

**HSCC (India) Limited**  
**as Executing Agency on behalf of**  
**MINISTRY OF HEALTH & FAMILY WELFARE,**  
**NEW DELHI**

Dated : 18.09.2018

**AMENDMENT No. – I**

**Project Name: Tender for “External Electrical Works for All India Institute of Medical Sciences (AIIMS) at Mangalagiri Distt. Guntur (AP)”**

**Tender No. HSCC/PMSSY/AIIMS/Guntur/Ext-Elect/2018; dated: 04.09.2018**

**Reply to Pre Bid Queries raised by bidders during pre -bid meeting held on 14.09.2018 at HSCC, Head Office, Noida**

Sl No.	Ref./ Vol./ Description	Item No.	Page No.	Tender Ref.	Bidders Queries	Reply
1	Vol05_BOQ		02/71	1) TRANSFORMERS : 1.1) & 1.2) ON load tap changer on HT side with 2.5% step each, range (-) 15% and (+) 5% along with RTCC Panel.	As there is a discrepancy among BOQ, technical specification and datasheet on the tapping range and steps, please clarify the actual requirement to be considered.	As per BOQ.
2	Vol04_TechSpecs		20/186	SUBHEAD-A TRANSFORMER - OIL TYPE 8. Transformer Tappings: The tapings to be provided for variation on HV side from +5% to - 10% in steps of 1.25% each.		
3	Vol04_TechSpecs		25/186	Datasheet Tap changer on primary side On load high speed resistor transition a) Range : +5%, to -15% e) Voltage per step variation : +/-1.25%		
4	Vol05_BOQ		02/71	1) TRANSFORMERS : 1.1) Supply, Installation, Testing & Commissioning of 12 MVA 3 phase, 33/ 11 kV outdoor, oil filled type Power Transformer, Dyn 11 vector group connection, having impedance as per IS, Transformer winding & Insulation : CRGO type core, 99.9% pure copper copper winding and neutral brought out for earthing, paper insulated Insulation & cooling : Class A insulation, Oil natural, Air Natural/ Oil Natural, Air Force (ONAN/ ONAF) type cooling.	Please specify both the ratings for ONAN & ONAF operation.	As per BOQ, ONAN

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5	Vol05_BOQ		03/71	1) TRANSFORMERS : 1.2) Supply, Installation, Testing & Commissioning of 2 MVA 3 phase, 33/ 11 kV outdoor, oil filled type Power Transformer, Dyn 11 vector group connection, having impedance as per IS, Transformer winding & Insulation: CRGO type core, 99.9% pure copper copper winding and neutral brought out for earthing, paper insulated Insulation & cooling: Class A insulation, Oil natural, Air Natural/ Oil Natural, Air Force (ONAN/ ONAF) type cooling.	Please specify both the ratings for ONAN & ONAF operation.	As per BOQ,ONAN
6	Vol05_BOQ		05/71	2) HT PANEL 2.1) 33KV FIVE PANEL HT VCB (INDOOR)- TWO INCOMERS, ONE BUS COUPLER AND TWO OUT GOINGS IN IP-44 ENCLOSURE, INSIDE A ROOM (For Residential, Hostel, OPD, IPD & Academic blocks)	Degree of protection shall be IP-4X for 33kV Panels. Please accept the same.	IP -4X will be accepted
7	Vol05_BOQ		08/71	2) HT PANEL 2.2) 11KV NINE PANEL HT VCB (INDOOR)- FOUR INCOMERS, ONE BUS COUPLER & FOUR OUTGOINGS IN IP-4X ENCLOSURE (For Residential Blocks) 2.3) 11kv SINGLE PANEL HT VCB (INDOOR) IN IP-44 ENCLOSURE INSIDE A ROOM (For IPD Substation) 2.4) HT APFC PANEL: Automatic Power Factor Controller Panel with Capacitor panel [Indoor Type]	Degree of protection shall be IP-4X for 11kV Panels. Please accept the same.	IP -4X will be accepted
8	Vol05_BOQ		13/71	2) HT PANEL 2.4) HT APFC PANEL: Automatic Power Factor Controller Panel with Capacitor panel [Indoor Type]	Please also provide the technical specification & datasheet for 11kV APFC Panel.	As per BOQ
9	Vol05_BOQ		16/71	3) D.G. SETS & HSD TANK	Please also provide the technical specification & datasheet for DG Sets.	Technical Specification of DG set enclosed at <b>Annexure -II.</b>
10	Vol05_BOQ		16/71	3) D.G. SETS & HSD TANK	Please specify the approximate distance between DG Set & DG Synchronizing Panel.	As per actual site condition.
11	Vol05_BOQ		16/71	3) D.G. SETS & HSD TANK 3.1) DG SET WITH REMOTE RADIATOR - IN ACCOUSTIC HOOD, 11 KV: Along with its Exhaust pipe & its insulation with all supporting structure & as per CPCB norms complete as required.	Please clarify whetehr the exhaust pipe shall have self supporting structure, or suported along with wall/in shaft.	Self supported structure as per CPCB guidelines
12	Vol05_BOQ		19/71	4) HT CABLES 4.1) & 4.2) Laying of one number PVC insulated and PVC sheathed/ XLPE power cable of 11 kV grade	As there is a discrepancy on the type of insulation in the BOQ, we understand that XLPE insulation to be considered for HT Cables. Please confirm.	XLPE as per BOQ
13	Vol05_BOQ		20/71	4) HT CABLES 4.8) Supply of the following sizes of 11KV, 33KV XLPE insulated, PVC type ST-2 inner & outer sheath, Aluminium conductor, armoured cable as per IS:7098 Part-2 (UnEarthed).		

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14	Vol05_BOQ		18/71	3) D.G. SETS & HSD TANK 3.2) HSD TANK	Please clarify whether the location of 3 Nos 2250KVA DG sets are in one place only or in different location. If different locations, then please clarify how to supply the diesel from Under ground Tank to each DG sets. Please furnish the DG sets & under ground tank location layout drawings for our reference.	Layout oalready provided with tender drawing
15	Vol05_BOQ		19/71	4) HT CABLES 4.6) RCC HUME PIPES	Please specify the class of RCC Hume Pipes to be considered.	ISI marked
16	Vol05_BOQ		20/71	4) HT CABLES 4.8) Supply of the following sizes of 11KV, 33KV XLPE insulated, PVC type ST-2 inner & outer sheath, Aluminium conductor, armoured cable as per IS:7098 Part-2 (UnEarthed).	Please clarify whether the 33kV & 11kV Systems are earthed or un-earthed. Since, the cables are mentioned as un-earthed and switchboards are mentioned for earthed system.	As per BOQ
17	Vol04_TechSpecs		26/186	SUB-HEAD: B1. HT VCB SWITCH BOARD – 33KV VCB OR 22 KV VCB 1) General a) Rated voltage - 33 kV or 22 kV, 3phase (earthed system)		
18	Vol04_TechSpecs		33/186	SUB-HEAD: B2. HT VCB SWITCH BOARD – 11 KV VCB 1) General a) Rated voltage - 11 kV, 3phase (earthed system)		
19	Vol05_BOQ		21/71	5) BUSDUCT 5.1) BUS DUCT - INDOOR (IN AIR - OVER HEAD TYPE) IP 65	Please also provide the technical specification & datasheet for indoor busduct.	As per BOQ
20	Vol05_BOQ		21/71	5) BUSDUCT 5.1) BUS DUCT - INDOOR (IN AIR - OVER HEAD TYPE) IP 65	As there is a discrepancy between technical specification and BOQ on IP rating of indoor busduct, please clarify the actual requirement.	As per BOQ
21	Vol04_TechSpecs		41/186	SUB-HEAD: D. 415V, 3 PHASE, 50Hz, 4POLES, CAST RESIN BUSDUCT (IP68) 4) IP RATING - The Busduct for indoor/outdoor application shall be IP68.		
22	Vol05_BOQ		36/71	6) DISTRIBUTION BOARDS & PANELS: 6.7) MAIN LT PANEL-IPD (TTA PANEL) IP Rating : IP 42 Double Door	Degree of protection shall be IP-4X for switchgear rating of 5000 Amps. Please accept the same.	panel will be with single door and IP 42
23	Vol05_BOQ		38/71	6) DISTRIBUTION BOARDS & PANELS: 6.9) ACTIVE HARMONIC FILTER (AHF) 300Amps at 440V	Please also provide the technical specification & datasheet for Active Harmonic Filter.	As per BOQ
24	Vol05_BOQ		39/71	7) MV CABLES, CABLE JOINTING & END TERMINATIONS 7.1), 7.2) & 7.3) Laying of one number PVC insulated and PVC sheathed/ XLPE power cable of 1.1 kV grade	As there is a discrepancy on the type of insulation in the BOQ, we understand that XLPE insulation to be considered for MV Cables. Please confirm.	XLPE as per BOQ
25	Vol05_BOQ		39/71	7) MV CABLES, CABLE JOINTING & END TERMINATIONS 7.5) Supply, loading, transportation unloading at site, storages at site, shifting from storage place to site of following sizes of 1.1kV grade XLPE insulated, Extruded PVC inner sheathed & overall FR-LSH PVC outer sheathed, Aluminium conductor, Armoured cables		

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26	Vol05_BOQ		45/71	10) EARTHING 10.7), 10.8) & 10.9) Supply and installation of one number earth pit with advance maintenance free Earthing System	Please provide the earth pit layouts for all the types mentioned in BOQ for our reference..	as per actual site condition
27	Vol05_BOQ		65/71	19) SPECIALIZED SERVICES OF AUDITORIUM	Please clarify whether there is any requirement of specialized sub-contractor for this tender, since the section title is mentioned as specialized services. Also, please provide the technical specification, datasheets & drawings for Specialized Services for Auditorium.	yes, specialized items which the bidder do not have experience
28	Vol05_BOQ		69/71	20) SOLAR PHOTVOLTAIC POWER GENERATION	Please also provide the technical specification & datasheet for Solar Photovoltaic Power Generation.	As per BOQ
29	Vol04_TechSpecs		15/186	SUBHEAD-A TRANSFORMER - OIL TYPE 1) Scope Design, manufacture, testing, supply, Installation, testing and commissioning of outdoor type 33 KV /11 KV transformers with ONAN cooling complete with all the accessories and fittings for efficient and trouble free operation. First filling of oil shall be at site by contractor.	Please also provide the technical specification & datasheet for 11/0.433kV transformers.	As per BOQ/CPWD specs/IS code
30	Vol04_TechSpecs		19/186	SUBHEAD-A TRANSFORMER - OIL TYPE 9) Cooling Equipment: It is recommended to provide sprinklers at 6.3 MVA transformers at Main receiving station.	We understand that this clause is not applicable for this tender, since there is no transformer with this rating specified in the BOQ. Please confirm.	As per tender
31	Vol04_TechSpecs		20/186	SUBHEAD-A TRANSFORMER - OIL TYPE 12) Electrical & Performance Requirement: Temperature Rise shall be continuously rated for full load. The temperature rise shall not exceed 45 degree C by thermometer in oil or 55 degree centigrade in winding by resistance over an ambient of 32 degree C.	As there is a discrepancy between technical specification and datasheet on the ambient temperature, we understand that the ambient temperature shall be 50 Deg. C only. Please confirm.	Ambient temperature will be 50 degree C
32	Vol04_TechSpecs		24/186	Datasheet Temperature rise over 50°C ambient temp a) In oil (measured by Thermometer) : 45 deg. C b) In winding (measured by Resistance method) : 55 deg. C		
33	Vol04_TechSpecs		20/186	SUBHEAD-A TRANSFORMER - OIL TYPE 14) Fittings And Accessories: - Dial type Magnetic thermometer (150 mm dia) with maximum set pointer at 75 deg C and electrical contacts for electrical alarm at high temperature.	Dial size shall be considered as per OEM manufacturing standard. Please accept the same.	as per standard practice of manufacturer.
34	Vol04_TechSpecs		24/186	Datasheet Percentage impedance - 7.5 % @ 6.3 MVA	Please clarify as there is no rating of 6.3MVA specified in the BOQ.	As per BOQ

