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BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

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TITLE STATION UPS <i>(UN-INTERRUPTIBLE POWER SYSTEM)</i>				SIGN	<i>Basaljit</i>	<i>Vinod</i> <i>Rakesh</i>	
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CUSTOMER	Power Grid Corporation of India Ltd
PROJECT	±800KV, 6000MW, HVDC MULTI-TERMINAL NER/ER – NR/WR INTERCONNECTOR-I PROJECT
CA No.	C-61901R-S056-8/CA-II/3660 dated 22.12.2011 for On –Shore Supplies & C-61901R-S056-8/CA-IV/3662 dated 22.12.2011 for Services
STATION	Agra

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SECTION – 1

SCOPE, SPECIFIC TECHNICAL REQUIREMENTS AND BILL OF QUANTITIES

1.1 SCOPE

This specification is intended to specify the requirements for design, engineering, manufacture, assembly, stage testing, inspection, testing before supply, packing, loading at works and Transportation / delivery at site of **STATION UPS (UN-INTERRUPTIBLE POWER SYSTEM)** along with its accessories and auxiliary equipments / instruments etc. as mentioned in this section and in various other sections of this specification.

The equipment is required for the following project:

Name of customer : **Power Grid Corporation of India Ltd**
Name of the project : **±800KV, 6000MW, HVDC MULTI-TERMINAL
NER/ ER – NR/WR INTERCONNECTOR-I PROJECT**
Name of Site : **Agra**

The scope shall encompass and include all the activities listed above.

In case of any conflict among the various sections of this specification, then the order of precedence shall be Section-1, Section-2 & then Section -3.

1.2 TERMINOLOGY

The following terminology shall be applicable for the purpose of interpreting the relevant clauses of the specification

Project title : **±800KV, 6000MW, HVDC MULTI-TERMINAL
NER/ER – NR/WR INTERCONNECTOR-I PROJECT**
Owner : Power Grid Corporation of India Limited (POWERGRID)
Purchaser : Bharat Heavy Electricals Limited (BHEL)
Contractor : Qualified Bidder who shall supply the item



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1.3 UN-INTERRUPTED POWER SYSTEM (UPS):

The UPS system shall provide continuous ac power to critical loads in the event of power failure. The critical loads shall include at least the VPS & SCADA systems, computer systems and printers in the control room.

UPS for HMI, VPS, SCADA system, computer system & printer etc. shall be rated for 30 minutes.

The UPS system shall consist of:

- Two numbers UPS systems in parallel redundant mode for supplying load.
- One set each of Maintenance free batteries (Ni-CD Type) for each UPS system with backup duration of 30 minutes
- UPS output AC Distribution Boards.
- Power, control and network cables

The UPS shall be designed for continuous-duty, on-line operation and shall be based on solid-state design technology to provide uninterrupted power supply for Critical loads mentioned above.

The control of the UPS system shall be microprocessor based providing monitoring and control of rectifier/charger, Inverter, static switches, firing and logic control.

Each UPS system provided by the Contractor shall include all of the following sub-systems as well as any other components and support hardware necessary for complete and proper operation of the UPS:

- a) Rectifier/charger unit
- b) Inverter unit
- c) Battery Low Voltage Disconnect device
- d) Static bypass switches
- e) Manual maintenance bypass switches
- f) Load transformer and filters
- g) Control panels, automatic controls and protection
- h) Hardware and software as required for parallel operation of UPS systems
- i) All necessary cables, MCCBs/ MCBs/ switches/ fuses

In the event of a loss of AC power source, the UPS equipment shall provide uninterrupted power to the critical loads from the output of the UPS inverter subsystems through batteries.

UPS OPERATION

The UPS system shall operate in parallel redundant configuration sharing the connected load. The UPS shall primarily use the inverter subsystem to deliver AC power to the computer system loads. In case of failure of any one UPS, the other healthy UPS shall continuously supply the power to the computer system loads without any interruption. If the other healthy UPS also fails then automatically Static bypass of UPS shall start supplying the connected load through AC mains without any interruption.



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The Manual Maintenance Bypass shall be provided for each of the UPS separately to extend AC raw power supply to computer systems in case of complete failure or shutdown of UPS systems. The UPS system shall provide continuous ac power to critical loads in the event of power failure, e.g. converter computer control system.

UPS LOAD REQUIREMENTS:

Following are the actual loads on the UPS Inverter system:

UPS SYSTEM

UPS loads for Station	U	P, total	Cos φ	S, total
	V	W	P.F.	VA
OWS	240	1725	0.85	2029
Laser printer	240	1210	0.85	1424
HMI	240	450	0.85	529
BMS	240	450	0.85	529
VPS - 1	240	12220	0.85	14376
Fox System	240	850	0.85	1000
Video Conferencing System	240	700	0.85	824
UPS fed CFL loads for lobbies, passage, stairs	240	850	0.85	1000
Backup - OWS	240	1725	0.85	2029
Laser printer (2 nd floor)	240	1210	0.85	1424
CCTV	240	4250	0.85	5000
VPS - 2	240	12220	0.85	14376
Total load	240	37860	0.85	44540

Total load on Station UPS System = **44.540 KVA**

Taking a design margin of 10%, Total load on Station UPS System becomes 49 KVA.

Hence, we are proposing **50KVA** UPS for both the systems.

