed by panel push button.

3.3.3 Automatic Load Sharing
The load sharing will also be automatic, by sensing both active & reactive power.

3.3.4 Back up Protection
The system should also have following inbuilt protection other than external relays in synchronization panel: Reverse power, Reverse KVAR, Over Current, Under voltage, Over voltage, Under frequency, Over frequency, synchro-check & earth fault relay except differential relay. Due to any electrical fault PLC shall trigger the master trip relay. These
PLCs will be state of the art equipments using latest technology and of most rugged and reliable design. Since they shall be operating in the harsh & unfriendly environment of DG room, they will be suitable to operate trouble free in those conditions. The chosen equipment should be able to withstand high temperature, humidity & voltage fluctuations, thus making it suitable for the operating conditions described above.

3.5 SEQUENCE OF OPERATION
The following sequence of operation shall be achieved through PLC based logic panel in addition to hardware interlocks as well as software interlocks:
(i) Selection of any generator as a lead generator to achieve the uniform running hours of all generators.
(ii) Three attempts to start the engine of lead generator. In case the engine fails to start or does not achieve the requisite speed within the predetermined time, PLC system declares engine of generator faulty. In this event PLC automatically selects next generator as the lead generator.
(iii) The PLC system automatically selects starting sequence of other generators on the basis of the lead generator being selected by the operator.
(iv) Before issuing close command to lead generator air circuit breaker, PLC checks that ACB of any other generator is not in close position. Then PLC system gives close command to lead generator ACB. The PLC system tries two times with interval of 5 secs. to close the ACB. Simultaneously, it also gives starting command to next generator engine in queue depending upon load.
(v) The speed, excitation, frequency and voltage of incoming generator is controlled identically as per the lead generator starting sequence described above, except closing of ACB.
(vi) When the lead generator KW crosses more than the 85% of rated capacity of DG set, the PLC system performs synchronization sequence for paralleling of generator prior to switching on of the ACB of 2nd generator. When the KW of 2nd generator crosses 80% of rated capacity of DG set then the PLC system performs synchronization sequence for paralleling of next generator prior to switching on the ACB of 3rd generator and similar sequence to be followed for other DG sets.
(vii) The last incoming generator ACB is tripped when PLC system senses that the total load on the system is less than the specified load and stops the engine after 5 minutes of idle running.
(viii) DG sets will start and stop automatically depending on the pre defined load setting in the PLC & also all DG sets will operate in load sharing mode.
EARTHING (DG SET)

4.1 EARTHING

Scope

This section covers the earthing requirement of DG Set installations. Copperplate earthing (Neutral Grounding) shall be provided for DG Sets of capacity 500 KVA or above, whereas G.I. plate earthing (Neutral Grounding) shall be provided for DG Sets below 500 KVA capacity. The body earthing shall generally be of G.I.

4.1.1 The generating set and all associated equipments control and switch gear and switchgear panels must be earthed before the set is put into operation.

4.1.2 Four numbers earth sets for each DG Sets are required as under:
- 2 earthing sets for Genset/ control panel body.
- 2 earthing sets for neutral.

In case there are more than one DG Set in one location, independent two nos. neutral earthing shall be provided for each DG set. However, two nos. earthing sets shall be common for the body earthing of DG Sets, Control Panel, AMF Panel and Essential LT Panel.

4.1.3 Earthing job should be carried out per General Specifications for Electrical Works, (Part 1-Internal), 2013.

4.1.4 Copper or GI strips of suitable size shall be used for earthing as detailed here under for interconnection:
4.1.4.1 DG Set of 500 KVA capacity or above:- Copper strip
4.1.4.2 DG Set below 500 KVA capacity:- GI strip

4.1.5 For Gensets with AVM’s between engine/ alternator and base rail, the body earthing must be done at the engine/ alternator and not at base-rail.

4.1.6 Genset should be earthed at two distinct points through a conductor strip having cross-section suitable to carry the short circuit (three phase dead short circuit with ground) current without burning out in conformity to General Specifications for Electrical Works (Part 1-Internal), 2013 in vogue.

4.1.7 Earth Bus: For body earthing, an earth-bus shall be provided.

4.1.8 In case, DG Set is being installed inside the substation building or near to the substation, for body-earthing of DG set, AMF Panel and Essential Panel, earth bus provided for sub-station shall be used.

4.1.9 Test joints should be provided for testing the earthing as and when required.
4.1.10 For further details of Earthing work, like size of plate/ earth strip, depth of earthing, method etc., please refer “CPWD General Specifications For Electrical Works (Part 1-Internal), 2013 in vogue.