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35	Vol04_TechSpecs		24/186	Datasheet for 12 MVA, 33/11kV	Please also provide datasheet for following rating transformers for our reference a) 2 MVA, 33/11kV b) 2.5 MVA, 11/0.433kV  Losses are also specified only for 12MVA, 33/11kV transformer. Please also specify for above mentioned transformers too.	losses will be as per latest IS code ammended upto date at the time of supply of transformers to site.
36	Vol04_TechSpecs		40/186	SUB-HEAD: C. HT CABLE 11 KV / 22KV / 33 KV GRADE XLPE INSULATED SINGLE / MULTICORE CABLES - EARTHED 2.f) Armouring : Single layer of galvanized steel round wires / flat strips	Please clarify whether the type of armouring of HT Cables shall be round wire or flat strip.	As per CPWD/IS specifications.
37	Vol04_TechSpecs		40/186	SUB-HEAD: C. HT CABLE 11 KV / 22KV / 33 KV GRADE XLPE INSULATED SINGLE / MULTICORE CABLES - EARTHED 2.g) Outer sheath : HR PVC type ST-2 of IS: 5831	Please clarify whether HR PVC outersheath is to be considered for HT Cables, as the same is not mentioned in BOQ.	as per standard manufacturer practice
38	Vol04_TechSpecs		47/186	SUB-HEAD: E1. LT SWITCH GEAR 1) AIR CIRCUIT BREAKERS (ACB) - The ACB shall confirm to IEC/ IS – 60947-2. The ACB shall have a rated service short circuit breaking capacity (Ics) as specified in SLD's and BOQ "Technical parameters" at rated operational voltage (Ue) at 415V, frequency at 50 Hz.	Please provide single line diagrams as mentioned in technical specification, as the same is not available in the tender documents.	SLD will be provided to successful bidder
39	Vol04_TechSpecs		47/186	SUB-HEAD: E1. LT SWITCH GEAR 1) AIR CIRCUIT BREAKERS (ACB) - ACB should have single frame size up to 4000A and shall be suitable for "Switch Disconnect" function (AC 23 utilization category).	ACB frame sizes shall be as per approved OEM manufacturing standard only. Please accept the same.	as per manufacturer standard practice.
40	Vol04_TechSpecs		55/186	SUB-HEAD: E1. LT SWITCH GEAR 16) CAPACITORS: 16.1) Power Factor Improvement Capacitors: - Dielectric losses shall less than or equal to 0.2W/ Watt/ KVAR.	Dielectric losses shall be as per approved OEM manufacturing standard only. Please accept the same.	As per tender
41	Vol04_TechSpecs		55/186	SUB-HEAD: E1. LT SWITCH GEAR 16) CAPACITORS: 16.2) Harmonic circuit filter reactors 7% & 14%:	Please clarify whether the reactor shall be of copper or aluminium.	Copper type
42	Vol04_TechSpecs		57/186	SUB-HEAD E2. TYPE TESTED ASSEMBLY PANEL (TTA)	We understand that all the LT Panels shall be Partially Type Tested Assembly. Please confirm.	TTA as per BOQ
43	Vol04_TechSpecs		57/186	SUB-HEAD E2. TYPE TESTED ASSEMBLY PANEL (TTA) 2.5) Switchboard Compartmentalization	Please clarify whether the panels shall be of single front or double front.	Single front access only
44	Vol04_TechSpecs		59/186	SUB-HEAD E2. TYPE TESTED ASSEMBLY PANEL (TTA) 2.5) Switchboard Compartmentalization	Please clarify whether the panels shall be of fixed type or drawout type..	As per TTA design
45	Vol04_TechSpecs		62/186	SUB-HEAD E2. TYPE TESTED ASSEMBLY PANEL (TTA) 2.13) Sheet Steel Treatment and Painting	Painting procedure shall be as per manufacturer standard painting procedure. Please accept the same.	as per standard manufacturer practice.

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46	Vol04_TechSpecs		71/186	SUB-HEAD: F. CONSTRUCTION FEATURES & GENERAL NOTES OF LOW VOLTAGE MAIN AND SUB DISTRIBUTION BOARDS/ PANELS/ SWITCH BOARDS/ METER BOARDS/ ACB ISOLATOR PANELS/ MOTOR CONTROLS CENTRES (MCC) GENERAL SPECIFICATIONS	Please clarify whether the panels shall be of fixed type or drawout type..	No change, As per tender
47	Vol04_TechSpecs		182/186	LIST OF APPROVED MAKES FOR ELCTRICAL SYSTEM HSCC engineer incharge reserves the right to opt for the best preferred listed make.	Contractor shall be free to consider any of the make from the list of approved makes. Please confirm.	No Change, As per tender
48	Vol04_TechSpecs		184/186	32) Cable Trays/ Raceways - OBO/ Legrand/ Cooper	Please approve Indiana/Profab/MEM makes for Cable Trays/Raceways.	No Change, As per tender
49	Vol04_TechSpecs		184/186	34) LED light fitting & Fixture - Philips / GE/ Crompton Greaves	Please approve Wipro/Bajaj makes for LED light fittings and fixtures.	No Change, As per tender
50	Vol04_TechSpecs		185/186	44) UPS system - Schneider- MG , APC/ Etone Power ware/ Emerson	Please approve Numeric/Delta makes for UPS.	No Change, As per tender
51	Vol04_TechSpecs		185/186	45) High Mast poles - Crompton Greaves /Phillips	Please approve Bajaj/Transrail makes for Highmast & Poles.	No Change, As per tender
52	-		-	Battery Limits	We understand that battery limits for our scope of works shall start from 33kV Switchboard. Also, only liaisoning for approvals of load sanctioning & electrical inspector shall be in our scope. Following scope shall be excluded from our scope of works 1. Any route approval, feeder approval from State Electricity Board and any other approvals shall be in customer scope. 2. Any statutory fee shall be in customer scope. Only fee related to liaisoning of our scope of works shall be paid by L&T. 3. Cabling and termination upto the incoming feeder of 33kV Switchboard shall be in customer scope.	As per tender
53	-		-	Seismic Zone IV	We understand that the building shall be designed as per Seismic Zone IV requirement. Please confirm.	NA
54	Vol05_BOQ & Vol04_TechSpecs		109/186	SUB HEAD K. IP CCTV SURVEILLANCE SYSTEM: 3) BRIEF OVER VIEW OF IP VIDEO SURVEILLANCE SYSTEM: 3.1) It is decided to have main control room at Security department having network video recording system (NVRs) with the required software and data storage facility installed from where apart from cameras control facility, the recording of all cameras output for suitable duration can be done.	IP CCTV is NVR based. BOQ doesn't mention NVR or any kind of storage. Please clarify.	integration with existing NVR is in the scope.
55	Vol05_BOQ		52/71	13) OUTDOOR PA SYSTEM 13.3) Horn speaker built-in 70v/ 100v transformer The built-in horn speaker driver is designed of wide frequency response 250-8kHz, the multiple power taps 7.5W & 15W.	15W / 60 Nos of Horn speakers will give 900 W .The amplifier rating is 500W which wont be sufficient.	as per actual requirement at site.

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56	Vol05_BOQ		52/71	13) OUTDOOR PA SYSTEM 13.7) The IP network paging microphone has several paging modes include: zone paging, group paging, all zone paging, two-way intercom, conference system, discussion system & voting system. The IP network paging microphone is built-in a LCD to display program status and its IP address, end-user is accessible to change the IP setting.	Please specify the zone distribution for PA system	as per actual site requirement.
57	Vol05_BOQ		55/71	14) EPABX SYSTEM 14.4) & 14.6) Supply of Digital Phones	Unit of digital phones mentioned in sets . Please specify the quantity of digital phones in Nos.	as per actual site requirement.
58	Vol05_BOQ		55/71	14) EPABX SYSTEM 14.7) Supply of Analog phones having following features (Before procurement of this item, the contractor shall have necessary approval approval of quantity from HSCC/ Client.	EPABX system is digital system.Please clarify Analog phones requirement.	As per BOQ
59	Vol05_BOQ		58/71	15) BUILDING MANAGEMENT SYSTEM (BMS) 15.5.9) BMS Software for ACS integration and CCTV integration	Please specify which protocol will be used for access control system interface. Also confirm that what interface is expected for CCTV system.	As per tender
60	Vol05_BOQ		62/71	16) BOOM BARRIER SYSTEM 16.1) & 16.2) Boom barrier system	Unit mentioned in sets. Please specify the quantity in Nos.	As per BOQ and site requirement
61	Vol04_TechSpecs		185/186	50) CCTV camera - Pelco /Bosch/Sony/Axis	Request to include Infinova, Vivotek and Hikvision in the approved makes.	No change as per tender
62	Vol04_TechSpecs		185/186	52) Fire Detection System Addressable - Honeywell-Notifier/Edward/Bosch/ Siemens	Request to share the BOQ as well as technical specifications for fire alarm system.	Already part of tender
63	Vol04_TechSpecs		186/186	55) EPABX system - Avaya/ Siemens-unify/Alcatel/Cisco	Request to include NEC make also for EPABX.	No change, As per tender
64	Vol04_TechSpecs		186/186	56) Nurse Call bell system - Category A: Honeywell/Schreak/ Rauland	Request to share the BOQ as well as technical specifications for Nurse call system.	Already part of tender
65	Vol04_TechSpecs		186/186	64) Access Control System - Honeywell-Pro-3000/Schneider/Lenel/Cardex	Request to share the BOQ as well as technical specifications for ACS.	As per BoQ
66						
67	SYSTEM DESCRIPTION		119	The entire Building Management System (BMS) shall be comprised of a network of interoperable, stand-alone digital controllers communicating via BACnet MSTP or BACnet over IP communication protocols to a Network Area Controller (NAC) / Router. Building Management System products shall be manufactured as per Lon Works products must be approved in writing by the consulting Engineer and be submitted for approval ten (10) days prior to the date of the bid submittal.	Lon Works Protocol is not used in the industry. BACnet and Modbus are the 2 widely used protocols. Request to approve the products supporting BACnet & Modbus which is used by all manufacturers for 3rd party integration	Backnet and modebus protocall will be accepted

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68	SYSTEM DESCRIPTION		119	The IBMS framework shall utilize JAVA based automation products and services with built-in Internet connectivity to a broad range of distribution partners in the building automation, energy services, power/utility, and industrial sectors. The Framework shall bring together the computerization of control applications under the umbrella of single integrated system architecture. The suite of component software applications shall support true plug-and-play, multi-vendor interoperability, resulting in lower automation and information infrastructure costs. The Network Area Controllers (NAC's) shall run a JAVA Virtual Machine (JVM) platform and use a common set of tools for accessing and integrating multiple protocols.	Request to approve .NET framework which is widely used	As per BOQ
69	DDC Controller		127	CSA (LR95329-3) Listed, Meets Canadian standard C108.8 (radiated emissions).	Request to approve UL & CE controllers which are the standard certifications followed in India.	As per tender
70	DDC Controller		128	Analog outputs (AO) shall be capable of being configured as digital outputs (DO).	Request to approve separate AO & DO outputs as per I/O requirement	As per tender
71	GUI Software		129	2.11 WEB BROWSER CLIENTS The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer™ or Netscape Navigator™. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacture-specific browsers shall not be acceptable.	Kindly specify actual number of users required as per the application	As per tender
72	LonWorks NETWORK MANAGEMENT		133	The Graphical User Interface software (GUI) shall provide a complete set of integrated LonWorks network management tools for working with LonWorks networks	Lon Works Protocol is not used in the industry.	Backnet , modebus and IP protocol will be accepted
73	DDE DEVICE INTEGRATION		137	The Network Area Controller / Router shall support the integration of device data via Dynamic Data Exchange (DDE)	Please provide BACnet IP for DDE devices integration	Ok can be used.
74	GENERAL POINTS:		139	Should be CE/UL Certified	Request to approve CE certified sensors	No change as per tender
75	Sensors and field devices		BOQ 15.8.1	Resistance type immersion temperature sensors for measuring Chilled water, condenser water temperature, (Range 0-50 Deg C). The accuracy shall be at least $\pm 1$ degree C. The pressure rating shall be 10 kgf/sq cm.	1. Request to approve $\pm 0.2^{\circ}\text{C}$ @ 0 to 70°C Accuracy, round ABS IP65 enclosures, -20 to 105 °C operating temp, 10k NTC thermistor type3 output, 150mm immersion sensor with thermowell, non spring return, thermal compound are available for better heat transfer which will be additional item  2. only Selected immersion temp sensor having Max pressure rating up to PN10. Request to remove this specs.	As per standard manufacturer practice.