One set of UPS in dual parallel redundant configuration of minimum (**2 x 50 KVA**) rating shall be supplied.



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1.4 SCOPE OF SUPPLY:

MAIN ITEMS (FOR AGRA STATION): [BBU Ref. No. BB II – A.21 (21.4)]

Item No.	Description	Unit	Total Quantity
1.	415V A.C, 3-phase, 50Hz, 50 kVA Station UPS in parallel redundant configuration (1 + 1) complete with required Battery Banks (each with back up time of 30 min.) and accessories as per enclosed block diagram sketch-1	Set	1
2.	UPS output, 415V, 3-phase, 50Hz, AC distribution Board along with fixing / mounting hardware as per enclosed block diagram sketch-1	Nos.	1
3.	Required Power, control and network cables etc.	Lot	1
4.	Supervision of erection, testing and commissioning of UPS system	Lot	1

Remarks:

1. Notwithstanding the details included in this specification, UPS shall be supplied complete with mounting arrangement, fixing hardware and other accessories as required for complete installation, putting in service and satisfactory operation of the UPS.

2. Installation and Commissioning

Bidder shall quote lump-sum price for ETC of the offered UPS. The required instruments for commissioning shall be brought by the bidder.

1.5 INTERFACES & REMOTE MONITORING OF UPS:

415 V (3-phase), 50 Hz AC power supplies with provision for dual input will be provided for station HMI UPS system. The output of the UPS shall be 3-phase, 415V AC, 50 Hz. All equipment shall be suited for operation in a range of 415 V ±10% without failure and influence on lifetime. DC operated contactors will be used for the automatic switchover.

The following alarms shall be wired to external terminals for remote monitoring (potential-free change-over relay contacts, 220 V DC)

Battery discharging signal
Status of manual bypass
Collective UPS fail

The collective UPS fail signal for remote monitoring shall include:
Mains fault (with delay of approx. 60 s)
UPS fault



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Fan fault (when UPS are forced air cooled)
Battery charger fault
Static bypass switch fault

1.6 BATTERIES:

DC Batteries shall be stationary Nickel – Cadmium type conforming to IS 10918. The batteries shall be medium discharge performance type. For the purpose of design, an ambient temperature of 50 degree Celsius and relative humidity of 100% shall be considered.

Each battery shall be installed in a separate metal-clad cubicle with front door, all equipment built in accessible from the front side The cubicles shall be suitable for installation against a wall.

The battery capacity and the battery system voltage shall be selected by the tenderer and shall be included in the tender return.

The battery shall be sized to meet the total load requirement for 30 minutes (as the case may be) under normal running arrangements

All necessary inter-cell and external connectors to the battery charger/inverter of the UPS shall be included. These connectors shall be shrouded and suitably designed for any mechanical loadings

The batteries shall have easy access for installation and replacement

1.7 CODES AND STANDARDS:

The UPS shall be in accordance with:

- IEC 60 146-2 Semiconductor converters
Part 2: Self-commutated semiconductor converters
Including direct DC converters
- IEC 62 040-1-1 Un-interruptible power system (UPS)
Part 1: General and safety requirements for UPS used in
operator access area
- IEC 62 040-2 Uninterruptible power systems (UPS)
Part 2: Electromagnetic Compatibility (EMC) requirements
- IEC 62 040-3 Uninterruptible power systems (UPS)-
Part 3: Method of specifying the performance and test
requirements



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1.8 TYPE TESTS, ROUTINE TESTS AND ACCEPTANCE TESTS:

Bidder shall submit valid type test reports (as per relevant IEC/IS Standard) for the tests carried out within last five years from 30.06.2009 (Technical bid opening date). The reports should have been conducted on identical or similar equipment/components to those offered. In case type test reports are more than 5 years old or the reports of type tests are found to be technically unacceptable, the type test shall be conducted by the vendor without cost and delivery implication to BHEL.

1.9 INSPECTION AND TESTING:

Before being fitted on the equipment, all components shall be subjected to routine tests at the Bidder's factory, as per the relevant IEC/IS standards. A detailed test report proving the successful passing of such tests shall be provided.

Prior to dispatch, the routine & acceptance tests shall be carried out on each battery set in accordance with the applicable IEC /IS and the material shall be offered for final inspection to BHEL and Powergrid in accordance with agreed quality plan with 3 weeks advance information.

Routine Test

The routine tests must be conducted on each unit and shall ensure the necessary manufacturing quality. The Manufacturer shall propose a test program, which is covering the requirements of standard systems. However, if any of the following tests is not covered, the manufacturer shall include them in his test plan.

UPS:

Visual inspection

Checking of auxiliary devices

Insulation test

Checking of the protective devices

Light load and functional test

Measurement of output voltage

Confirmation of output voltage adjustable range

Transfer test (static bypass switch)

1.10 QUALITY PLAN

The Bidder shall carry out contract works in accordance with sound quality management principles which shall include such as controls which are necessary to ensure full compliance to all requirements of the specification & applicable international standards. These quality management requirement shall apply to all activities during design, procurement, manufacturing, inspection, testing, packaging, shipping, inland transportation, storage, site erection & commissioning. Bidder shall submit detailed Quality Plan at contract stage for BHEL / Powergrid's approval.