**LIST OF APPROVED MAKES/BRANDS/AGENCIES**

The Owner/Consultant reserves the right to select any of the brands indicated in the list of approved makes without any extra claim from the contractor. Following makes/brands are also approved in addition to those mentioned in the item of works as described in BOQ & Specifications.

**CIVIL WORKS**

<table>
<thead>
<tr>
<th>SL. No.</th>
<th>ITEM</th>
<th>MAKE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GREY CEMENT</td>
<td>ACC, LARSEN &amp; TOUBRO, GUJARAT AMBUJA, J.K, BIRLA; ULTRA TECH, JAYPEE, VIKRAM, PENNA, PRISM OR EQUIVALENT</td>
</tr>
<tr>
<td>2</td>
<td>WHITE CEMENT</td>
<td>JK, BIRLA</td>
</tr>
<tr>
<td>3</td>
<td>WALL PUTTY</td>
<td>BIRLA, J.K, SUKRANI, NCL OR EQUIVALENT</td>
</tr>
<tr>
<td>4</td>
<td>REINFORCEMENT/STRUCTURAL STEEL</td>
<td>SAIL, TISCO, RINL, JINDAL</td>
</tr>
<tr>
<td>5</td>
<td>ANTI-TERMITE TREATMENT</td>
<td>PEST CONTROL INDIA LTD, PEST CON INDIA, PEST CONTROL INCORPORATED OR EQUIVALENT</td>
</tr>
<tr>
<td>6</td>
<td>CONCRETE ADDITIVE</td>
<td>KRYTON, CICO, PIDILITE, FOSROC OR EQUIVALENT</td>
</tr>
<tr>
<td>7</td>
<td>FLUSH DOOR/ SHUTTERS</td>
<td>GREEN, DURO, CENTURY, KITPLY OR EQUIVALENT .</td>
</tr>
<tr>
<td>8</td>
<td>PLYWOOD / BLOCK BOARD / SOFT BOARD</td>
<td>DURO, GREEN, CENTURY, KITPLY, MARINO OR EQUIVALENT .</td>
</tr>
<tr>
<td>9</td>
<td>PRELAMINATED PARTICLE BOARD</td>
<td>NOVAPAN, ANCHOR, GREEN LAM, Mayur. KITLAM, MARINO, CENTURY, ARCHID</td>
</tr>
<tr>
<td>10</td>
<td>LAMINATES</td>
<td>CENTURY, GREEN LAM, DURO, EURO, MARINO, FORMICA, DECOLAM</td>
</tr>
<tr>
<td>11</td>
<td>ADHESIVE FOR WOOD WORK</td>
<td>DUNLOP, FEVICOL, VAMICOL, PIDILITE.</td>
</tr>
<tr>
<td>12</td>
<td>POLYRETHANE SEALANT</td>
<td>KRYTON, PIDILITE, OR EQUIVALENT</td>
</tr>
<tr>
<td>13</td>
<td>POLYETHELENE BOARD/ BACK UP ROD</td>
<td>SUPREME INDUSTRIES, FINOLEX OR EQUIVALENT</td>
</tr>
<tr>
<td>14</td>
<td>ALUMINIUM SECTIONS</td>
<td>JINDAL, HINDALCO, INDAL OR EQUIVALENT</td>
</tr>
<tr>
<td>15</td>
<td>STAINLESS STEEL</td>
<td>SOLEM, JINDAL, CARELLER OR EQUIVALENT</td>
</tr>
<tr>
<td></td>
<td>EXPANSION/ FASTNERS</td>
<td>FISHER, HILTI, ANCHOR, CANON OR EQUIVALENT</td>
</tr>
<tr>
<td>---</td>
<td>---------------------------------------------------------</td>
<td>-------------------------------------------</td>
</tr>
<tr>
<td>17</td>
<td>FLOAT GLASS/ TOUGHENED GLASS</td>
<td>SAINT GOBAIN, AIS GLASS, MODI GUARD</td>
</tr>
<tr>
<td>18</td>
<td>CERAMIC TILES</td>
<td>KAJARIA, NITCO, SOMANY, JOHNSON, ASIAN, ORIENT</td>
</tr>
<tr>
<td>19</td>
<td>VITRIFIED PORCELIN TILES</td>
<td>KAJARIA, NITCO, SOMANY, JOHNSON, RAK, ASIAN</td>
</tr>
<tr>
<td>20</td>
<td>INTERLOCK TILES/ GRASS PAVER BLOCKS</td>