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76	Sensors and field devices		BOQ 15.8.2	Outside air temperature, humidity RH & Wetbulb sensors for measuring outside air temperature (Range 0-50 C). The accuracy of temperature sensor shall be $\pm 1$ degree C and RH sensor is $\pm 3\%$ . It should be provided with sun shield and rain protection. It should be IP 66.	Request to approve outside temp sensor $\pm 1^\circ\text{C}$ Accuracy in wet bulb temp, grey ABS enclosures, -30 to $50^\circ\text{C}$ 0-95% RH non condensing operating condition, 20 – 27 Vdc, 16 – 27 Vac (non-isolated half-wave rectified) power supply, 4-20mA output.	As per tender
77	Sensors and field devices		BOQ 15.8.4	Water Differential Pressure Switch across the Pumps for indicating the Pump status of Pumps complete with all accessories.	Request to approve Water differential pressure switch, 0.2 to 4.5Bar (0.2-4.5 Kg/cm <sup>2</sup> pressure), IP30 enclosures, -20 to $70^\circ\text{C}$ operating condition, switch output with 3 Amp @ 230 Vac Inductive or 0.1 Amp @ 230 Vdc rating.	As per tender
78	Sensors and field devices		BOQ 15.8.5	Air Differential pressure switches across Air Filters for indicating status. Pressure differential – 10 mm–125 mm, The switch shall be with connecting tube and metal bends for connections to the duct. The housing shall be IP 54 rated.	Request to approve air DP switch with 500 to 2500 Pa with 150Pa switch differential, $\pm 15\%$ switch tolerance, Switch body make of PA 6.6, IP54 with cover, -20 to $60^\circ\text{C}$ operating condition, SPDT output	As per tender
79	Sensors and field devices		BOQ 15.8.6	BACnet Compatible UL Listed duct mount CO <sub>2</sub> Sensor, Measuring range 0-2000PPM CO <sub>2</sub> with sensing resolution, 1ppm, Response time (0-90%) should be 1 Minute & Warm-up Time should less than 1 minute	Request to approve duct CO <sub>2</sub> sensor having Duct type CO <sub>2</sub> sensor with IP65 rated enclosure, 0 to 2000 PPM, $\pm 75$ PPM @ 1000 PPM @ $22^\circ\text{C}$ , $0^\circ$ - $50^\circ\text{C}$ ( $32^\circ$ - $122^\circ\text{F}$ ), 0-95% RH non condensing operating condition, 20-28 Vac/dc (non-isolated half-wave rectified) power supply with BACnet communication with LCD display.	As per tender
80	Sensors and field devices		BOQ 15.8.9	Water Flow Switch	Request to approve inline water static pressure switch with range of -0.5 to 7 Bar, - $50^\circ$ to $70^\circ\text{C}$ operating temp, IP44 enclosures, switch output	As per tender
81	Sensors and field devices		BOQ 15.8.10	UL Listed Current Relay with built in LEDs for On/ Off commands Status.	Considered current switch with adjustable between 1 to 200 Amps by rotating the adjustment potentiometer, self powered, normally open output	As per tender
82	Sensors and field devices		BOQ 15.8.11	Duct Pressure sensors with copper/ metal tubing, accessories etc.	1.Request to approve air DP transmitter having $\pm 0.5\%$ FSO Accuracy, ABS IP61 enclosures, $0$ to $70^\circ\text{C}$ , 10 to 95% RH non condensing operating temp, 20 to 28 Vac/dc (non isolated half wave rectified) power supply, 4-20mA (2wire), 0-5V or 0-10V DC (3wire) output with LCD display. 2. Please provide the pressure range.	As per tender

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83	Sensors and field devices		BOQ 15.8.12	Air Duct Temperature Sensor (Range 0-50 Deg C) shall be with rigid stem and of averaging type. These shall be Platinum sensor suitable for duct installation and accuracy shall be $\pm 1$ degree C, for measuring supply -air temperature of AHUs etc.	Request to approve Duct average type sensor, 450mm rigid stainless steel probe with $\pm 0.2$ °C ( $\pm 0.36$ °F) @ 0 to 70°C (77°F) Accuracy, round ABS IP65 enclosures, '-20 - 60°C operating condition, 10000 ohms NTC type3 thermistor output. 450mm rigid stem length.	As per tender
84	Sensors and field devices		BOQ 15.8.13	Wall mount room temperature sensor for measuring space/ room temperature. Measuring range 0 to 40°C with accuracy $\pm 1$ °C (in AHU rooms for return air temperature sensing).	Request to approve room temperature sensor having $\pm 0.2$ °C @ 0 to 70 °C Accuracy, 10k NTC thermistor type3, white ABS IP30 enclouser,'0 to 50 °C operating temp,	As per tender
85	Sensors and field devices		BOQ 15.8.14	Chilled water Line Pressure sensors UL listed 0-30 kg/ Sq.Cm.	Request to approve water pressure transmitter having '0-500 PSIG (0-3447.4 kPa) ranges, 0.25% F.S.O Accuracy, 17-4PH Stainless Steel media compatibility , -40 to 85 °C, operating condition, 9 to 30 Vdc power supply, 4-20mA loop powered output.	As per tender
86	HT VCB 11KV- General		32, 33 & 34	Sub head B2-1, 6 & 12: Fault Withstand Capacity 350MVA specified	Please upgrate to 500MVA in line with requirement of Transformer IS Standard which states that VCB should be 500 MVA if system fault level is not furnished by Power Utility	500 MVA
87	HT VCB 11KV- General		32, 33 & 34	Internal Arc test	Like LV Panels, 11 & 33 Kv VCB Panels should also be tested for Internal Arc of 25 KA for 1.0 secs. Please include in specs	As per tender
88	Air Circuit Breaker		46	Sub head E1: ACB Should have single frame size upto 4000A	This clause is specfic to Schneider electric ACBs. Single frame upto 400A is advantage for Manufacturer and disadvantage for User as panel oversize increases as no of Outgoing ACBs are more in number. Please accept Standard Frame sizes of approved makes	As per standard manufacturer practice.
89	Air Circuit Breaker		46	Sub head E1: All Incomer ACBs shall be provided with display for current & Voltage parameters	All Incomer ACBs shall be provided with display for current & Voltage, <b>all Power &amp; Energy parameters including Maximum demand. Please include Power metering as only Voltage display will not be adequate. Please include</b>	as per BOQ
90	Moulded case Circuit Breakers		49	Sub head E1: The rated Insulation Voltage specified is 690V AC	The rated Insulation Voltage should be 750V AC for all MCCBs	As per tender

SI No.	Ref./ Vol./ Description	Item No.	Page No.	Tender Ref.	Bidders Queries	Reply
91			49	MCCB Operating mechanism should be Roto active design	Roto active design is patented feature of Schneider electric MCCBs. Please accept standard construction design of approved makes	As per tender
92			49	Electrical & Mechanical life should not be less than 10000 and 20000 operations respectively	This data is specific to one make. Please accept standard data ( for Electrical & Mechanical Life) of all approved makes as it is much higher than requirement of IS/IEC60947 standards	As per tender
93			50	Microprocessor based MCCBs to be provided with CBCT as per specifications	Microprocessor based MCCBs to be provided with inbuilt Earth Fault protections & same is available with all approved makes	As per BOQ
94			50	MCCB shall comply to RoHS & WEEE norms	WEEE norms compliance is specific to Schneider MCCBs. Please delete this clause	As per standard manufacturer practice of approved makes.
95			50	Spreader terminals not specified for MCCBs	Please include Silver plated Copper spreader terminals for better termination	can be accepted.
96	MCB		51	Electrical life of MCB shall be 20000 operations upto 63A	Electrical life of MCB shall be 20000 operations upto 32A. Please incorporate	As per standard manufacturer practice of approved makes.
97	MCB		52	Fault differentiation for Over Load & Short Circuit is not specified like MCCBs	There should be separate / distinct indication for tripping due to S/C faults	As per standard manufacturer practice of approved makes.
98	LT Capacitors		54	16.2 :Harmonic filters should be 7% & 14%	For Hospital Installations, 14% detuned reactor is recommended to suppress 3rd Harmonic & above	As per BOQ
99	TTA Panels -LT Panels		56	2.1 :Panel Manufacturer must have an established track record in Design, Manufacturing and Supply of IEC certified Assemblies for at least 10-12 Years.	This requirement of 10-12 years does not hold good for Panels as per IEC61439 as standards got implemented in 2014 in India.	As per list of approved makes.
100	Switchboard Configuration		56	2.2: Switchboard shall be tested for Impulse withstand test at 12KV for all the Panels	The Switchboard shall be tested for Impulse withstand test at <b>8KV</b> for all the Panels I line with IEC61439 & 60947 standards. Please accept 8KV as 12 KV is favouring few makes	As per tender
101			56	2.4 :OEM & Partner's name should be mentioned on Top of each all columns of switchboard	Not required for each compartment as each Individual Panels shall have OEM name on Panels manufactured by franchisee	As per tender
102	Constructional Features		57	2.3 :All panels and covers shall be properly fitted and square with the frame.	Please clarify Square with the frame	As per tender
103	Switchboard Dimensional Limitations		58	2.4 :Panel should have integral base frame of 75mm	Allow us to provide integral base frame of 50 mm. Since Panels are as per IEC61439 standards, Please accept standard dimensions & construction details of OEMs	As per tender

SI No.	Ref./ Vol./ Description	Item No.	Page No.	Tender Ref.	Bidders Queries	Reply
104	Switchboard Bus Bars		59	2.6 :All ACB terminals shall have vertical-vertical configuration for termination of incoming & outgoing bus links. All MCCB's upto 630A shall be provided with rear stud type terminations.	The Termination shall be as per L&T's type Tested Design which is in compliance with IEC 61439. All MCCB's upto 630A shall be provided with Standard termination. Stud type may be specif to some make	As per tender
105	Ventilation Fans		60	2.11 :The Switchboard shall be provided with panel mounting type ventilation fans in each panel with switchgear rated for 4500 amp and above. The fan shall be interlocked with switchgear operation. The degree pf enclosure protection to be maintained even with Fans.	Our design is tested with Natural cooling mechanism , since the requirement is as per IEC 61439, the busbars are designed in such a way that the temperature will not go above the limitations set by the standards. Kindly accept the same. We comply as per standards. For non TTA panels, we acctet your restricted temperature rise limits	As per tender
106	Sandwiched Busduct		40	Sub Head-D: IP68 Cast resin BBT speciified	Please clarify if Sandwiched BBT other than Cast resin is also required	As per BOQ
107	Vol05_BOQ	1.2		Supply, Installation, Testing & Commissioning of 2 MVA 3 phase, 33/ 11 kV outdoor, oil filled type Power Transformer, Dyn 11 vector group connection, having impedance as per IS,	In the layout drawing, 3MVA, 33/11KV Tr. as shown, where as BOQ says 2MVA, 33/11KV Transformer, Pls confirm the rating	IP-4X can be accepted.
108	Vol05_BOQ	2.1		33KV FIVE PANEL HT VCB (INDOOR)- TWO INCOMERS, ONE BUS COUPLER AND TWO OUT GOINGS IN IP-44 ENCLOSURE, INSIDE A ROOM (For Residential, Hostel, OPD, IPD & Academic blocks)	as per IEC 62271-200, IP shall be 4X only, shall we consider IP4X	As per tender
109	Vol05_BOQ	2.1		CT chamber with double wound single phase, cast resin CT, 15VA burden with core-1 for metering (CL-1) and core-2 for protection (CL-5P10) and of 250/5/5A ratio or as required.	For Differential Relay CT core was not considered, pls confirm	As per BOQ
110	Vol05_BOQ	2.1		Potential transformers, 3 phase, 3 limb, drawout type, resin cast 33000/ (Root 3)/ 110/ (Root 3) ratio class 1accuracy, 150 VA burden, with HV fuse on primary side and MCB/ MPCB on secondary side.	PT shall be independent for every 1Phase	As per tender
111	Vol05_BOQ	2.2		CT chamber with double wound single phase, cast resin CT, 15VA burden with core-1 for metering (CL-1) and core-2 for protection (CL-5P10) and of 150/5/5A ratio.	For Differential Relay CT core was not considered, pls confirm	As per BOQ
112	Vol05_BOQ	2.2		Potential transformers, 3 phase, 3 limb, drawout type, resin cast 11000/ (Root 3)/110/ (Root 3) ratio class 1accuracy, 100 VA burden, with HV fuse on primary side and MCB/ MPCB on secondary side.	PT shall be independent for every 1Phase	As per BOQ
113	Vol05_BOQ	2.3		CT chamber with double wound single phase, cast resin CT, 15VA burden with core-1 for metering (CL-1) and core-2 for protection (CL-5P10) and of 150/5/5A ratio.	For Differential Relay CT core was not considered, pls confirm	As per tender
114	Vol05_BOQ	2.3		Differential protection Relay	For Differential Relay CT core was not considered, pls confirm	As per tender
115	Vol05_BOQ	3.0		DG Sets & HSD tank	There is no specific DG technical spec available in Volume -4. Request you to please share the technical spcs of DG Sets.	DG set Specification enclosed