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1.11 QUALIFYING REQUIREMENTS

A minimum of ten years' experience in the design, manufacture, and testing of solid-state UPS system is required. The bidder should meet the Standards ISO 90001 and CE certified. All these requirements must be fulfilled

1.12 Remarks:

1. Notwithstanding the details included in this specification, UPS along with 240V ACDB shall be supplied complete with mounting arrangement, fixing hardware, Relays, Transducers, Switches for interfacing with MACH-II System and other accessories as required for complete installation, putting in service and satisfactory operation.
2. Bidder to furnish unit prices of each type of MCCB, MCB, fuses, Relays, Transducers and Switches for each compartment of each panel including each type of accessories, for addition / deletion during detailed engineering / contract stage.
3. Minimum 25% spare feeders shall be considered for each type and rating of AC feeders as per SLD for 240V ACDB
4. Terminal Block details for each of the incoming and outgoing feeders in 240V ACDB (i.e. suitability for cable sizes) shall be intimated during contract stage

1.13 ANNEXURES

1. Refer Block diagram of Station UPS attached as Sketch - 1.
2. Refer UPS and its Battery location in Main Service Building Layout to check adequacy of space



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SECTION – 2

EQUIPMENT SPECIFICATION

2.1 PURPOSE

The UPS System of 50KVA (True one line double conversion VFI type as per IEC 62040-3) will be in standalone/parallel mode. Battery (Ni-Cd Type) backup has to be 30 Minute with each UPS module.

2.2 REFERENCE STANDARDS

The manufacture must demonstrate that it makes use of a quality management system in compliance with standard **EN ISO 9001:2000** for the design, production, sale, installation, maintenance and support of the uninterruptible power system.

The uninterruptible power system must have **CE marking** in accordance with the Directives on safety and EMC 89/336, 2006/95 and 2004/108.

The uninterruptible power system shall be designed and produced in compliance with the following standards:

- EN62040- 1: uninterruptible power system (UPS): General and safety requirements:
- EN62040- 1:-2: uninterruptible power system (UPS): General and safety requirements used in locations with restricted access:
- EN 62040-3: Methods of specifying the performance and test requirements:
- EN 50091 -2 and IEC 62040-2 electromagnetic compatibility.
- IEC60529, Degree of protection provided enclosures:
- IEC 60664: insulation for equipment within low-voltage system:
- IEC 60755: General requirements for residual current operated protective devices:
- IEC 60950: General safety requirements for information Technology equipment:
- IEC 61000-2-2: Electromagnetic compatibility immunity:
- IEC 61000-4-1: Electromagnetic compatibility – overview of IEC 61000-4 series:
- IEC 61000-4-2: Electrostatic discharge immunity test:
- IEC 61000-4-3: Radio –frequency, electromagnetic immunity test:
- IEC 61000-4-4: Electrical fast transients/burst immunity test:
- IEC 61000-4-5: surge immunity test:
- IEC 61000-4-6: Test for immunity to conducted disturbance induced by radio frequency fields:
- IEC61000-4-8: power frequency magnetic field immunity test:
- IEC 61000-4-11: voltage dips, short interruptions and voltage variations immunity test:



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2.3 EUROPEAN DIRECTIVES

LV2006/95/EC replace LV 73/23/EC and 93/68/EC

Low voltage Directive: contains provision relating to equipment safety and imposes the EC marking obligation from 1/1/97.

EMC 2004/108/EC

Electromagnetic compatibility directive: covers the immunity and emission aspects of UPS in installation environment and imposes the obligatory use of CE marking as from 1/1/96.

2.4 DESCRIPTION OF THE REQUIRED SYSTEM

The UPS must be of the on Line double conversion (VFI-SS-111 classification-as defined by standard IEC EN 62040-3) type with **a transformer on the output to the inverter:** the load shall always be powered from the inverter, which shall supply a sinusoidal voltage that is stabilized in voltage and in frequency .The UPS must also be provided with input and output filters which, together with the transformer, significantly increase the immunity of the load against mains interference and lightning.

The input stage of the UPS must be **IGBT (Isolated gate Bipolar Transistor) with DSP microprocessor digital control.**

The input must be compatible with the most critical installations and must, at the very least, anticipate the following blacks and peculiarities:

- **Isolation transformer in output to the inverter:**
- High short circuit current:
- Back-feed protection:
- Full and detailed diagnostics:

The UPS must be able to power the load for prolonged periods (by means of optional battery modules) or for periods that are sufficient for the closure of the computer system via supervision and shut-down software that must be provided as standard for the following operating system: windows95, 98, 2000, me, XP, NT 4.0, link, Mac os 9.X, osx, windows vista.

2.5 COMPOSITION OF THE UPS

2.5.1 RECTIFIER

The rectifier must be realized with a IGBT (Isolated Gate Bipolar Transistor) with technology DSP microprocessor digital control.

The rectifier must provide a “soft start” with a time programmable from 1 to 30 seconds (during this interval of time, current absorption goes from zero to normal operating rate), so that the current by the mains or generator is gradually absorbed.

In addition it shall be possible to test a power walk in delay timer programmable for 1 to 120 secs.



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This must convert the alternating voltage of the power supply line into direct-current voltage. The certifier shall carry out the following functions:

- Power the inverter with direct-current voltage :
- Ensure the battery is charged automatically.

The battery shall be charged in two stages: the first phase must provide 80% of the energy, with limited recharge and increasing voltage: the second must provide the remaining 20% capacity, with constant float voltage.