<td>NIMCO PREFAB, UNISTONE, MODERN, NITCO, BHARAT OR EQUIVALENT</td>
</tr>
<tr>
<td>21</td>
<td>TERRAZZO TILES</td>
<td>NITCO, MODERN, HINDUSTAN, ULTRA, BHARAT OR EQUIVALENT</td>
</tr>
<tr>
<td>22</td>
<td>CEMENT CONCRETE TILES</td>
<td>ULTRA, EUROCON, NITCO, DURACRETE, UNISTONE OR EQUIVALENT</td>
</tr>
<tr>
<td>23</td>
<td>SYNTHETIC ENAMEL PAINTS</td>
<td>BERGER, ASIAN, ICI DULUX, NEROLAC</td>
</tr>
<tr>
<td>24</td>
<td>OIL BOUND DISTEMPER</td>
<td>ASIAN (TRACTOR), BERGER (BISON), NEROLAC</td>
</tr>
<tr>
<td>25</td>
<td>CEMENT PAINT</td>
<td>SNOWEEM PLUS, BERGER (DUROCEM EXTRA), ULTRATECH, NEROLAC</td>
</tr>
<tr>
<td>26</td>
<td>PLASTIC EMULSION PAINT</td>
<td>ICI, ASIAN, NEROLAC</td>
</tr>
<tr>
<td>27</td>
<td>OTHER PAINTS/ PRIMERS</td>
<td>ICI DULUX, ASIAN, BERGER, NEROLAC, ULTRATECH</td>
</tr>
<tr>
<td>28</td>
<td>STRUCTURING STEEL</td>
<td>SAIL, TATA, JINDAL, RINL</td>
</tr>
<tr>
<td>29</td>
<td>SURFACE TEXTURE</td>
<td>ULTRATECH, HERITAGE, SPECTRUM, UNITILE OR EQUIVALENT</td>
</tr>
<tr>
<td>30</td>
<td>DOOR/ WINDOWS / PATCH FITTINGS</td>
<td>AS APPROVED BY PROJECT IN CHARGE.</td>
</tr>
<tr>
<td>31</td>
<td>LOCKS</td>
<td>AS APPROVED BY PROJECT IN CHARGE</td>
</tr>
<tr>
<td>32</td>
<td>WARDROBE/ CUBBOARDS</td>
<td>EBCO, GODREJ, HETTICH, PLAZA OR EQUIVALENT</td>
</tr>
<tr>
<td>33</td>
<td>NON METALLIC HARDENER COMPOUND</td>
<td>CICO, FOSROC, PIDILITE, FAREMATE, STP</td>
</tr>
<tr>
<td>34</td>
<td>POLYSULPHIDE SEALANT</td>
<td>PIDLITE, FOSROC, FAREMATE, STP.</td>
</tr>
<tr>
<td>35</td>
<td>MS PIPE</td>
<td>JINDAL (HISAR), PRAKASH, SURYA, KALINGA OR EQUIVALENT</td>
</tr>
<tr>
<td>36</td>
<td>Hinges</td>
<td>AS APPROVED BY PROJECT IN CHARGE</td>
</tr>
<tr>
<td>37</td>
<td>Door Closer</td>
<td>AS APPROVED BY PROJECT IN CHARGE</td>
</tr>
<tr>
<td>38</td>
<td>METAL FALSE CEILING</td>
<td>Fame Line, Armstrong, USG, Ultra OR EQUIVALENT</td>
</tr>
<tr>
<td>39</td>
<td>silicon SEALANT</td>
<td>Dow Corning, GE Bayer Silicone, Wicker, Remmers, ALCO</td>
</tr>
<tr>
<td>40</td>
<td>pad lock</td>
<td>AS APPROVED BY PROJECT IN CHARGE</td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Brand/Model</td>
</tr>
<tr>
<td>---</td>
<td>------------------------------------------</td>
<td>----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>41</td>
<td>FIRE DOORS</td>
<td>GLOBLE FIRE PROTECTION COMPANY, RADIENT STAFF FIRE DOORS, GODREJ, KUTTY, ROMAT OR EQUIVALENT</td>
</tr>
<tr>
<td>42</td>
<td>PVC DOOR/FRAME</td>
<td>FENESTRA, FIBRE WAYS, AQUA CELL, JAISHREE, SINTEX OR EQUIVALENT</td>
</tr>
<tr>
<td>43</td>
<td>GI SHEETS</td>
<td>SAIL, TATA, JINDA, blue scope, LOYAD</td>
</tr>
<tr>
<td>44</td>
<td>FLOOR SPRING</td>
<td>AS APPROVED BY PROJECT INCHARGE</td>
</tr>
<tr>