SI No.	Ref./ Vol./ Description	Item No.	Page No.	Tender Ref.	Bidders Queries	Reply
116	Vol05_BOQ	3.1			Request you to confirm the number of hours the DG needs to tested in Factory & Site.	As per tender/CPWD Specifications
117	Vol05_BOQ	3.1			Please confirm, scope of the Diesel, load etc. at the time of site testing	As per tender/CPWD Specifications
118	Vol05_BOQ	3.1		DG set shall be auto start within 3 seconds.	As it is mentioned in description the DG Set shall not take more than 3 secs to start As the DG set is remote radiator mounted and 11KV Alternator it will take atleast 1-2 minsto start the DG Set so we would request you to please go with radiator cooled Dg Sets instead of remtote radiator.	As per BOQ
119	Vol05_BOQ	5.1		Sandwich busway	There is no specific Sandwich technical specifications available in volume - 4, Please provide.	As per BOQ/CPWD specs/
120	Vol05_BOQ	5.2		5000Amp, 65KA, 4P, IP 68, Aluminum Conductor including all the accesories/ horizontal & vertical bends. (from 5 nos. transformer to Main LT Panel) ( Considered Cast Resin Bus Duct)	IP 68 cast resign bus ducts is manufactured only by C&S in india and by Schneider from Hangary.So please provide C&S also in the approved makes list as it is fast track project.	C&S may be accepted
121	Vol- (NIT/PQ) 1.4.1 (b)			Own works/Work Under the Same management/Own Certification of the bidder shall not be considered for pre-qualification	Kindly Elaborate on "Work Under the Same management" in Eligibility Criteria	Shall be as per tender condition.
122	Drawings			Single line Digram (SLD)	Plese share the SLD for better understanding	SLD will be provided to successful bidder
123	List of approved Makes : Tech_Specs			Main LT Panel/ APFC panels / Active Harmonic Filter (AHF)	Please add SPC Electrotech Pvt Ltd. & Adlec.	No change as per tender
124	Tech_Specs			MV panels/Fire panel/AHU Panel	Please add SPC Electrotech Pvt Ltd., Adlec & Shivalic.	No change, as per tender
125	Tech_Specs			Transformer	Please add Voltamp & Sudhir.	No Change
126	Tech_Specs			Bus Duct/Rising main	Please add C&S in Bus Duct / Rising Main.	Additional approved make list at <b>Annexure - I</b> L&T/ABB/Siemens/Schneider/ GE/Legrand/ <b>C&amp;S</b>
127	Tech_Specs			HT/LT- XLPE cables	Please add Rallison & Bonton.	Additional approved make list at <b>Annexure - I</b> CCI/Universal/Finolex/ <b>Rallison</b>

SI No.	Ref./ Vol./ Description	Item No.	Page No.	Tender Ref.	Bidders Queries	Reply
128	Tech_Specs			Copper Control cable	Please add Rallison & Bonton .	Additional approved make list at <b>Annexure - I</b> CCI/Universal/Finolex/ <b>Rallison</b>
129	Tech_Specs			Copper conductor PVC insulated wires, Co-axial, Telephone wires & cables	Please add Rallison, RR Kabel & Havells	Additional approved make list at <b>Annexure - I</b> CCI/Universal/Finolex/ <b>Rallison</b>
130	Tech_Specs			UPS system	Please add Riello Ups	No change
131	Tech_Specs			DG Set	Technical Specification is not available in the tender documents. Request you to kindly provide the same	DG set Specification enclosed
132	Tech_Specs			Epabx System	Technical Specification is not available in the tender documents. Request you to kindly provide the same	As per BOQ/CPWD Specifications
133	Tech_Specs			Specialized Services of Auditorium	Technical Specification is not available in the tender documents. Request you to kindly provide the same	As per BOQ/CPWD Specifications
134	Main LT & APFC boards :			IP Protection	Can we considered IP42 instead of IP54, please clarify.	IP 42 can be considered.
135	List of Approve Make		4	CCTV Cameras - Pelco / Bosch / Sony / Axis	Please approve GE - Interlogix for CCTV Cameras	No change, As per tender
136	List of Approve Make		5	BMS, field devices etc	Please approve - UTC - ALC for BMS system and Greystone for Field Devices in approve make list	As per tender
137	Vol05_BOQ	15.5.8		For Access control Integration with BMS System	Please confirm, which type of Access Control Integration Required? Hird Wired or Software Integration? In case of Software Integration, Please note that none of Access Control system provides data in Standard protocol like BACnet or Modbus to integrate with BMS. Respective make of BMS system integrate only with there own make Access Control? Which may lead to change in approve makes as well. As the Access Control requirement is limited to few Door, We suggest to remove the access control Integration.	As per tender

SI No.	Ref./ Vol./ Description	Item No.	Page No.	Tender Ref.	Bidders Queries	Reply
138	Vol05_BOQ	15.5.9		For CCTV Integration	Please confirm, which type of CCTV Integration Required? Hird Wired or Software Integration? In case of Software Integration, Please note that non of CCTV system provides data in Standard protocol like BACnet or Modbus to integrate with BMS. Respective make of BMS system integrate have very limited VMS software, which can integrate with BMS System. This will also lead to change in CCTV design & approve makes as well. We suggest removing the CCTV soft Integration, as separate in BOQ separate architect is considered for CCTV System.	As per tender
139	Vol05_BOQ	15.6.2		DDC Panel for AHUs (max 2 AHU's/ DDC to be considered)	Please confirm, Can we consider nearby other devices to integrate with the DDC control with 2 AHUS.	As per tender
140	Vol05_BOQ				Where a sub station or a switching station with aparatus having more than 2000 Ltr oil capacity, baffel walls need to be provided between the aparatus. The same may be considered. Please clarify the scope of CIVIL work.	Baffel wall will be in the scope of contractor and price are inclusive.
141	Vol05_BOQ				Transformer having oil capacity more than 9000 Ltr Burn Oil Pit / Soak pit may be incorporate. Please clarify the scope of CIVIL work.	Soak pit will be in the scope of contractor and price are inclusive.
142	Vol05_BOQ				The Transformer of 10 MVA and or in case of oil filled transformers with oil capacity of more than 2000 Ltr are provided with fire fighting system as per IS - 3034 : 1993 or with Nitrogen Injection Fire Protection system. The same may be cosidered. Please calrify the scope of work.	fire fighting system as IE rules and CPWD specifications will be in the scope of contractor.
143	Vol05_BOQ				In BOQ 2 MVA Trafo mentioned but 3 MVA 33/11Kv Trafo mentioned in Teder Drawing HSCC/AIIMS-Guntur/TD/EL-02. Please calrify.	As per BOQ

SI No.	Ref./ Vol./ Description	Item No.	Page No.	Tender Ref.	Bidders Queries	Reply
144	Tech_Specs: Approved Makes				33 KV HT Panels (C&S Electric Ltd)- We are pleased to inform you that we are manufacturer of HT VCB Panel Board. We are on the approved list of makes with NTPC, MECON, HPSEBL, IOCL, Railway, RITES, CPWD, DGVCL, MES, MSEDCL, PSPCL, BSES and many other govt. and private bodies. We request to please approve C&S Make 33 Kv panel HT VCB, and add the same into the approved makes.	No Change
145	Vol05_BOQ				In 11 Kv HT Panel you have provided 4 Nos Incomer, 1 No Bus Coupler & 4 Nos Out Going (BOQ & Tender Drawing). Please clarify the pupose of 4I/C + 1B/C + 4O/G.	As per BOQ
146	Tech_Specs: Approved Makes				11 KV HT Panels (C&S Electric Ltd)- We are pleased to inform you that we are manufacturer of HT VCB Panel Board. We are on the approved list of makes with NTPC, MECON, HPSEBL, IOCL, Railway, RITES, CPWD, DGVCL, MES, MSEDCL, PSPCL, BSES and many other govt. and private bodies. We request to please approve C&S Make 11 Kv panel HT VCB, and add the same into the approved makes.	No Change
147	Tech_Specs: Approved Makes				We would like to bring in to your kind notice that we are the Oldest and Largest Manufacturer of Bus Duct in India. We have already supplied Bus Duct to the AIIMS Patna, AIIMS Raipur, AIIMS Rishikesh, AIIMS Jodhpur, AIIMS Bhubaneshwar, AIIMS Bhopal and AIIMS Delhi. Also, we are only Cast Resin Bus Duct Manufacturer in India. We request, kindly include C&S Electric make Bus duct & add the same into the approved makes.	C&S make may be accepted as Bus duct
148	Tech_Specs: Approved Makes				All the civil work related to execution of this job i.e, foundations, i/c repair there of, supporting brackets etc. required to complete the work in functional condition may be included.Major civil work like building, trnches, trench covers inside & out side of sub sation building may be excluded from the scope of this contract.	As per BOQ



SI No.	Ref./ Vol./ Description	Item No.	Page No.	Tender Ref.	Bidders Queries	Reply
149	Tech_Specs: Approved Makes				We are manufacturing the Street Lighting luminaries and the same have been used in many prestigious locations i.e, NTPC, SAIL. We would request that the name of C&S Electric Ltd. May kindly be added.	No Change
150	Vol.-III (SCC)			Terms of Payments	Terms of payment may be as CPWD General Specifications for Electrical Works Part IV Sub Station: 85% after initial inspection & delivery at site in good condition on pro-rata basis, 10% after completion of installation in all respects, Balance 5% will be paid after testing commissioning & handing over to the department.	No Change
151	Vol05_BOQ				1 Core flexible + 100% neutral cu cable may be taken for UPS Incoming & out going connectivity for reliability & minimization of losses.	As per BOQ
152					During Trail operation of DG Sets at site fuel, water shall be provided by the AIIMS Client	As per tender
153					Requested to confirm that the site is without any dispute.	As per tender
154					Please confirm any hindrances due to work of other agency related to front for Installation, testing & commissioning of executing agency of this contract shall not be attributable to executing agency	As per tender
155	Vol05_BOQ				As per BOQ Sl.No. 5.1 IP65 Sandwich Busduct, the enclosure should be Extruded Aluminium / G.I. sheet.	Aluminium / GI sheet as per standard manufacturing practice of OEM
156	Vol-I (NIT/PQ)	1.3.1			The Bidder must be in existence as an OEM/a contracting firm at least since last 7 years. They should have experience of 33 KV sub station	As per tender
157	Vol-I (NIT/PQ)	1.9	56	Bid shall be accompanied with Earnest money of Rs. 52.42 Lacs. in shape of demand draft of a scheduled bank issued in favour of "HSCC (India) Limited" Payable at New Delhi/Noida or fixed deposit receipt or Banker's cheque or Bank Guarantee in favour of "HSCC (India) Limited" as per Form B,	In order to prepare EMD in the shape of Bank Guarantee, Client's bank detail/IFSC Code is required which is not provided with the tender documents. Please provide the same.	As per tender
158	VOLUME - II (GCC)	14	123	The contractor shall submit an irrevocable Performance Guarantee of 5% (Five percent) of the tendered value in addition to other deposits mentioned elsewhere in the contract for his proper performance of the contract agreement, (not withstanding and/or without prejudice to any other provisions in the contract) within period specified in Schedule 'F' from the date of issue of letter of acceptance.	We presume that Performance Guarantee of 5% (Five Percent) of Contract Price is to be submitted. Please Confirm.	As per tender

SI No.	Ref./ Vol./ Description	Item No.	Page No.	Tender Ref.	Bidders Queries	Reply
159	VOLUME - II (GCC)	Section-2, Cl.No.-2	16	(i) Compensation for delay of work @ 1 % of tendered value per month of delay to be computed on per day basis. Provided always that the total amount of compensation for delay to be paid under this Condition shall not exceed 10% of the Tendered Value of work or of the Tendered Value of the item or group of items of work for which a separate period of completion is originally given.	We presume that Compensation for delay of work will be calculated on Contract Price for the whole of the facilities, (or a part for which a separate time for completion is agreed). Please Confirm.	As per tender
160	VOLUME - IV, Technical Specifications Clause No. 2	Cl.No. -2		Enhancement/Sanctioning Electrical Load from State Electricity Board.	Please clarify whether Sanctioning of Electrical Load from State Electricity Board is in Contractor's Scope or Client's Scope. If it is in Contractor's Scope please provide the value of Load to be sanctioned.	As per tender
161	VOLUME - IV, Technical Specifications			Technical Specification of below mentioned BOQ items are not provided 1.2 - 33/11 kV, 2 MVA Power Transformer 1.3 - 11/0.415 or 0.430 kV, 2500 kVA Distribution Transformer 3 - DG Set & HSD Tank 14 - EPABX SYSTEM 20 - Solar Photovoltaic Power Generation	Technical Specifications of referred Items are not provided in Volume-IV Technical Specifications. Please provide Technical Specifications of all the items required in the BOQ so that we may work in line with your requirement.	DG set Specs enclosed. As per tender
162	Vol05_BOQ	5.1 & 5.2	21 & 22	5.1 BUS DUCT - INDOOR (IN AIR - OVER HEAD TYPE) IP 65 5.2 BUS DUCT - OUTDOOR - IP 68	With reference to the BOQ Item no. 5.1, IP rating of Indoor Bus Duct should be IP 65. However, as per 'Volume IV, Technical Specifications' IP rating of Indoor as well as Outdoor Bus Duct should be IP 68. Please clarify which IP rating is to be considered for Indoor Bus Duct. Whether it is IP 65 or IP 68.	As per tender/BOQ
163	Vol05_BOQ	5.1 & 5.2	21 & 22	5.1 BUS DUCT - INDOOR (IN AIR - OVER HEAD TYPE) IP 65 5.2 BUS DUCT - OUTDOOR - IP 68	As per the description in BOQ, Indoor Bus Duct is extruded Aluminium Sandwich Busduct & Outdoor Bus Duct is Cast Resin Sandwich Busduct. However, as per 'Volume-IV, Technical Specifications' of Bus Duct both Indoor & Outdoor Bus Ducts are of Cast Resin Type Construction. Therefore, it is requested from HSCC to clarify which type of Bus Duct is to be considered.	As per BOQ