The recharge current must be automatically limited to 10% of the value of the capacity over 20h and must be adjustable. The maximum recharge current available may be greater at reduced load, in order to exploit the rectifier's potential in full with prolonged back-up times.

The rectifier must be able to power the inverter with a direct-current voltage at normal power, even if the input voltage is 25% lower than specified normal voltage: in this condition the batteries will not discharge.

The batteries must not cut in for in for mains interruptions of less than 20msec. this means that the inverter shall continue to power the load following micro interruptions without needing to draw energy from the batteries.

The battery charging circuit must be able to compensate the buffer changing voltage according to the ambient temperature (correction factor:-0.11% per °c)

2.5.2 BATTERIES

DC Batteries shall be stationary Nickel – Cadmium type. The batteries shall be medium discharge performance type. For the purpose of design, an ambient temperature of 40 degree Celsius and relative humidity of 100% shall be considered.

DC batteries shall be suitable for standby duty. The batteries shall normally be permanently connected to the load in parallel with UPS and shall supply the load during emergency conditions when AC supplies are lost.

Batteries shall be suitable for a long life under continuous float operations and occasional discharges. Nominal cell voltage shall be 1.2V & end cell voltage 1.14V. The batteries shall be boost charged at about 1.54 to 1.7 Volts per cell maximum and float charged at about 1.42 Volts per cell Batteries shall also be suitable for continuous operation for the maximum ambient temperature as specified elsewhere in the technical specification.

2.5.2.1 CONTAINER

Containers shall be made of polypropylene plastic material. Containers shall be robust, heat resistant, leak proof, non-absorbent, alkali resistant, non-bulging type and free flaws such as wrinkles, Cracks, blisters, pin holes etc. Electrolyte level lines shall be marked on containers.



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2.5.2.2 VENT PLUGS

Vent plugs shall be provided in each cell. They shall be of anti- splash type, having more than one exit hole and shall allow the gases to escape freely but shall prevent acid from coming out. The design shall be such that the water loss due to evaporation is kept to minimum. In addition, the ventilator shall be easily removed for topping up the cells and of Such dimensions that the syringe type hydrometer can be inserted into the vent to take electrolyte samples.

2.5.2.3 PLATES

The plates shall be designed for maximum durability during all service conditions including high rate of discharge and rapid fluctuations of load. The construction of plates shall conform to latest revisions of IS: 10918/ IEC as applicable. The separators shall maintain the electrical insulation between the plates and shall allow the electrolyte to flow freely. The positive and negative terminal posts shall be clearly marked.

2.5.2.4 SEDIMENT SPACE

Sufficient sediment shall be provided so that cells will not have to be cleaned out during normal life and prevent shorts within the cells.

2.5.2.5 CELL INSULATOR

Each cell shall be separately supported on PVC/porcelain/hard rubber insulators fixed on to the racks with adequate clearance between adjacent cells.

2.5.2.5 ELECTROLYTE

The electrolyte shall be prepared from battery grade potassium hydroxide conforming to BS: 1069. The cells shall be shipped either in charged condition or in dry condition. Necessary electrolyte for make-up shall be supplied separately.

2.5 .2.6 MANUFACTURE'S IDENTIFICATION SYSTEM

The following information shall indelibly marked on outside of each cell:

- Manufacture's Name and trade mark
- Country and year of manufacture
- Manufacture's type designation
- AH capacity at 5 hour discharge rate
- Serial Number



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2.5.2.7 CONNECTORS AND FASTENERS

Nickel coated copper connectors shall be provided for connecting up adjacent cells and rows. Bolts, Nuts and washers shall be effectively nickel coated to prevent corrosion. The thickness of nickel coating of connectors should be not less than 0.02mm. All the terminal and cells inter-connectors shall be fully mutated shrouds. End take off connectors from positive and negative poles of the batteries shall be provided for end connections to the power cables. More than one cable may be required to be connected to the battery terminals. Suitable arrangement for termination of multiple cables shall be provided so as to avoid extra load on the battery terminals. The cable will be single core having stranded copper conductor and PVC insulation.

All connectors and lugs shall be capable of continuously carrying the 30 Minute discharge current of the respective Batteries and through fault short current which the battery can produce and withstand for the period specified.

2.5.2.8 BATTERY RACKS

Mild steel racks shall be provided for all Batteries. They shall be free standing type mounted on porcelain/hard rubber/PVC pad insulators. Batteries shall preferably be located in the single tier arrangement. However, batteries having a complete cell weight of lower than 50 kg could be located in the double tier arrangement. The batteries racks and supports for cable termination shall be coated with three (3) coats of anti-alkali paint of approved shade. Name plate, resistant to alkali, for each cell shall be attached on to the necessary racks.

2.5.2.9 TESTS

Batteries shall conform to all type tests as per the latest issue of IS: 10918/ IEC - 60623 as applicable. The Bidder shall submit for ABB/Powergrid approval the reports of all the type tests at contract stage as per clause 1.4 of Section -1.

2.5.2.10 PACKING & MARKING

The cells shall be suitably packed as per relevant standards so as to avoid any loss or damage during transit. Loose item such as connectors, copper rods, hardware, insulators and accessories etc. shall also be packed in cases.

2.5.3 INVERTER

The inverter must convert the direct-current voltage in to stabilize sinusoidal alternating voltage for the power supply to the load. With the UPS in “on line” mode, the connected load must always be powered from the inverter.