<td>45</td>
<td>POLYCARBONATE SHEET</td>
<td>GE PLASTICS, DANPALON OR EQUIVALENT</td>
</tr>
<tr>
<td>46</td>
<td>ROLLING SHUTTER</td>
<td>RAMA, PRAKASH OR EQUIVALENT</td>
</tr>
<tr>
<td>47</td>
<td>EXPANSION JOINT</td>
<td>VEXCOLT, WATSON, BOWMAN, ACME OR EQUIVALENT</td>
</tr>
<tr>
<td>48</td>
<td>ALLUMINIUM COMPOSITE PANEL</td>
<td>FAME LINE, ALUCOBOND, REYOBOND, ALSTRONG OR EQUIVALENT</td>
</tr>
<tr>
<td>49</td>
<td>ASPHALT EMULSION</td>
<td>STP/KARNAK, CHEMICAL CORPORATION, TIKTAR</td>
</tr>
<tr>
<td>50</td>
<td>TILE JOINT FILLER</td>
<td>ROFF RAINBOW TILE MATE, WINSIL 20/SILICON SEALANT OF GE BAYER SILICON, KERAKOLL.</td>
</tr>
<tr>
<td>51</td>
<td>RUBBER GASKET</td>
<td>BIS APPROVED QUALITY</td>
</tr>
<tr>
<td>52</td>
<td>POLYURETHANE PAINT</td>
<td>MRF OR EQUIVALENT</td>
</tr>
<tr>
<td>53</td>
<td>WAX POLISH</td>
<td>MEN’SSSION, RECKITT &amp; COLMAN, ASIAN OR EQUIVALENT</td>
</tr>
<tr>
<td>54</td>
<td>MELAMINE</td>
<td>ICI DULUX, ASIAN, MRF OR EQUIVALENT</td>
</tr>
<tr>
<td>55</td>
<td>SILICON WATER REPELLENT SOLUTION</td>
<td>GE BAYER, REMMERS, DUPONT OR EQUIVALENT</td>
</tr>
<tr>
<td>56</td>
<td>GYPSUM CEILING</td>
<td>INDIA GYPSUM, LAFARGE, GYPROC, SAINT GOBIN</td>
</tr>
<tr>
<td>57</td>
<td>MINERAL FIBRE TILES CEILING</td>
<td>ARMSTRONG, AMF, USG, GYPROC</td>
</tr>
<tr>
<td>58</td>
<td>LAMINATED WOODEN FLOORING</td>
<td>KRONO, PERGO, TARKETT, ARMSTRONG OR EQUIVALENT</td>
</tr>
<tr>
<td>59</td>
<td>VENETIAN BLINDS</td>
<td>MAT CORNER, DÉCOR, VISTA OR EQUIVALENT</td>
</tr>
<tr>
<td>60</td>
<td>PVC FLOORING</td>
<td>POLYFLOR, TARKETT, GERFLOR, ARMSTRON OR EQUIVALENT</td>
</tr>
<tr>
<td>61</td>
<td>MDF BOARD</td>
<td>ANCHOR, D URO, MERINO, GREENLAM, CENTURY, KITPLY, NOVAPAN, NUWUD</td>
</tr>
<tr>
<td>62</td>
<td>EXTERIOR WOOD HIGH PRESSURE LAMINATE</td>
<td>REZNOCLAD, PRODEMA, FUNDERMAX, FORMICA, MERINO, DECLOM</td>
</tr>
<tr>
<td>63</td>
<td>WOODEN PANELLING</td>
<td>FAME LINE, ARMSTRONG OR EQUIVALENT</td>
</tr>
<tr>
<td>64</td>
<td>ALUMINIUM LOUVERS</td>
<td>FAME LINE, DEXONE OR EQUIVALENT</td>
</tr>
<tr>
<td>S. NO.</td>
<td>ITEM</td>
<td>MAKE</td>
</tr>
<tr>
<td>--------</td>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>MS BLACK ENAMELLED/ GALVANIZED ERW CONDUITS</td>
<td>BEC / AKG/ NIC OR EQUIVALENT</td>
</tr>
<tr>
<td>2</td>
<td>MS CONDUIT ACCESSORIES</td>
<td>AKG/BEC/ APPROVED EQUIVALENT</td>
</tr>
<tr>
<td>3</td>
<td>PVC CONDUIT (FRLS HEAVY DUTY)</td>
<td>AKG/BEC/RAVINDRA,AVONPLAST OR EQUIVALENT</td>
</tr>
<tr>
<td>4</td>
<td>GI/MS PIPES</td>
<td>JINDAL/PARKASH SURYA/ TATA,KALINGA</td>
</tr>
<tr>
<td>5</td>
<td>COPPER CONDUCTOR PVC INSULATED WIRES</td>
<td>EDEN/ BRIMSON/ POLY CAB/SKY TONE OR EQUIVALENT</td>
</tr>
<tr>
<td>6</td>