SI No.	Ref./ Vol./ Description	Item No.	Page No.	Tender Ref.	Bidders Queries	Reply
164	Vol05_BOQ	4.3. & 4.4	19	4.3 Supplying and making indoor cable end jointing with cast resin compound, including lugs and other jointing materials, for following size of 3 core, XLPE aluminium conductor cable of 11kV grade as required. 4.4 Supplying and making outdoor cable end jointing with cast resin compound, including lugs and other jointing materials, for following size of 3 core, XLPE aluminium conductor cable of 11 kV grade as required.	As per the BOQ 11 kV Cable Jointing kits are required of Cast Resin Compound. However, this is to inform you that this technology is obsolete. Therefore, we request you to allow us to quote Heat Shrinkable Jointing Kits. Please confirm.	cable joint will be heat shrinkable type.
165	Vol05_BOQ	Item No. 2.5.1, 4.6, 17.1, 17.2 & 18,	19 & 63	2.5.1 Battery Charger 4.6 RCC Hume Pipes 17.1 DWC HDPE Pipe 17.2 RCC Pipe 18 Safety Equipment	HSCC approved makes are not provided for the referred items. Therefore, it is requested from HSCC to provide us complete List of Approved makes of all the items Present in the BOQ.	ISI marked/As approved by HSCC
166	VOLUME – VI, Tender Drawings		3	3 MVA, 33/11 kV OLTC Power Transformer - 2 sets (1 working & other stand by)	As per the Volume-05 Bill of Quantities, 33/11 kV, 2MVA Power Transformers are to be supplied. However, as per referred drawing 3 MVA, 33/11 kV Power Transformers are shown. Please confirm the rating of Power Transformers to be supplied.	As per BOQ
167	General			General	Which of the between BOQ & Technical Specifications will Supercede. Please Clarify.	As per BOQ
168	Vol. I: NIT & PQ: Annexure-1 Checklist			Documents to be submitted with bid: In Original in Envelop no. 1 & Copy Online:1. DD ofRs.15,0001- as cost of bid 2.Bid Security 3.Form of bid and Appendix (Form A)4. Affidavit by Bidder (Form K)	Please confirm exactly which documents shall be submitted in hard copy / in original?	As per tender condition
169	Vol. I: NIT & PQ: Annexure-1 Checklist Note			No hard copy of the documents is required to be submitted except(1) Original DD of Rs.150001- as cost of bid (2) Original Bid Security		
170	Vol. I: NIT & PQ:		46	Form-H: Undertaking	Kindly confirm which works are to be considered under specialized category and to be mentioned in Form-H: Undertaking.	Specialized items which the bidder do not have experience
171	Vol. I: NIT & PQ: FORM T-1,B		50	Form of Bankers Certificate	Please accept General Solvency certificate duly attested against Form-'T-1 B'	As per tender condition

SI No.	Ref./ Vol./ Description	Item No.	Page No.	Tender Ref.	Bidders Queries	Reply
172	Vol. IV:Tech Spects			Technical Specifications of the various items in BOQ	the following items <ul style="list-style-type: none"> <li>• DG sets</li> <li>• Solar Photovoltaic Power Generation</li> <li>• Specialized Services for Auditorium</li> <li>• LED fittings</li> <li>• Outdoor PA Systems</li> <li>• External Lighting including high mast, Feeder pillars EPABX System</li> </ul>	As per BOQ, DG Specs enclosed at <b>Annexure-II</b>
173	Vol. IV: Tech specs			GTP, GA drawings, technical literature, Tech Spects data sheets, test reports, manuals	Please accept the submission of GTP, GA drawings, technical literature, data sheets, test reports and manuals after award of work.	successful bidder will submit details after award of work.
174	General			Single line diagram	Kindly provide SLD	SLD will be provided to successful bidder
175	General			Last date to fill/upload the tender through e-Tendering: 28.09.2018 upto 15:00 hrs.	As the various systems are involved in the project & also due to festive season, vendors are taking time to quote for the various items in BOQ. Hence we request you to extend the last date of submission of the tender for 15 days from the existing date of submission and oblige.	No change
176	Vol01_NIT&PQ		15	Notice Inviting Bid : 1.17 :The bidder shall be responsible for arranging and maintaining at its own cost all materials, tools & plants, water, electricity, access, facilities for workers and all other services required for executing the work unless otherwise specifically provided for in the contract documents.	Supply of water and electricity upto a single point for constructional works shall be in customer scope. Further distribution of power from that point shall be in our scope. Kindly confirm.	As per tender
177	Vol01_NIT&PQ		36	Form A Appendix: Defects Liability Period is 12 months from the date of issue of "Taking-over certificate"	If there is any delay in handover due to non-availability of fronts, other reasons and dependency on other agencies, corresponding period shall be reduced from the DLP Period.	As per tender
178	Vol01_NIT&PQ		52	PERFORMANCE REPORT OF WORKS	Please confirm whether we can furnish the Completion Certificate as per standard format of Client, in place of the given format.	As per tender
179	Vol01_NIT&PQ		46	FORM H :UNDERTAKING	Please confirm for which Items, we need to furnish this Undertaking.	As per tender

SI No.	Ref./ Vol./ Description	Item No.	Page No.	Tender Ref.	Bidders Queries	Reply
180	Vol01_NIT&PQ		16	<p>CLAUSE 2 : COMPENSATION FOR DELAY</p> <p>Compensation for delay of work @ 1 % of tendered value per month of delay to be computed on per day basis Provided always that the total amount of compensation for delay to be paid under this Condition shall not exceed 10% of the Tendered Value of work or of the Tendered Value of the item or group of items of work for which a separate period of completion is originally given.</p>	As a compensation for delay of work consider 0.5% of tender value to max. 5% of the tender value.	As per tender
181	Vol01_NIT&PQ		15	<p>CLAUSE 1 A RECOVERY OF SECURITY DEPOSIT</p> <p>The person/persons whose tender(s) may be accepted (hereinafter called the contractor) shall permit Government at the time of making any payment to him for work done under the contract to deduct a sum at the rate of 5% of the gross amount of each running and final bill till the sumdeductedwill amount to security deposit of 5% of the tendered value of the work. Such deductions will be made and held by Government by way of Security Deposit unless he/they has/have deposited the amount of Security at the rate mentioned above in cash or in the form of Government Securities or fixed deposit receipts.....</p>	We propose to submit at the start of project a Bank Guarantee of 5% of contract value valid till DLP of 12 months. Hence no retention shall be deducted from our bills.	As per tender
182	Vol01_NIT&PQ		34	<p>CLAUSE 10C</p> <p>PAYMENT ON ACCOUNT OF INCREASE IN PRICES/WAGES DUE TO STATUTORY ORDER(S)</p>	We request you to amend the clause as any variation in current taxes & duties or levies of any new taxes shall be to clients account.	As per tender
183	Vol01_NIT&PQ		35	<p>CLAUSE 10 CA</p> <p>PAYMENT DUE TO VARIATION IN PRICES OF MATERIALS AFTER RECEIPT OF TENDER</p> <p>The increase/decrease in prices of cement, steel reinforcement, structural steel and POL shall be determined by the Price indices issued by the Director General, CPWD. For other items provided in the Schedule 'F', this shall be determined by the All India Wholesale Price Indices of materials as published by Economic Advisor to Government of India, Ministry of Commerce and Industry</p>	We understand that this clause in not applicable for this tender. Kindly confirm.	As per tender
184	Vol01_NIT&PQ		81	<p>PROVISION OF SHELTER DURING REST</p> <p>At every place there shall be provided, free of cost, four suitable sheds, two for meals and the other two for rest separately for the use of men and women labour. The height of each shelter shall not be less than 3 metres (10 ft.) from the floor level to the lowest part of the roof. These shall be kept clean and the space provided shall be on the basis of 0.6 sq. m. (6 sq. ft.) per head.</p>	Please clarify whether this clause is applicable for this tender or not.	As per tender
185	Vol01_NIT&PQ		108	<p>SCHEDULE 'E'</p> <p>Performance Guarantee: 5% of Tendered Value Security Deposit: 5% of Tendered Value</p>	Please clarify if both Performance guarantee and Security deposit are to be submitted and also specify their duration of validity.	As per tender

SI No.	Ref./ Vol./ Description	Item No.	Page No.	Tender Ref.	Bidders Queries	Reply
186	Vol01_NIT&PQ		59	CLAUSE 25 SETTLEMENT OF DISPUTES & ARBITRATION Disputes or difference shall be referred for adjudication through arbitration by a Tribunal having sole arbitrator where Tendered amount is Rs. 100 Crore or less.	Please consider all disputes to be resolved by one arbitrator from each side(Client & Contractor) and third selected by both the parties.	As per tender
187	Vol01_NIT&PQ		11	4:Scope of work & Approval required .....their maintenance during defect liability period including & preparation of all detailed shop drawings, obtaining approval from electrical inspectorate, chief inspector explosive and other local authorities for electrical works, liaison for getting electrical connection from state electricity board and all others local Statutory requirements if any, from the concerned authorities.	* If Load sanctioning and approval will be in contractor scope, please clarify the requirement of load. * Clarify that Cabling and other associated work from electricity board Substation to project substation will be part of this tender or considered elsewhere.	load will be in the range of 10-12 MVA. State electricity Board will provide the connection
188	Vol01_NIT&PQ		11	4:Scope of work & Approval required 3 (e.) Obtaining related NOC's from statutory/ local/governmental agencies. Statutory payment on this account will be reimbursed by the client at actual.	We propose that obtaining occupancy certificate as mentioned above shall be in client scope. Kindly confirm.	As per tender
189	Vol01_NIT&PQ		37	32.6 : Site office and Infrastructure Deleted	Site office and Storage of material space will be provided at site with free of cost. Please clarify.	As per tender
190	Vol01_NIT&PQ		46	24 : Terms of Payment Terms of Payment (Only for items of major electrical equipments) a. 70% of BOQ rate on receipt of equipment against receipt of complete material at site & test certificates. b. 15% of BOQ rate on erection and installation of equipment. c. 10% after successful completion of all works including all testing, commissioning & taking over. d 5% after taking over of all works.	*Please specify major electrical equipments for which tender payment terms are applicable. *Provide the payment term for other tender items. Please consider following payment terms. • 10% interest free non recoverable mobilization advance • 80% against delivery of material on prorata basis • 5% against installation ,Testing and commissioning on prorata basis • 5% against Handing Over	No change, As per tender
191	Vol01_NIT&PQ		39	Separate bank Account: The contractor shall open a bank account specifically for this contract. The mobilization advance given to the contractor shall be deposited in this account only. The details of this account shall be made available to the Executing agency.The contractor shall draw from this account the expenses for the purpose of procurement of materials, machineries, tools & plants and shuttering required for the said work only	We propose that Bidder shall not maintain a separate bank account for the transactions. It shall be done through our regular bank account. Kindly accept the same.	No change, As per tender
192	Vol01_NIT&PQ		46	23: Confirmation of Quantities All quantities indicated in BOQ are tentative which may vary as per site conditions. Contractor has to verify quantities before procuring the material. No payment shall be payable for quantity brought to site but not used.	Material quantity approved by consultant and delivered to site should be paid & taken by client. Kindly accept the same.	As per tender

SI No.	Ref./ Vol./ Description	Item No.	Page No.	Tender Ref.	Bidders Queries	Reply
193	Vol01_NIT&PQ			EMD	Please provide bank details of the beneficiary to prepare the EMD.	Name of the bank : <b>Punjab National Bank</b> , 2. Address : Sector-27, Noida 3. Beneficiary Name : <b>HSCC (India) Ltd</b> 4. Beneficiary A/c No. : 2726001800000011 5. Branch Code : 2726 6. Bank IFSC : PUNB0272600
194	Vol01_NIT&PQ		2	Last date to fill/ upload the tender through e-tendering is 28.09.2018 upto 15.00 Hrs.	Requesting for extension for two week from last date of submission 28.09.2018 ( as per tender).	No change, As per tender