The inverter must be **IGBT (Isolated Gate Bipolar Transistor) with DSP microprocessor digital control.**



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The inverter shall be provided with its own current limiting circuit so that any short circuits do not damage the components. This circuit shall be sized so that the inverter can power a phase-neutral short circuit with a current of 300% of the nominal current for a time of 1 second; at the end of time the inverter shall be automatically withdrawn from service.

The inverter shall also be able to manage overload conditions for variable periods of time according to its level, and more specifically.

- 60 minutes for single phase overloads that are 110% of the nominal load.
 - 10 minutes for single phase overloads that are 125% of the nominal load
 - 1 minutes for single phase overloads that are 150% of the nominal load
 - 7 second for single phase overloads that are 200% of the nominal load
 -
- After this time the load shall be transferred, without any interruption, on to the By-Pass line.

2.5.4 AUTOMATIC BYPASS

The By-pass device must allow the synchronized Passage, either automatic or manual, in zero time (by means of SCR static technology) of the power supply to the load from a protected line (INVERTER output) to an unprotected line (By-pass line) or vice versa.

It may be provided with a back-up power supply that is separate from the main power supply.

The by-pass must also be provided with a protection device, commonly called back-feed protection, to prevent, in the event of a failure of the SCRs, a back-feed of voltage on the mains power supply. This device must comply with standards EN62040-1-1 and DK56000.

2.5.5 MANUAL BYPASS

The UPS must be provided with a non-automatic maintenance circuit breaker; by closing the manual by-pass and opening all the other circuit breakers, the UPS is excluded while keeping the load in output powered.

This operation is necessary in order to carry out maintenance operations inside the equipment.

The manual by-pass line must be sized for the nominal power of the UPS

2.5.6 AUTOMATIC PHASE SEQUENCE REVERSAL CORRECTION

The system **should** be capable of supplying power to load from commercial mains without any break, in case of phase reversal at the input. **The UPS should not draw power from batteries or it should not transfer in to bypass in case of input phase reversal.** In case



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the feature is not available in the standard design of UPS the bidder to provide an external back-to-back thyristor in conjunction with series and parallel contractors.

2.5.7 STARTING UP FROM BATTERY(COLD START)

This device makes it possible to switch on the UPS even in the event of a mains failure using only the battery energy.

2.5.8 INTERFACE CARD

The UPS must contain, as standard, an interface card having the following minimum features:

- Be equipped with at least two RS232 serial ports:
- Have the availability of at least 12 potential-free contacts for the remote signaling of the main reports.
- Have the possibility of acquiring four input signals from the field (settable) to enable the remote shutdown of the inverter and UPS, battery recharge inhibition with motor generator and other two programmable inputs;
- Be set to receive the (isolated) emergency shutdown command, commonly known as Emergency power off (E.P.O.)

2.5.9 MIMIC PANEL

This must provide the user with visual (by means of LEDs and LCD display) and audible (by means of buzzer) reports on the status of the UPS. It shall also allow the control, diagnostics monitoring and personalization of the UPS through easy access to the display menus;

2.6 DESCRIPTION OF OPERATION

The Uninterruptible power system, by means of DSP digital control, may operate in accordance with the following type of operation:

- Double conversion operation:
- Line Interactive operation:
- Smart Economy operation;

It shall be possible to select the mode of operation from the mimic panel, by means of special codes.

The input stage with IGBT technology shall guarantee a value lower than 3% of harmonic distortion current (THDI) rejected in the mains supply.

The IGBT inverter must be constantly synchronized with the stand-by mains, in order to enable the transfer of the load from the inverter to the back-up mains and vice versa without any interruption of the power supply to the load.



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In any mode of operation, the battery charger must supply the energy needed to keep the accumulator battery at the maximum charge level.

2.6.1 DOUBLE ONVERSION OPERATION (ON LINE)

In this mode of operation, in normal conditions of service, the power supply to the applications shall always be provided from the inverter, guaranteeing the maximum protection to the load.

If the primary main is not present or when it is outside the admitted range, the power supply to the applications shall be assured by the accumulator battery through the inverter during this phase, the accumulator battery will be in discharging conditions. The user shall be notified of the operating status by both visual and audible reports. A diagnostic algorithm shall calculate the residual available back-up time.

When the primary mains returns within the admitted limits, the uninterruptible power system shall automatically go back to operating in normal mode.

If the inverter should stop (voluntarily or due to the triggering of a protective device) or if there should be a temporary overload downstream of UPS, the application shall be automatically transferred, without any interruption, onto the stand-by mains.

2.6.2 LINE INTERACTIVE OPERATION (STAND BY ON)

In this mode of operation, in normal conditions of service, the power supply to the applications shall always be provided by the stand-by line through the static switch. The quality of the direct line shall be constantly monitored by means of algorithms carried out in real time by the DSP control.

In the event of a stand-by line outside the allowed range, the load shall be automatically transferred, without any interruption, onto the inverter line.

If the primary main is not present, the power supply to the applications shall be assured by the accumulator battery through the inverter. During this phase, the accumulator battery will be in discharging conditions. The user shall be notified of the operating status by both visual and audible reports. A diagnostic algorithm shall calculate the residual available back-up time.

When the quality and reliability of the direct line return within the allowed limits, the uninterruptible power system shall automatically go back to powering the load this.