<td>MODULAR SWITCHES, SOCKET OUTLETS AND WIRING ACCESSORIES WITH MOULDED COVER PLATE (COLOUR APPROVAL SHALL BE DONE BY PROJECT MANAGER/ARCHITECT)</td>
<td>MDS -LEGRAND ( MOSAIC SERIES)/ CLIPSAK (OPAL)/ MK (WRAPAROUND PLUS)/ CRABTREE/NORTH WEST/ANCHOR</td>
</tr>
<tr>
<td>7</td>
<td>A/C OUTLETS</td>
<td>NORTH WEST/MDS- LEGRAND/CLIPSAL/CRABTREE</td>
</tr>
<tr>
<td>8</td>
<td>DATA OUTLETS</td>
<td>DIGILINK/SIEMON/CORNING/POLY CAB</td>
</tr>
<tr>
<td>9</td>
<td>PHOTO CHROMATIC SWITCH</td>
<td>BAJAJ/WIPRO/PHILIPS/HAVELLS</td>
</tr>
<tr>
<td>10</td>
<td>LIGHT FIXTURES</td>
<td>PHILIPS/WIPRO/BAJAJ/PRIERLITE/HPL</td>
</tr>
<tr>
<td>11</td>
<td>CEILING/EXHAUST FANS</td>
<td>CROMPTONGREAVES/KHAITAN/USHAA/BAJ AJ/ ORIENT</td>
</tr>
<tr>
<td>12</td>
<td>DISTRIBUTION BOARDS</td>
<td>SCHNEIDER/SIEMENS/HAGER/ HAVELLS OR EQUIVALENT</td>
</tr>
<tr>
<td>13</td>
<td>COPPER CONDUCTOR PVC INSULATED WIRES</td>
<td>EDEN/BRIMSON/ POLY CAB/HAVELLS OR EQUIVALENT</td>
</tr>
<tr>
<td>14</td>
<td>MV CABLES</td>
<td>UNIVERSAL (SATNA)/GLOSTER/POLY CAB/</td>
</tr>
<tr>
<td>15</td>
<td>CONTROL CABLES</td>
<td>SKYTONE OR EQUIVALENT</td>
</tr>
<tr>
<td>No.</td>
<td>Description</td>
<td>Brand(s)</td>
</tr>
<tr>
<td>-----</td>
<td>-----------------------------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>15.</td>
<td>POWER &amp; CONTROL CABLES</td>
<td>UNIVERSAL (SATNA)/GLOSTER/POLYCAB/SKYTONE OR EQUIVALENT</td>
</tr>
<tr>
<td>16.</td>
<td>BUS DUCT (AIR INSULATED TYPE)</td>
<td>CONTROL AND SWITCH GEAR/SCHNEIDER/ADVANCE/L&amp;T OR EQUIVALENT</td>
</tr>
<tr>
<td>17.</td>
<td>CO-AXIAL CABLES</td>
<td>UNIVERSAL (SATNA)/GLOSTER/POLYCAB/SKYTONE</td>
</tr>
<tr>
<td>18.</td>
<td>FLIXIBLE WIRES</td>
<td>EDEN/BRIMSON/POLYCAB/HAVELLS</td>
</tr>
<tr>
<td>19.</td>
<td>SPLITTER BOX</td>
<td>SHYAM ANTENNA/CAT VISION/SWIFT AUDIO VIDEO</td>
</tr>
<tr>
<td>20.</td>
<td>CABLE TRAY</td>
<td>CONTROLS AND SWITCH GEAR/SCHNEIDER/ADVANCE/L&amp;T OR EQUIVALENT</td>
</tr>
<tr>
<td>21.</td>
<td>HT XLPE 11 KVA CABLE</td>
<td>UNIVERSAL (SATNA)/GLOSTER/SKYTONE/POLYCAB OR EQUIVALENT</td>
</tr>
<tr>
<td>22.</td>
<td>HT CABLE TERMINATION/JOINTING KIT</td>
<td>RAYCHEM/3M OR EQUIVALENT</td>
</tr>
<tr>
<td>23.</td>
<td>EARTHING SYSTEM</td>
<td>ERICO/ALLTEC/JMV OR EQUIVALENT</td>
</tr>
<tr>
<td>24.</td>
<td>BATTERY CHARGER</td>
<td>AE/VOLTSTAT/WAVE ELECTRONICS</td>
</tr>
<tr>
<td>25.</td>
<td>FREE LEAD ACID BATTERY</td>
<td>EXIDE/AMRON/AMARA RAJA</td>
</tr>
<tr>
<td>26.</td>
<td>CT/PT</td>
<td>KAPPA/AE/MATRIX</td>
</tr>
<tr>
<td>27.</td>
<td>MCB/ELCB/RCBO/DB</td>
<td>MDS/HAGER/SIEMENS/MG/HPL/L&amp;T/HAVELS</td>
</tr>
<tr>
<td>28.</td>
<td>MCCB</td>
<td>SIEMENS (3VL)/MERLIN GERIN (COMPACT NSX)/HPL/L&amp;T/HAVELS</td>
</tr>
<tr>
<td>29.</td>