**All other terms & Conditions of the Tender shall remain unchanged.**

**Prospective bidders are advised to regularly scan through HSCC e-tender portal <http://www.tenderwizard.com/HSCC> and HSCC Website [www.hsccltd.co.in](http://www.hsccltd.co.in) as corrigendum/amendments etc., if any, will be notified on this portal only and separate advertisement will not be made for this.**

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**General Manager (Elect.), HSCC (India) Ltd.**

**ANNEXURE - I**

**LIST OF ADDITIONAL APPROVED MAKES FOR ELCTRICAL SYSTEM**

<b>S.No.</b>	<b>ITEM</b>	<b>MAKE</b>
1	HT/LT- XLPE cables	CCI/Universal/Finolex/ <b>Rallison</b>
2	Copper Control cable	CCI/ Universal/Finolex/ <b>Rallison</b>
3	Bus Duct/Rising main	L&T/ABB/Siemens/Schneider/GE/ <b>C&amp;S</b> /Legrand



**Technical Specification DG Sets**

**SUPPLY OF D. G. SETS**

**1.0 GENERAL SPECIFICATIONS**

- a. Actual Capacity after de-rating for site conditions : **2250 kVA**, 11 KV, 3 phase, 50 Hz. Pure sine wave, 1500 RPM, prime duty base load application
- b. Ambient conditions : Minimum temperature: 4°C during winter  
Maximum temperature: 45°C during summer  
Relative Humidity: 20% to 90%
- c. Duty cycle : Continuous 24 hours, 7 days a week, with 10% over-loading for one hour in every 8 hours.
- d. Starting : The sets shall be suitable for Auto start-up with provision for manual start and stop.
- e. Standards : The system will have to be in accordance with relevant BSS/ISS/ DIN or any other internationally accepted standard and shall comply with Indian Electricity Act & Rules 1956 amended from time to time.
- f. Fuel : The diesel generating sets shall be capable of working on Ultra Low Sulfur Diesel (ULSD).
- g. Scope of Supply : Diesel Engine: The set should be complete with a diesel engine of suitable BHP rating to give the desired alternator output of **2250kVA** (taking into account de-rating factors for the ambient conditions specified).

**Radiator fan mounted on the engine.**

Alternator: Alternator is to generate **2250 kVA**, of output power at 11 KV, 50 Hz, pure sine-wave form (with brushless excitation system and built in AVR) mounted on a common base-plate with suitable coupling to the diesel engine and foundation bolts with suitable termination box for connection to a control panel. Alternator capacities shall be suitable for the ambient conditions considering necessary de-rating factors.

Starting System: Starting by Electrical Motor, suitable voltage and capacity (preferably 24 V DC) and the supply should be from a set of batteries. The charging circuit for the battery should be built in the L.T. Panel with current controlling type with provision for trickle & boost charge. Engine will also have inbuilt charger alternator.

Fuel Supply: Day tank for each of the sets shall be included in the scope of supply.

- h. DOCUMENTATION : Two sets of complete detailed documentation is to be provided

for installation, commissioning and maintenance of the engine, alternator, control panel and other sub-systems, comprising of general and dimensional layout drawings, foundation details, wiring and schematic drawing, inter-piping and inter-cabling drawings, installation instructions, operation, maintenance and service manuals, part list, spare-parts catalogue, third party supplied catalogue, are to be supplied along with the main equipment.

Test Certificates: All test certificates at works with regard to diesel engine, turbo-charger fuel pump, governor, fuel injection system, silencer, alternator, AVR, excitation system and control panel shall be supplied in six copies.

## **2.0 DETAILED SPECIFICATIONS**

### **2.1 GENERAL:**

DG Sets, coupled to a suitable alternator to give a continuous output of **2250kVA** at 415 Volts, 1500 RPM, 3-Phase, 4-Wire, 50Hz, Pure-Sine wave form. The rating of **2250kVA** is required at site conditions of 50°C ambient and should be arrived at after taking into consideration all de-rating factors.

### **3.0 DIESEL ENGINE**

3.1 Turbo-charged, Vertical/ V cylinders, Diesel engine with cylinders either in line or in V formation, counter-clockwise rotation, Water-cooled with **Radiator type of Cooling** with turbo charger, charge air cooled-Direct injection – Four stroke, compression ignition- D.C. motor starting – Designed for operation with fuel oil and lube oil as per enclosed specifications – Continuous rated output of **2250kVA** at 1500 RPM – Stationery type conforming to IS/ BS/ DIN or any other equivalent internationally accepted standards.

3.2 Output: **2250kVA**, at site at ambient temperature of 50°C. (This is the rating required at site after taking into consideration all de-rating factors).

3.3 Standard accessories for the Engine:

- a. Exhaust driven turbo charger with insulated piping.
- b. Day tank: Outdoor mounting type with capacity to hold fuel oil required for running the diesel engine on full load for 8 hours, flow pipe, drain pipe, fuel oil level indicator, man-hole for inspection, etc. (all pipes connected through flanged joints).
- c. Lubrication System: Sump tank incorporated in the common base frame for Diesel engine and generator, with one level switch for minimum level alarm – with shell type oil to air heat exchanger (with flanged pipe connection) coarse and fine filters with by-pass arrangements in the lubricating circuit when the engine is on and with automatic by-pass valve for the filter in case of filter getting clogged. Thermostatic by-pass valve for lube-oil heat exchanger when the lube oil is cold, lube oil pressure gauge, lube oil temperature indicating devices, both at the inlet and outlet of the lube-oil heat exchanger.

d. Speed Load Regulation:

Controller

The speed governing system should be compatible to parallel operation with other DG Sets and utility mains, for selective load sharing in manual/ auto conditions.

e. Fuel Oil: Engine shall be equipped with fuel oil filters-fine and coarse. The fuel consumption of the engine shall be expressed by the Contractor in the bid in litres per gross/ nett kWh output from the alternator

(after supplying the requirements of auxiliaries) at full, three quarters and half of its rated power output and at 0.8 and unitary power factor. A fuel service tank of suitable capacity with each D.G. Set shall be provided on a suitably fabricated steel platform. The tank shall be complete with level indicator marked in litres, filling inlet with removable screen, an outlet, a drain plug, an air vent and necessary piping. The fuel tank shall be painted with oil resistant paint. All pipe joints should be brazed/ welded.

- f. Engine Cooling System: The diesel engine shall be provided with radiator fans for radiator type of DG set.
- g. Charge AIR system: Charge air for the engine shall be through a turbo charger with flexible expansion joint, transition pipe with an intermediate air cooler – Dry type filter, dry type air cleaner and absorption silencers at the air inlet point.
- h. Exhaust system: Exhaust from the engine manifold shall be connected to the turbo charger through a flexible expansion joint or SS flexible connection. Outlet from the turbo charger should be connected to the exhaust silencers (residential type) through another set of expansion joint-preferably of Bellows type and the entire exhaust piping shall be fully insulated by means of flagging and cladding. Provision shall be available for tapping exhaust gas after turbo charger for analysis purpose.
- i. Water In/ Out temperature monitoring at heat exchanger inlet and outlet.
- j. Fuel oil level indicator for the day tank.
- k. The sets shall be provided with vibration isolation pads, the main frame and the accessories as well as flexible vibration insulation joints for all piping.
- l. ALTERNATORS:  
Self-regulating, three-phase synchronous alternator, Brushless TEFC with copper windings, antifriction bearing, flanged shaft, suitable for parallel operation and synchronizing with each other and mains supply, damper cage for parallel operation, fully tropicalised insulation (class H) temperature sensors located in the windings, over-riding controls for manual operation of excitation system, all the six terminals brought out, suitable for delivering the full load at 45°C conforming to relevant ISS/ BSS/ DIN any other internationally accepted standard or equivalent.

Output: **2250 kVA** 0.8 pf lagging

Voltage: 415 Volts, 4- wire, 3 phase, solidly earthed neutral power system. The steady state voltage stability shall be  $\pm$  (0.5%) from no load to full load, and at power factors from 0.7 to 1.0 and for any speed variation unrelated to load of approximately 1%.

Wave Form	:	Pure sine wave, free of all harmonics.
Frequency	:	50 Hz
Speed	:	1500 rpm
Protected against	:	Over-load, short circuits, earth faults, winding protection, differential type winding over-temperature. Transient surges and lightning protection. Earth leakage protection as specified by Elec. Inspectorate
Earthing facility	:	Earth lugs on the alternator should be provided for two separate earth connections.
Over-load	:	10 % for one hour in every eight hours.
Exciter	:	Brush less revolving-field, built-in AC exciter with Rotating rectifiers, automatic regulation with suitable accessories, and

provision for adjusting the terminal voltage by means of a continuous trimmer by  $\pm 5\%$  of the nominal Voltage.

m. Starter Battery:

The battery shall conform to the requirement of IS: 1651. Starting battery each of 12 V, heavy duty high performance approved make/ quality shall be provided to enable crank & start the engine even in cold/ winter morning conditions. Type/ voltage/ AH capacity of same on 20 hour rated discharge period shall be indicated in the offer. The battery set shall be capable of performing at least (5) five normal starts without recharging.

The battery shall be provided with good quality iron battery stand painted with acid proof black paint with min 3mm thick rubber mat below the battery.

Batteries shall be of load container type only and not with PVC moulded sealed container so that each individual cells are available for individual monitoring during its life span. Each cell shall be provided with electrolyte filling cap with level floats for easy monitoring of electrolytic level.

The battery shall be provided with 2 Nos. cables, minimum 1.5m long heavy duty rubber/ PVC insulated cabling with brazed tinned lug at one end and with brazed tinned brass terminal lug at battery end - for connecting batteries to cranking system - with 0.25 m long inter battery connecting cable.

The lugs shall be clearly stamped (+) or (-) and positive cable also red sleeved for easy identification.

The batteries Set shall be supplied fully filled and first charged ready to use.

Batteries set shall be supplied with spring type hydrometer, thermometer with specific gravity correction scale and cell testing voltmeter etc.

n. CONTROLLER

DG Set shall be complete with its controller. This controller shall be capable of enabling auto start/ stop of DG Sets & auto synchronization of DG Sets. Various features of controllers offering safeties, protection and metering shall be as per the details mentioned in the BOQ.

o. ACOUSTIC ENCLOSURE/ HOOD

DG Set with acoustic enclosure shall be:

The enclosure is fabricated out of CRCA sheet of 14 SWG

The sheet metal components are hot dipped in NINE TANKS pretreated before powder coating.

Enclosure is powder coated (inside as well outside) with a special pure polyester based powder. All Nuts and, bolt/ external hardware are made from stainless steel.

The doors are gasketed with high quality EPDM gaskets to avoid leakage of sound.

The door handles are lockable type.

Sound proofing of enclosure is done with high quality rock wool/ mineral wool confirming to IS 8183.

The rock wool is further covered with fibre glass cloth and perforated powder coated MS sheet.

Specially designed attenuators are provided to control sound at air entry to the container and exit from the container.

Adequate ventilation is provided to meet air requirement for combustion and heat removal.

Temperature of enclosure does not exceed beyond 5-7°C of ambient temp.

There should be a provision for emergency shutdown from outside the enclosure.

Noise levels shall be as per CPCB norms with acoustic enclosure.

Door hinges are made of anti corrosive special alloy.

**q. NOISE LIMIT FOR GENERATOR SETS RUN WITH DIESEL:**

**1. Noise limit for diesel generator sets (upto 1000 KVA)**

The maximum permissible sound pressure level for new diesel generator (DG) sets with rated capacity up to 1000 KVA, manufactured on or after the 1<sup>st</sup> July, 2003 shall be 75 dB(A) at 1 metre from the enclosure surface.

The diesel generator sets should be provided with integral acoustic enclosure at the manufacturing stage itself.

**2. Noise limit for DG sets not covered by above paragraph 1 (above 1000 KVA)**

Noise limits for diesel generator sets not covered by paragraph 1, shall be as follows:

- i. Noise from DG set shall be controlled by providing an acoustic enclosure or by treating the room acoustically, at the users end.
- ii. The acoustic enclosure or acoustic treatment of the room shall be designed for minimum 25 dB (A) insertion loss or for meeting the ambient noise standards, whichever is on the higher side (if the actual ambient noise is on the higher side, it may not be possible to check the performance of the acoustic enclosure/ acoustic treatment. Under such circumstances the performance may be checked for noise reduction upto actual ambient noise level, preferably, in the night time). The measurement for Insertion Loss may be done at different points at 0.5 m from the acoustic enclosure/ room, and then averaged.
- iii. The DG set shall be provided with proper exhaust muffler with insertion loss of minimum 25 dB(A).
- iv. These limits shall be regulated by the State Pollution Control Boards and the State Pollution Control Committees.
- v. Guidelines for the manufacturers of Diesel Generator sets shall be as under:
  - The manufacturer shall offer to the user a standard acoustic enclosure of 25 dB(A) insertion loss and also a suitable exhaust muffler with insertion loss of 25 dB(A).