2.6.3 SMART ECONOMY OPERATION (SMART ACTIVE)

In this mode of operation, in normal conditions of service, the UPS may autonomously activate on Line or stand-by on operation according to the quality of the power supply.

When this mode is activated, the UPS power supply source shall be monitored for a few minutes, at the end of which, if the values have remained within the preset limits, the load shall be switched onto the By-pass line without any interruption. Otherwise, the load must remain powered by the inverter, while the monitoring must be repeated, for longer periods



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this time, in order to check the quality of the by-pass line, before deciding whether or not to active the transfer of the load the emergency line.

2.6.4 MODULAR POWER SUPPLY (PARALLEL CONNECTION)

In order to guarantee maximum reliability, the UPSs shall be connected in parallel to others of equal. It must be possible to connect the units in parallel with others of the same type (up to a total of 2 units) at the installation site.

The UPSs may be connected in parallel either to increase the power of the uninterruptible system (power parallel) or to improve reliability (the stopping of one UPS must not cause loss of the power supply, thus providing a redundant configuration).the parallel connection must be of the “distrusted” type (each UPS shall therefore have automatic by-pass).

Both the connection and the configuration of the parallel UPSs must be easy to execute and may also be carried out subsequent to the installation of the first unit, by means of a parallel kit for the connection between UPSs.

The operation shall not require manual calibration since the digital control must provide for the balance of currents between the UPSs and for the exchange of information needed for this type of configuration.

The information shall be exchanged between the UPSs via signal cables; in order to guarantee redundancy in the interconnection cable, these connections shall be of the ring type so that the system will not fail if the signal cable should break.

Communication shall be effected by means of an opt-isolated system, in order to keep the control system of the individual UPSs electrically isolated from each other.

2.7 COMMUNICATION

2.7.1 MONITORING & SHUT DOWN SOFTWARE INCLUDED

The system must be provided with the related software to guarantee efficient and intuitive management of the UPS, displaying by means of bar graphs all the main information such as input voltage, applied load, battery capacity, etc.

The software must be able to give detailed information even in the event of a failure of the UPS, in support of the failure diagnostics. It must be developed with a client/server architecture that makes it flexible and easy to manage, and it must have multilingual support and on-line help.

The software must be supplied with the UPS, SNMP agent included, for the following operating systems: windows 95,98,2000,Me,NT4.0,nonell,Linux,Macos 9.X, OXS, windows Vista. The software must also allow weekly programming of UPS start-up and shutdown in automatic mode.



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2.7.2 MIMIC PANEL

The UPS shall be provided with a liquid crystal display (LCD), through which it shall be possible to get information, display status and/or alarm messages or insert commands.

2.8 ENVIRONMENTAL CONDITION

The UPS shall be able to withstand the following environmental conditions without damage or degradation of operating characteristics:

2.8.1 OPERATING AMBIENT TEMPERATURE

UPS Module: 0 °c to 50 °c, if operating temperature is below than the required temperature than dreading @ 1.5% per degree should be considered. (Supporting document should be attached) Battery: 25± 5 °c

2.8.2 STORAGE/ TRANSPORT OPERATING AMBIENT TEMPERATURE

-25 °c to 70 °c

2.8.3 RELATIVE HUMIDITY

<100% at 20 °c

2.8.4 ALTITUDE OPERATING

Site Altitude above sea level is less than 1000.

2.8.5 AUDIBLE NOISE

Noise generated by the UPS under any condition or normal operation shall not exceed 65 dbA measured 1.0 meter from surface of the UPS.

2.9 QUALITY ASSURANCE

2.9.1 MANUFACTUREE QUALIFICATIONS

A minimum of ten years' experience in the design, manufacture, and testing of solid-state UPS system is required. Standards ISO 90001, CE certified. All these certified must be full fill.

2.9.2 FACTORY TESTING

Before shipment, the manufacture shall fully and completely test the system to assure compliance with the specification.



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2.9.3 COOLING

Cooling of the UPS shall be forced-air through redundant fans.

2.10 FIELD ENGINEERING SUPPORT

The UPS supplier shall directly employ a national field service network staffed by trained field service engineers to provide start up, maintenance and repair of the UPS equipment.



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UPS SYSTEM

TECHNICAL PARAMMETERS & COMPLIENCE STATEMENT

(To be filled up and enclosed along with the tender)

Sl. No.	Parameter	Requirement as per Specification	Compliance or otherwise shall be confirmed against each item by the bidder
1	UPS Make offered	To be furnished	
2	Technology	The UPS must be of the DSP controlled On line double conversion (VFI-SS-111 classification – as defined be standard IEC EN 62040-3) type with a transformer on the output to the inverter. “CE Marked”	
3	System Rating	As per calculated requirement	
4	System Configurations	Parallel Redundant Configuration	
5	Rectifier Section		
5.1	Technology	The rectifier must be realized with an IGTB (Isolated Gate Bipolar Transistor) technology with DSP microprocessor digital control VFI Based UPS System.	
5.2	Operating Parameters:		
5.2.1	Input Voltage rating	380/400/415V (user selectable) 3 phase, 4 wire + ground, Dual AC Input with automatic changeover facility	
5.2.2	Input Voltage range	415+/-10%	
5.2.3	Input frequency	50 Hz ± 10%	
5.2.4	Power Walk in	The rectifier must provide a “soft start” with a time programmable from 1 to 30 seconds. In addition shall be possible test a power walk in delay timer programmable for 1 to 120 seconds	
5.2.5	Power factor at nominal voltage (415V) and battery charged from 25% to 100%	>0.99	