<td>ACB</td>
<td>L&amp;T (U-POWER WITH UN RS 3)/SIEMENS (3 W L WITH ETU 76B) / MERLIN GERIN (MASTERPACT WITH MICROLOGIC 6A)/HPL/HAVELS</td>
</tr>
<tr>
<td>30.</td>
<td>MV CONTACTORS/TIMER/STARTERS</td>
<td>L&amp;T/SIEMENS/MG/HPL/HAVELS</td>
</tr>
<tr>
<td>31.</td>
<td>ALL METERS</td>
<td>CONZERV (ENERCON)/MG OR EQUIVALENT</td>
</tr>
<tr>
<td>32.</td>
<td>PROTECTIVE RELAYS</td>
<td>ALSTOM/ABB/SIEMENS/L&amp;T/MG</td>
</tr>
<tr>
<td>33.</td>
<td>INDICATION LAMPS/PUSH BUTTON</td>
<td>L&amp;T/SCHNEIDER/SIEMENS</td>
</tr>
<tr>
<td>34.</td>
<td>CAPACITOR</td>
<td>L&amp;T/SIEMENS/ABB/GE/NEPTUNE/MATRIX</td>
</tr>
<tr>
<td>35.</td>
<td>TERMINAL BLOCKS</td>
<td>BCH/INDUSTRIAL CONTROL/L-MAK/JAINSON</td>
</tr>
<tr>
<td>36.</td>
<td>CHANGE OVER SWITCH</td>
<td>HPL/L&amp;T/SIEMENS/C&amp;S</td>
</tr>
<tr>
<td>37.</td>
<td>BUS BAR</td>
<td>JINDAL/INDALCO/CENTURY</td>
</tr>
<tr>
<td>38.</td>
<td>DIMMERS</td>
<td>LUTRON / DARBARI / CALIPSAL</td>
</tr>
<tr>
<td>39.</td>
<td>L.T. PANEL BOARDS / SUB-PANEL/ METER BOARDS</td>
<td>CONTROL AND SWITCH GEAR/VIKAS PANELS/ AMBIT/L&amp;T/BHARAT SWITH GEAR</td>
</tr>
<tr>
<td>40.</td>
<td>DISTRIBUTION BOARDS</td>
<td>LEGRAND/SIEMENS/HAGER/MG/HPL</td>
</tr>
<tr>
<td>41.</td>
<td>SUB-STATION SAFEY EQUIPMENT</td>
<td>ISI MARKED</td>
</tr>
<tr>
<td>42.</td>
<td>BATTERIES</td>
<td>EXIDE/PANASONIC/ROCKET</td>
</tr>
<tr>
<td>43.</td>
<td>LIST OF APPROVED MAKES FOR EPABX, ACTIVE AND PASSIVE COMPONENTS</td>
<td></td>
</tr>
<tr>
<td>44.</td>
<td>JACKPANEL, PATCHCORDS, I/O, FACEPLATE ETC.</td>
<td>DIGILINK/SIEMON/CORNING OR EQUIVALENT</td>
</tr>
<tr>
<td>45.</td>
<td>LAN SWITCHES</td>
<td>CISCO/EXTERME/JUNIPER OR EQUIVALENT</td>
</tr>
<tr>
<td>46.</td>
<td>RACKS</td>
<td>APW/VALL RACK/RITTAL</td>
</tr>
<tr>
<td>47.</td>
<td>EPABX SYSTEM AND DIGITAL PHONES</td>
<td>AVAYA/ALCATEL/CISCO/HITACHI/SEIMENS</td>
</tr>
<tr>
<td>48.</td>
<td>ANALOG PHONES</td>
<td>BEETEL/SIEMENS/BPL</td>
</tr>
<tr>
<td><strong>FIRE SUPPRESSION &amp; PUMPS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>FIRE HYDRANT VALVES</td>
<td>MINIMAX,NEWAGE,SUPEREX PLAZA OR EQUIVALENT</td>
</tr>
<tr>
<td>2.</td>
<td>FIRE HOSE PIPES</td>
<td>JAYSHREE, NEWAGE,MINIMAX PLAZA OR EQUIVALENT</td>
</tr>
<tr>
<td>3.</td>
<td>FIRST AID FIRE HOSE REELS</td>
<td>MINIMAX,NEWAGE,SAFE GUARD OR EQUIVALENT</td>
</tr>
<tr>
<td>4.</td>
<td>PRESSURE SWITCH</td>
<td>INDOFOSS/SWITZER,SAFE GUARD OR EQUIVALENT</td>
</tr>
<tr>
<td>5.</td>
<td>VIBRATION ISOLATOR</td>
<td>RESISTOFLEX, DUNLOP, KUNWAL OR EQUIVALENT</td>
</tr>
<tr>
<td>6.</td>
<td>CI BUTTERFLY VALVES</td>
<td>AUDCO, ZOLOT, CASTLE OR EQUIVALENT</td>
</tr>
<tr>
<td>7.</td>
<td>CI DOUNLE FLANGED NEVS</td>
<td>KIRLOSKAR, DRIP, CASTLE, INTER VALVE OR EQUIVALENT</td>