**3. EMISSION LIMITS FOR NEW DIESEL ENGINES (UP TO 800 KW) FOR GENERATOR SETS (GENSETS) APPLICATIONS:**

The emission limits for new diesel engines up to 900 kW, for Gensets applications shall be as given in the Table below:

**Table:**

Capacity of diesel engines	Date of implementation	Emission Limits (g/kw-hr) for				Smoke Limit (light absorption coefficient, m <sup>-1</sup> )(at full load)	Test cycle	
		NOx	HC	CO	PM		Torque %	Weighting factors
Upto 19 kw	1.7.2003	9.2	1.3	5.0	0.6	0.7	100	0.05
	1.7.2004	9.2	1.3	3.5	0.3	0.7	75	0.25
>19 kw upto 50 kw	1.7.2003	9.2	1.3	5.0	0.5	0.7	50	0.30
	1.7.2004	9.2	1.3	3.5	0.3	0.7	25	0.30

>50 kw upto 260 kw	1.7.2003	9.2	1.3	3.5	0.3	0.7	10	0.10
> 260 kw upto 800 kw	1.7.2004	9.2	1.3	3.5	0.3.	0.7		

## **SUB-HEAD: L (II). INSTALLATION OF D. G. SETS**

### **1.0 GENERAL:**

- 1.1 The preliminary drawings shall be provided by the **CLIENT** to the contractor and based on these drawings contractor shall prepared and submit detailed and working drawing to **CLIENT**. After getting the approval by **CLIENT** duly signed and stamped, the work shall be carried out in the accordance with the approved drawings and design. The contractor shall not take cognizance of any drawings, designs, specifications etc. not bearing **CLIENT** representative's signature and stamp. Similarly the contractor shall not take cognizance of instructions given by any other authority except the instructions given by the Engineer-in-charge in writing.
- 1.2 The work shall be executed and measured as per metric dimensions given in the Schedule of Quantities/ drawings etc.
- 1.3 The Contractor shall acquaint himself fully with the partial provisions for supports that may be available in the structure and utilize them to the extent possible. In any case the contractor shall provide all the supports regardless of provisions that they have been already made. Nothing extra shall be payable for situations where insert plates (for supports) are not available or are not useful.

### **1.4 MEASUREMENTS**

All measurements shall be taken in accordance with relevant IS codes unless otherwise specified.

### **2.0 APPLICABLE CODES, STANDARDS AND PUBLICATIONS**

All equipments supply, erection, testing and commissioning shall comply with the requirements of Indian Standards and code of practice given below as amended to date. All equipments and material being supplied by the Contractor shall meet the requirements of IS, Tariff advisory committee's regulation (fire insurance). Local Authorities, electrical inspectorate, pollution emission norms as may be prescribed by the competent authority & Indian Electricity rules and other Codes/ publications including NEMA, TEMA.

IS:1651	Stationary cells and batteries, lead-acid type (with tabular positive plates).
IS: 5216	Safety procedure and practices in electrical work.
IS: 1271	Electrical Insulation.

### **3.0 QUALITY ASSURANCE AND QUALITY CONTROL**

- 3.1 The works shall conform to high standard of design and workmanship, shall be structurally sound and aesthetically pleasing. Quality standards prescribed shall form the backbone for the quality assurance and quality control system.
- 3.2 At the site, the Contractor shall arrange the materials and their stacking/ storage in appropriate manner to ensure the quality. Contractor shall provide equipment and manpower to test continuously the quality of material, assemblies etc. as directed by the **CLIENT**. The test shall be conducted continuously and the result of tests maintained. In addition the Contractor shall keep appropriate tools and equipment for checking alignments, levels, slopes and evenness of surface.
- 3.3 The **CLIENT** shall be free to carry out such tests as may be decided by him at this sole discretion, from time to time, in addition to those specified in this Document. The Contractor shall provide the samples and labour for collecting the samples. Nothing extra shall be payable to the Contractor for samples or for the collection of the samples.
- 3.4 Prior to shipment, complete unit shall be tested under actual load conditions for performance and proper functioning of component parts.

### **4.0 DC BATTERY SYSTEM:**

4.1 The batteries shall be installed duly acid filled uncharged with stand. At time of testing & commissioning of DG sets battery shall be charged by the contractor.

### 6.3 Testing:

All piping shall be tested to hydrostatic test pressure of at least two and half times the maximum operating pressure, but not less than 10 kg per sq.cm gauge for a period of not less than 36 hours. All leaks and defects in joints revealed during the testing shall be rectified and gotten approved at site.

Piping repaired subsequent to the above pressure test shall be re-tested in the same manner.

System may be tested in sections and such sections shall be securely capped, then re-tested for entire system.

The Contractor shall give sufficient notice to all other agencies at site of his intention to test a section or sections of piping and all testing shall be witnessed and recorded by Owner's site representative.

The Contractor shall make sure that proper noiseless circulation of fluid is achieved through heat exchanger equipment in the system concerned. If connection, the Contractor shall rectify the defective connections. He shall bear all expenses for carrying out the above rectifications including the tearing up and re-finishing of floors and walls as required.

The Contractor shall provide all materials, tools, equipment, instruments, services and labour required to perform the test and to remove water resulting from cleaning and after testing.

### 7.0 EXHAUST PIPING.

The exhaust piping system shall be of heavy duty of MS pipes thickness as mentioned in the BOQ. Suitable length of flexible piping shall be used for connecting the piping to the engine as per the recommendations of manufacturers.

All terminal connections and pipe joints shall be of welded construction. The terminals of sizes 2 inches & above shall be butt welded.

The welding shall be done as per relevant ASME/ ASA codes. The contractor will have to indicate beforehand the welding procedure proposes to use. After confirmation by the **CLIENT**, the procedure which is finalized shall be strictly adhered to.

All pipes shall be supported with necessary supporting arrangement and approval shall be taken for the same before execution.

### 8.0 INSULATION WORKS OF DG EXHAUST PIPE.

#### 8.1 GENERAL

The Insulation of exhaust pipe shall be carried out as per specifications given below & as specified in bill of quantities (BOQ):

#### 8.2 MATERIALS

The materials to be used for insulation shall be as follows, unless some other material is specifically mentioned elsewhere. The detailed specifications of the materials are listed under respective sub head. **Refer BOQ for the exact insulation type and thicknesses. Details given below are for various options of insulation.**

Pipe insulation : Rock wool



Surface Temperature	:	Up to 450 °C
Density	:	150 Kg/m <sup>3</sup>
Thickness of insulation	:	75mm
Cladding	:	26G Aluminum

**Scope:**

The scope of this section comprises the supply and application of insulation conforming to these specifications & as mentioned in the BOQ.

**8.3 PIPE INSULATION: - UNEXPOSED & EXPOSED TO WEATHER.**

- a) Clean the surface of the pipe with wire brushes manually.
- b) Check the size and length of pipe to be insulated and cut the pre-formed Ceramic wool/ Rockwool.
- c) Providing and applying a layer of MAS-17 adhesive over pipe length.
- d) Fix the 25 mm thick Ceramic wool pre-formed pipe section – 128Kg/ m<sup>3</sup> density followed by another layer of 100mm Rockwool of 150 Kg/ m<sup>3</sup> density.
- e) Cover the insulated pipe with 26 SWG aluminum sheet with proper overlaps at circumference with the self tapping screws fixed at maximum 150 mm distance all throughout the overlapping.
- f) After completion of work, remove burrs, dirt, and construction debris, and repair any damaged finishes including chips, scratches, and abrasion. The work location is clean and tidy.

**8.4 MEASUREMENT OF INSULATION:** Unless otherwise specified measurement for insulation for the project shall be on the basis of center line measurement.

**8.5 MEASUREMENT OF PIPING**

- a. Unless specified otherwise, measurement for piping for the project shall be on the basis of center line measurements described herewith.
- b. Piping shall be measured in units of length along the center line of installed pipes including all pipe fittings, flanges (with gaskets, nut, bolts for jointing), unions, bends, elbows, tees, concentric and/ or eccentric reducers, inspection pieces, expansion loops etc. The above accessories shall be measured as part of piping length along the center line of installed pipes and no special multiples of pipe lengths for accessories shall be permitted.
- c. The quoted rates for centre line linear measurements of piping shall include all wastage allowances, pipe supports including hangers, MS channel, wooden haunches, nuts, check nuts, vibration isolator suspension where specified or required and any other item required to complete the piping installation as per the specifications. None of these items will be separately measured nor paid for.
- d. However, all valves (gate/ globe/ check/ purge/ butterfly/ drain etc.). Strainers, thermometers, pressure gages shall be separately counted and paid as per BOQ include.

**9. INSPECTION AND TESTING AT SITE**

- 9.1 All pre-commissioning and commissioning test and checks shall be carried out at site. The contractor shall be required to produce manufacturer's test certificate for the particular batch of materials supplied to him by the manufacturers. The test carried out shall be as per the relevant standards.

- 9.2 For examination and testing of materials and the works at site the Contractor shall provide necessary testing and gauging equipment as required. All such testing and gauging equipment shall be tested for calibration at any approved labor at any required by the **CLIENT**.
- 9.3 The Contractor shall give notice well in advance to the **CLIENT** before commencement of any site testing. All materials like consumable stores, fuel oil grease, lubricating oil etc. required for the trials shall be arranged by the contractor.
- 9.4 The Contractor shall make all necessary hook-ups to carry out tests at site and shall furnish necessary fuel.
- 9.5 The complete installation should be initially started and checked out for operational compliance by manufacturer's representative.

## **10.0 TRIALS (AT SITE) FACTORY TRIALS FOR 3 PERSONS**

### **10.1 PRIMARY TRIALS**

After completion of erection of generating sets and before carrying out main trials, preliminary site trials shall be conducted in the presence of **CLIENT** representative. Such trial shall include the checking and adjustment of all the instrument relays. Timers, interlocks and meters. Insulation resistance of stator, rotor and exciter windings shall be checked and reading recorded and their starting accessories supplied with the set.

### **10.2 MAIN TRIALS**

- a. The main trials shall include over 8 hours continuous run at full load.
- b. Alternator efficiencies as determined in works test shall be used as the basis of calculation for fuel consumption rate. A tolerance of 3% shall be allowed on the fuel oil consumption to cover possible errors in measurement. Tests providing the satisfactory performance of all safety and operating controls shall be carried out. Governor trials shall be carried out as laid down in BS: 5514. Alternator insulation resistance & commutation check shall be as per BS: 5000.
- c. Starting time of sets shall be tested at least five times after sufficient time intervals to allow for cold start. On completion of test, inspection doors shall be removed and running gears inspected and alignment checked. Any further reasonable trial as suggested by the **CLIENT** shall be carried out with no extra charges. All instruments, materials and labour required for carrying out the trials shall be provided by the Contractor. Test sheet of trials shall be forwarded in quadruplicate to **CLIENT**.

### **11.0 TEST WITNESS**

Test shall be performed in the presence of **CLIENT**. The contractor shall give at least thirty (30) days advance notice of the date when the tests are proposed to carried out.