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	of the load.		
5.2.6	Current Harmonic distortion (THDI) (with mains distortion $\leq 2\%$) . Load 100% . Load 75% . Load 25 - 50 %	< 3 % < 5 % < 8 %	
6	Inverter Section		
	Technology	Microprocessor based PWM-based Technology	
6.1	UPS output factor	0.85 Lagging. (between load power factor 0.8 Lag to 0.9 lead without de-rating).	
6.2	Output voltage rating	415V, 3 phase, 4 wire + ground	
6.3	Output voltage regulation	± 1% steady state for a static 100% unbalanced load	
6.4		± 5% steady state for a dynamic 100% unbalanced load	
6.5	Voltage distortion with linear load	1% (typical), 2% (max)	
6.6	Voltage distortion with non-linear load(EN 62040-3)	<3%	
6.7	Out frequency	± 0.05% free running.	
6.8	Output harmonic distortion (Ph/N)	3% THD maximum and 1% any single harmonic for a 100% linear load 5% THD maximum for a 100% nonlinear load.	
6.9	Crest factor:	3:1 minimum	
6.10	Voltage Transient Response	± 3% for a 5% load step. ± 5% for a 100% load step.	
6.11	Voltage Transient recovery Time within +/-1%.	20 milli- seconds.	



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6.12	Phase Displacement	120 degrees ±1 degree for balanced load.	
		120 degrees ±1 degree for 50% un balanced load.	
7.0	Overload capability (Single phase)	125% for 10 minutes in normal operation.	
		150% for 10 seconds in normal operation.	
8.0	AC to efficient	Min. 93% at 100% load in double conversion mode at nominal input voltage with battery fully charged.	
9.0	Back feed protection	To be provided as standard feature	
10.0	Input phase sequence correction circuit	This device makes it possible to switch on the UPS even in the event of a mains failure using only the battery energy.	
11.0	Hot insertion/disconnection	The UPS should work in parallel redundant load sharing mode. Three should be redundant communication cable & control (Redundant signal cable between individual units). It allows hot insertion and the hot disconnection of UPS modules without affecting loads.	
13.0	Acoustical Noise	<65 dB (A) of noise typical, measured at 1 meter from the operator surface.	
14.0	Output wave form	Pure sine wave	
15.0	Transient recovery time.	Within 20 milliseconds to ±1%	
16.0	Heat losses	To be furnished	
17.0	MTBF of the system	Minimum 1, 00,000 hour for standalone system with static bypass and batteries.	
18.0	Automatic integral bypass	The integral by pass shall perform an automatic transfer of the critical load from the inverter to the bypass, in the events of overload, over temperature, or inverter failure conditions with zero transfer time.	
19.0	Automatic restart	Upon restoration of mains AC power, after a mains AC power outage and complete battery discharge, the UPS	



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		shall automatically restart and resume supplying power to the critical load and the battery charger shall automatically recharge the battery.	
20.0	Output Galvanic Isolation Transformer	To be provided as standard at inverter output within the UPS cabinet to provide separate neutral in Delta star configuration.	
21.0	Display and control		
21.1	Metered parameters	Input AC voltage (line to line , three phase simultaneously)	
		Input AC current	
		Output AC voltage.	
		Output AC current	
		Battery temperature	
		Out peak current	
		Battery voltage	
	Battery current (charge/discharge.)		
21.2	Event log	Display a log of status and alarm events to be provided for up to 120 events on the front panel display.	
22.0	Internal Manual maintenance bypass	To be provided	
23.0	Charger temperature compensator	To be provided	
24.0	Remote UPS monitoring kits.	Be able to connect to a LAN network, using the main network communication protocols(TCP/IP,HTTP and SNMP)	
25.0	Protection	Output fully isolated form input(Bypass is disabled)	
		Built in overload	
		Built in short circuit	
		MCB protection at input	



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		Over temperature sensing circuit	
26.0	Alarms	Mains fail	
		Low battery over load	
		Over load	
		UPS on bypass	
		UPS on battery	
27.0	Software capability	The UPS shall be capable to communicate with network operating system and shall be capable of doing safe shutdown of critical load by means of a auto shutdown software.	
28.0	SNMP/Web management	To be provided	
29.0	Operating Ambient temperature	0°c to 40 °c, if operating temperature is below than the required temperature than de-rating @1.5% per degree should be considered.(supporting document should be attached)	
30	Relative Humidity	< 100 % at 20 degree C	
31	Altitude Operating	To 1000 meters above mean Sea Level	
32	Degree of protection	IP20	
33	Battery Parameters		
33.1	Type	Nickel cadmium pocket Plate type	
33.2	Make	HBL/ AMCO-SAFT Battery having design life 20 year or higher (Subjected to manufacturer operating conditions)	
33.3	Battery charger	Current limiting max voltage 1.42 volts per cell	
33.4	Battery backup	30 min with each UPS for all the ratings with full load.	
33.5	Max. charging current	10 % of AH rating	
33.6	Battery rating for each UPS in VAH	To be furnished	