</tr>
<tr>
<td>8.</td>
<td>GATE VALVE</td>
<td>LEADER, ZOLOT, SANT OR EQUIVALENT</td>
</tr>
<tr>
<td>9.</td>
<td>BALL VALVE</td>
<td>AUDCO, ZOLOT TBS OR EQUIVALENT</td>
</tr>
<tr>
<td>10.</td>
<td>FIRE EXTINGUISHERS</td>
<td>MINIMAX, SAFEX, SUPEREX OR EQUIVALENT</td>
</tr>
<tr>
<td></td>
<td>PLUMBING</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>VITREAUS CHINA WARE</td>
<td>PARRYWARE, HINDUSTAN SANITARY WARE, CERA, JOHNSON, RASI</td>
</tr>
<tr>
<td>2.</td>
<td>PVC CONNECTORS</td>
<td>SUPRIME, PARKASH, SURYA</td>
</tr>
<tr>
<td>3.</td>
<td>SEAT COVER (HEAVY DUTY)</td>
<td>COMMANDER, DIPLOMAT, BESTOLITE, PRINCE, HINDWARE, PARRYWARE</td>
</tr>
<tr>
<td>4.</td>
<td>STAINLESS STEEL SINK</td>
<td>PRESTIGE, KINGSTON, NEELKANTH, JAYANA, NIRALI, AMC</td>
</tr>
<tr>
<td>5.</td>
<td>AUTO URINAL FLUSH SYSTEM</td>
<td>AOS AUTO ROBO FLUSHING SYSTEM, TOSHI, UTEC SYSTEM</td>
</tr>
<tr>
<td>6.</td>
<td>CP BRASS FITTINGS AND TOILET ACCESSORIES</td>
<td>JAQUAR, GEM, ESS-ESS, KINGSTON, SEIKO</td>
</tr>
<tr>
<td>7.</td>
<td>ANGEL VALVE WITH FITTINGS</td>
<td>ARCO, AQUA PLUS, PARKO, SEIKO/MAYUR/OTHELO/ZOLOTO</td>
</tr>
<tr>
<td>8.</td>
<td>FLOOR DRAIN FIXTURE, RAIN WATER OUTLET &amp; CHANNEL GRATINGS</td>
<td>ISI APPROVED</td>
</tr>
<tr>
<td>9.</td>
<td>C.P. GRATING FOR FLOOR TRAP</td>
<td>CHILLY, SEIKO, COBRA, NEELKANTH</td>
</tr>
<tr>
<td>10</td>
<td>CAST IRON PIPES &amp; FITTINGS MANHOLE COVERS AND FRAMES</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>AS PER IS:3989 (PIPES &amp; FITTINGS)</td>
<td>NEO, HEPCO, BENGAL IRON OR EQUIVALENT</td>
</tr>
<tr>
<td>12</td>
<td>AS PER IS:1726 (MANHOLE COVERS AND FRAMES)</td>
<td>NEO, BC, SKF, RAJ IRON FOUNDRY AGRA OR EQUIVALENT</td>
</tr>
<tr>
<td>13</td>
<td>AS PER IS:1536- C.I. (LA)</td>
<td>KESORAM CALCUTTA, ELECTRO STEEL CALCUTTA, IISCO, SUPRA</td>
</tr>
<tr>
<td>14</td>
<td>C.I. L.A FITTINGS</td>
<td>KARTAR, KESORAM, ELECTROSTEEL OR EQUIVALENT</td>
</tr>
<tr>
<td>15</td>
<td>PIPE CLAMPS</td>
<td>ISI APPROVED,</td>
</tr>
<tr>
<td>16</td>
<td>GI PIPES (IS : 1239 AND IS : 3589)</td>
<td>TATA STEEL, JINDAL, PRAKASH-SURYA, KALINGA</td>
</tr>
<tr>
<td>17</td>
<td>GI PIPES FITTINGS</td>
<td>UNIK, ZOLOTO, KS, R BRAND, OR EQUIVALENT</td>
</tr>
<tr>
<td>18</td>
<td>BUTTERFLY VALVE</td>
<td>CASTLE, AUDCO, KSB, OR EQUIVALENT</td>
</tr>
<tr>
<td>19</td>
<td>WAFER TYPE CHECK VALVE</td>
<td>CASTLE, ADVANCE, KIRLOSKAR, ZOLOTO, LEADER</td>
</tr>
<tr>
<td>20</td>
<td>AIR RELEASE VALVE</td>
<td>ZOLOTO, OR, RBM, LEADER OR EQUIVALENT</td>
</tr>
<tr>
<td>21</td>
<td>ANTI VIBRATION MOUNTING AND FLEXIBLE CONNECTIONS</td>
<td>KANWAL INDUSTRIAL CORPORATION, DUNLOP, RESISTOFLEX</td>
</tr>
<tr>
<td>22</td>
<td>PRESSURE SWITCH</td>