**TECHNICAL PARTICULARS**

**(Technical Particulars to be filled in by tenderers and enclosed along with the tender for each rating of DG Sets)**

ITEM	Conformations or comments or data shall be furnished by tenderer against each item
<b>Diesel Generating Set</b>	
Manufacturer of DG Set	
Prime rating of DG set based on continuous operation for 365 days in a year at varying loads.	
The prime rating as above shall be suitable for continuous operation over an ambient of 45°C. Tenderer to categorically confirm this operation and to furnish design calculation in support of this confirmation.	
DG set to be suitable for 10% overload capacity for 1 hour on 12 hours – over and above the governor capacity being suitable.	
DG Set Dimensions (LxWxH)	
DG Set Weight (in kgs.)	
<b>Diesel Engines:</b>	
Manufacturer of Diesel Engine	
Manufacturers Model No.	
BHP	
RPM	
No. of Cylinder	
Type of Cooling	
Type of Starting	
Aspiration	
Air cleaner type	
Fuel/Lub Oil Filter Type	
Governor type and class	
Flywheel to suit flexible coupling	
Flexible coupling with guard	
Fuel Pump	
Hot water auxiliary pump with thermostatic control to maintain the water temperature in the engine jacket at 40°C.	
Interconnection wiring, cabling and piping as required	
Cooling water quality	
Max. engine water temperature	
Lub Oil pressure	
Max. Lub Oil temperature	
<b>Fuel Consumption:</b>	
Typical fuel consumption gms/BHP/hr	
50% load	
75% load	
100% load	

ITEM	Conformations or comments or data shall be furnished by tenderer against each item
Fuel consumption figures vis-à-vis alternator electrical output – kWh/litre	
50% load	
75% load	
100% load	
Fuel air compression ratio	
Suitability for locally available HSD	
Suitability of operation of DG set on cheaper fuel like LDO etc.	
<b>Lub Oil Consumption:</b>	
Lub oil consumption at 100% load	
<b>Heat Balance:</b>	
Typical heat balance	
Heat rejected to cooling water	
Heat rejected after cooler	
Heat rejected to exhaust	
Heat rejected to Ambient	
<b>Alternator:</b>	
Manufacturer	
Enclosure	
Mounting	
KW Rating	
KVA Rating	
Insulation class	
Temperature Rise under continuous operation	
Excitation unit	
Voltage Regulation no load to full load	
Wave form distortion on full load	
Radio Interference	
Telephone Interference	
Stator winding thermistor with trip	
Space heater	
Single step load acceptance	
Peak motor starting KVA	
Sustained short circuit % of rated current for 10 seconds	
Terminal Box (Yes/No)	
Alternator Impedance	
<b>Anti-vibration Mounting:</b>	
Make	
Vibration Isolation Efficiency	
<b>Exhaust System:</b>	
Exhaust silencer type	
Number of Silencers provided	
Noise level dB at 1m from silencer	

ITEM	Conformations or comments or data shall be furnished by tenderer against each item
Noise level 1m outside DG room and 1 m from the enclosure surface	
Exhaust pipe diameter, material and thickness	
Guaranteed Temperature on external face of exhaust pipe insulation	
Details of insulation provided for exhaust pipe	
Temperature of flue gases at exhaust manifold	
Expansion joints in exhaust piping	
Exhaust stack height – along with back pressure calculation	

## SELECTION OF AC GENERATORS

### 1. Introduction :

In recent times, diesel generators are being relied upon heavily both as supplement to Electricity Board and as a prime power supply. The quality of power realized from a diesel generating set has certain limitations as compared to quality of Electricity Board supply. The selection of AC Generator for DG set application has therefore assumed greater importance.

The optimized selection is reflected in the number, size and characteristics of AC generator with due consideration to economics of alternatives.

The need and the constraints stated above leads to analysis of various factors which are dealt with in subsequent paragraphs.

### 2. Connected Load and Average load :

Adding up of all connected loads gives a very rough estimate of AC Generator capacity. However, depending on the usage, all the connected loads may not work simultaneously. The average load which takes into account the diversity in use of various equipment's leads to a better estimate of AC Generator capacity. It is observed that the operation of loads can be rescheduled for working on a DG set, thereby reducing the average load. This aspect should be carefully evaluated to restrict the size of the AC Generator.

### 3. Continuous Load and Over Load

AC Generators are designed to deliver their nominal rating continuously at standard site conditions of 40 deg. C ambient and 1000 meters altitude. As required by standards, AC Generators also have a short time overload capability. The short time overload will go unnoticed by the board supply but AC Generator may be incapable of accepting such overloads. The selections should take care of the size of overload, its duration and the base load carried by the AC Generator just before the occurrence of overload.

### 4. Name plate-rating and Actual Input

Loads such as AC motors, d.c. motors, transformers rectifiers etc., have their name plate rating with respect to output. While assessing the DG set capacity, it is necessary to interpret the rating in terms of input required considering the overall efficiency of the equipment. The inputs in such cases will be naturally higher than output. As opposed to this, there may be cases where equipment's are oversized and operate only at part of their name plate ratings. Therefore, in estimation of AC Generators capacity, the actual input for various loads must be considered.

### 5. Single and Unbalanced Loads

Considerations should be given for installing a single phase AC Generator if single phase loads are predominant. In case of three phase AC Generators unbalanced loading results in additional heating and unbalanced output voltages. The additional heating may damage the AC Generators while unbalance voltage may affect the connected loads. Hence, in arriving at AC Generator capacity, consideration should be given for distributing single phase loads as evenly as possible among the three phases. The equivalent three phase rating is estimated from the maximum value of line currents out of the unbalanced system of currents. This will ensure the rated current is not exceeded in any of the phases when unbalanced loads are operated.

### 6. Leading and Lagging Power Factor Loads.

AC Generators have no control over the power factor of the load it supplies. Standard AC Generators are designed for a worst power factor of 0.8 lagging. For operation of AC Generator at power factor than 0.8 they have to be de-rated. Alternatively, power factor of the load can be improved economically by the use of capacitors. As prime movers are matched to AC Generators output at 0.8p.f. Loads which have better

p.f. than 0.8 lagging and with AC Generator capacity, may overload the engine. Leading power factor loads cause instability and rapid voltage rise. Such loads should normally be restricted to within 10 percent of the AC Generators rating and power factor improvement capacitors should be switched off along with loads whose power factor they are intended to correct. In case of small heating and lighting loads, unity power factor AC Generators which are cheaper may be used. While estimating the DG Set capacity. KVA and kW requirements are separately evaluated with the capabilities of the standard set.

**7. Environmental Conditions and Duty:**

The extend of modification required on a standard AC Generator depends on the severity of the environmental conditions. High humid conditions require fitment of space heaters on AC Generators. Corrosive or chemical atmosphere requires improves protection to windings. Extreme cases even totally enclosed machines are specified. The site conditions like higher ambient or higher altitudes require de-ration of AC Generator rating. The selection should take into account rating required at site conditions. AC Generators for rolling stock application require additional design care as compared to stationary ones. Marine AC Generators which are subjected to rolling and pitching likewise extra care during design stage itself.

**8. SUDENLY APPLIED LOAD AND THE VOLTAGE DIP**

Most common transient loading arise due to induction motor starting. This is one of the important aspects which often decide AC Generator size. In case of induction motors, the rating of motor, the method of starting, the base load on the AC Generator, the acceptable value of transient voltage dips for motors and other connected loads should be collected as data studied. Additional data's like, limitations in sequence of starting, simultaneous starting of motors and where the transient load exceeds AC Generator capacity, the frequency of transient load application should also be generated. Small and medium sized AC Generators can supply upon 2.5 times their rated current for motor starting. The transient voltages dip for full load application range from 15 – 20 %.

Depending on requirement, a higher sized or specially designed AC Generator may have to be recommended. Where high value and high power factor transient loads are involved, the engine capability should also be checked.

During starting an Induction Motor draws a heavy current at low power factor. When large load is suddenly impressed on an AC Generator, its terminal voltage drops momentarily. The excitation and regulating system of the AC Generator tries to restore the voltage.

The value of the voltage dip depends on the sudden load, its power factor and the base load on the AC Generator at the time of motor starting.

The effect of low power factor is to increase the value of dip & the value of dip increases with increase in base load slightly. For this reason it is advisable to start Motor with high starting current first.

The starting current of an Induction Motor varies widely with make, type of Induction Motor and method of starting. As a guide the following may be referred:

<b>Method of starting</b>	<b>Starting current as K Times full load current</b>
Direct on line	6-7.2
Star Delta	2-2.4
Rotor Resistance	1.5-2
Auto Transformer :	
at 40% tapping	1.1
at 60% tapping	2.5
at 80% tapping	4.5
Soft Starting	2-3

Transient voltage dip limitation is the important criteria during selection for motor starting condition considering effect on connected loads and motor torque to drive the connected load. The method of minimizing voltage dip includes:

- Low voltage method of starting wherever the load torque requirement is not affected.
- To employ sequential operation of motors i.e in descending order of their starting currents.
- By selecting a higher frame size.
- Machines specially designed for low reactance is more economical to limit the transient voltage dip.

AC Generator of higher rating are designed to supply 3 times their rated current for motor starting for not more than ten seconds. The transient performance varies with type of Alternator and excitation system. The typical recovery time vary from 0.5 seconds to 1 seconds depending on the size of the Motor to be started and the generator size used.

It is equally important to evaluate engine capability for transient loads. Due to low starting power factor, engine may not be severely loaded for most of the methods of starting. But in case of rotor resistance relatively higher duty is imposed on the engine because of better power factor.

Critical loads which cannot accept voltage and frequency fluctuation may be fed by a Separate supply or by a buffer set.

Motors are always rated for their output, but in transient voltage dip calculations Motor input kVA is required.

Details of Motor loads as per questionnaire helps recommending the optimum size of the Alternator.

#### QUESTIONNAIRE FORM FOR MOTOR LOADS

(Following details should be filled up for motors having High Starting currents).

Rating of motor	:	
Type	:	
Rated full load current	:	
Starting method	:	DOL/ STAR-DELTA/ ROTOR RES/ AUTO TFR/ SOFT START
Starting current	:	
Starting power factor	:	
Starting time	:	
Interval between successive starts	:	
Base load on genset before starting the motor	:	
Can sequence of starting the motor Be adjusted to produce the best conditions for the genset	:	
Can motor starting current be limited by an appropriate type of starter as required	:	
Any voltage sensitive loads	:	
connected in same circuit	:	
Taking account of all factors including other loads what is the maximum permissible transient voltage dips during the application of highest motor starting current	:	

#### 9. Frequency and Waveform

The Frequency is direct function of speed and hence frequency regulation in entirely dependent on engine speed regulation. Most engines have their governor set such that no – load speed is FOUR per cent above nominal speed which linearly reduces upon loading and reaches rated speed at full load. This



characteristic is essential for parallel operating DG Sets which share kW load by natural means. For solo operation, engines fitted with hydraulic/ electric governors can be set to provide close frequency regulation.

Waveform requirements as specified in standards are easily satisfied by most AC Generators. But certain type of loads like computer loads require improved waveform. Yet certain other type of non-linear loads like Thyristor loads distorts the AC Generators waveform. AC Generators have to be specially designed if restriction on waveform is stringent.

#### **10. Parallel Operation and Load sharing**

Many a times, requirements of operational flexibility, optimum usage, pattern of loading or load addition necessitates multiset selection involving parallel operation. The characteristics of AC Generator and type of excitation system determine the scheme for parallel operation and accuracy of load sharing. Where parallel operation is envisaged, prerequisites like provision of damper winding in the machine and quadrature droop circuit in voltage regulator are to be specified.

#### **11. Transformer Charging**

This type of load generally occurs with medium and high voltage AC Generators are feeding to the grid. Proper rating of AC Generator to be selected considering the type of charging the transformer. When transformer is connected to supply it draws the magnetizing current to magnetize the core, to meet up with the core losses. The problem is the inrush current. Based on the inrush current AC Generator to be selected for its rating

### **SELECTION OF ALTERNATORS**

#### **1.0 SITE CONDITION**

##### **A) Environment Condition**

- i. Ambient Temperature (Storage)
- ii. Ambient Temperature (Operating)
- iii. Altitude
- iv. Humidity
- v. Clean/ Dusty/ Hazardous

##### **B) Connected Load Details**

- i. Linear Load - KW/KVA
- ii. Non-Linear Load with % Harmonic --- KW/ KVA
- iii. Impact Loads with voltage dip/ voltage rise limits

#### **2.0 APPLICABLE STANDARDS**

- IS/ IEC 60034-1 (Formerly IS: 4722)
- IS: 13364 Part 1 and Part 2 for Defence Application
- IS: 5422 for Turbine Application
- IRS/ ABS for Navel Application
- IS/ ISO: 8528-3 : 2005 for DG set application
- IS: 12065: Noise level limits
- IS: 12075: Vibration limits
- IEC: 60034-6 : 1991-10 : Methods of cooling
- IS/ IEC 60034-5 2000: Degrees of Protection

### **3.0 ALTERNATOR CONSTRUCTION**

The alternator shall be a three phase, salient pole, air cooled, self-ventilated brushless type. The alternator excitation system shall be closed loop type consists of brushless exciter with rotating rectifier assembly, surge protection device mounted on same shaft and Automatic Voltage Regulator.

The main poles shall be fitted with damper winding for better dynamic stability. Alternator winding insulation shall be 'Class H' and temperature rise limit shall be 'Class H' or 'Class F'.

Mica based insulation to be used for main output winding for medium and high voltage alternators. The alternator shall be suitable for solo/ parallel among same make/ with grid application. Alternator shall be suitable for neutral is solidly grounded.

The Automatic Voltage Regulator shall maintain the terminal voltage constant within +0.25% regulation limit from no-load to full load for a power factor between 0.8 to unity for non-distorted balanced linear load including hot and cold conditions. The AVR shall have in-built function for parallel operation, overvoltage & underspeed protection by LAM and under-frequency (U/F).

The alternator shall be designed with excitation system where AVR gets independent power supply from two auxiliary windings, ensure higher overload capacity and short circuit capability (of 300% nominal load for a duration of 10 seconds), with no separate rotating component.