<td>DANFOSS / SYSTEM SENSOR / INDFOSS OR EQUIVALENT</td>
</tr>
<tr>
<td>23</td>
<td>PRESSURE GAUGE</td>
<td>H GURU, FIEBIG, SANT OR EQUIVALENT</td>
</tr>
<tr>
<td></td>
<td>LIGHTENING PROTECTION</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>----------------------</td>
<td>---</td>
</tr>
<tr>
<td>1</td>
<td>ESE TERMINALS</td>
<td>LPI – AUS., FOUDRETECH – FRANCE, E.F. – SWITZERLAND</td>
</tr>
<tr>
<td>2</td>
<td>DOWN CONDUCTOR</td>
<td>LPI–AUS., FOUDRETECH – FRANCE, E.F. – SWITZERLAND</td>
</tr>
<tr>
<td>3</td>
<td>GROUND RESISTANCE IMPROVING COMPOUND</td>
<td>LPI–AUS., FOUDRETECH – FRANCE, E.F. – SWITZERLAND</td>
</tr>
<tr>
<td>4</td>
<td>SURGE COUNTER</td>
<td>LPI–AUS., FOUDRETECH – FRANCE, E.F. – SWITZERLAND</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>AIR CONDITIONING</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OUTDOOR &amp; INDOOR UNITS</td>
<td></td>
</tr>
<tr>
<td>a</td>
<td>HIWALL UNIT</td>
<td>TOSHIBA, DAIKIN , OG</td>
</tr>
<tr>
<td>b</td>
<td>CASSETTE TYPE UNIT</td>
<td>TOSHIBA, DAIKIN , OG</td>
</tr>
<tr>
<td>2</td>
<td>DIGITAL INEVRTER &amp; OTHER ACCESSORIES</td>
<td>TOSHIBA, DAIKIN , OG</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>FDA &amp; PAVA</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FIRE AALRM PANEL</td>
<td>ESSER –GERMANY</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HFP-11-FIRE FINDER USA-(Siemens)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GENT</td>
</tr>
<tr>
<td>2</td>
<td>ADDRESSABLE DETECTORS</td>
<td>ESSER –GERMANY</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HFP-11-FIRE FINDER USA-(Siemens)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GENT</td>
</tr>
<tr>
<td>3</td>
<td>MODULES/ MCP</td>
<td>ESSER –GERMANY</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HFP-11-FIRE FINDER USA-(Siemens)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GENT</td>
</tr>
<tr>
<td>4</td>
<td>TRANSPONDER/MODULES</td>
<td>ESSER –GERMANY</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HFP-11-FIRE FINDER USA-(Siemens)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GENT</td>
</tr>
<tr>
<td></td>
<td>RESPONSE INDICATOR</td>
<td>AS APPROVED BY CONSULTANT/CLIENT</td>
</tr>
<tr>
<td>---</td>
<td>--------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Wherever makes have not been specified for certain terms as equivalent makes referred, the same shall be as per BIS and as per approved by Engineer-in-charge/Consultant.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Contractor shall be required to get the finishing items/products approved in respect of their make, finish, texture, colour &amp; such parameter</td>
<td></td>
</tr>
</tbody>
</table>