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34	Overall Weight & dimensions		
34.1	Overall dimensions of Battery bank	To be furnished	
34.2	Over all Weight		
	UPS System	To be furnished	
	Batter bank	To be furnished	



±800KV, 6000MW, HVDC MULTI-TERMINAL NER/ER – NR/WR
INTERCONNECTOR-I PROJECT

STATION UPS (UN-INTERRUPTIBLE POWER SUPPLY)

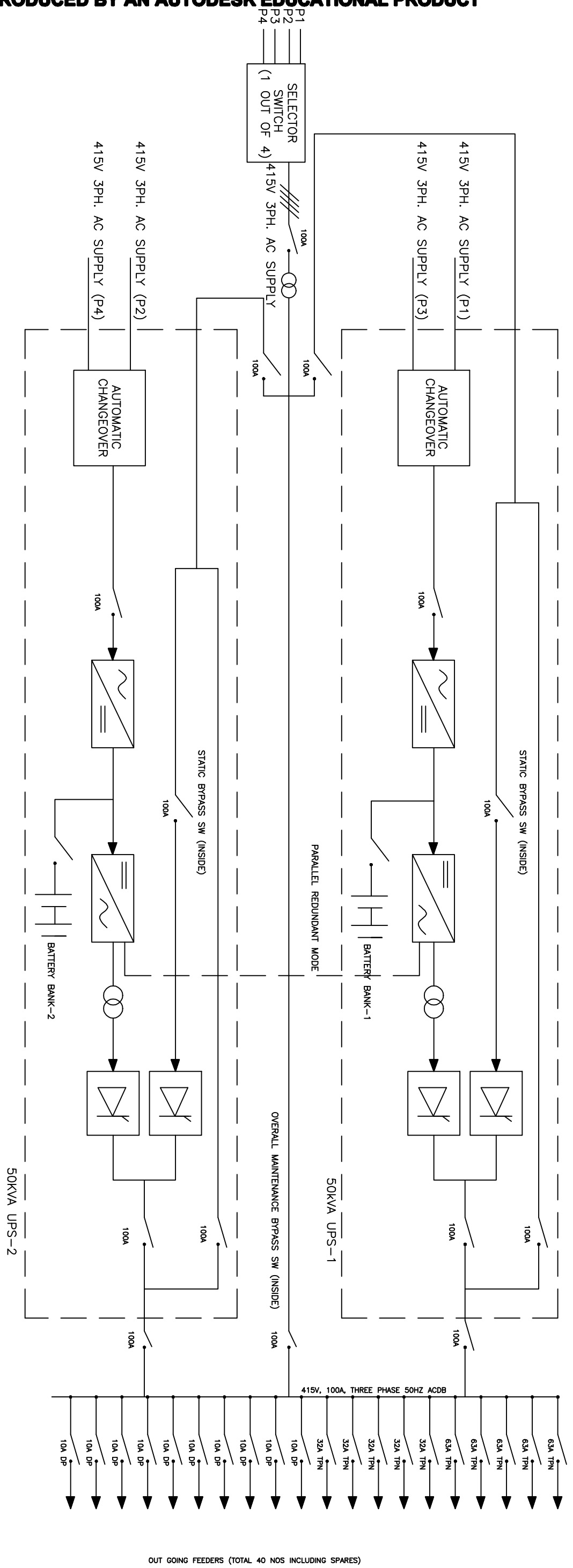
Doc. No. : TB-343-561-026, Rev. 00

SECTION – 3

PROJECT DETAILS AND GENERAL TECHNICAL REQUIREMENTS

Please refer Technical Specification Document No. **TB-343-316-00, Rev 02** titled

“General Technical Requirements – Section -3 “



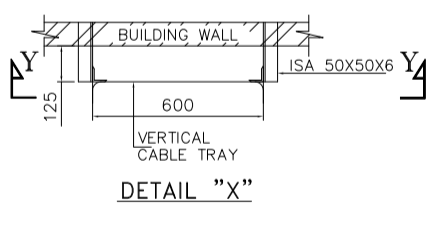
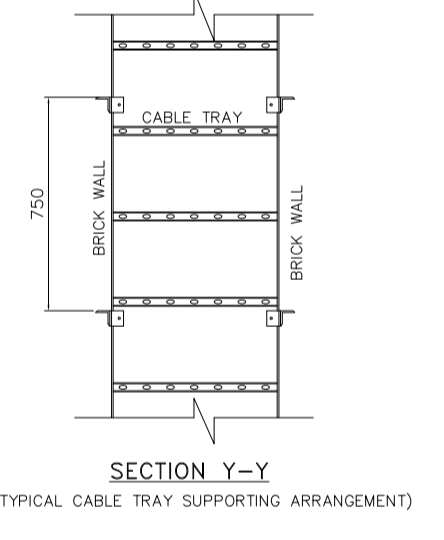
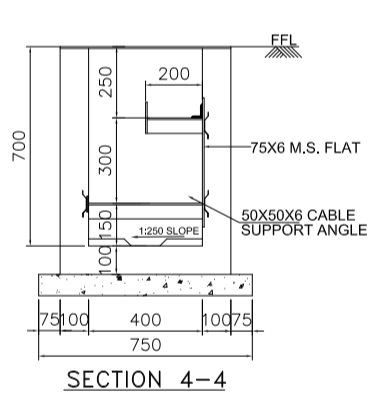
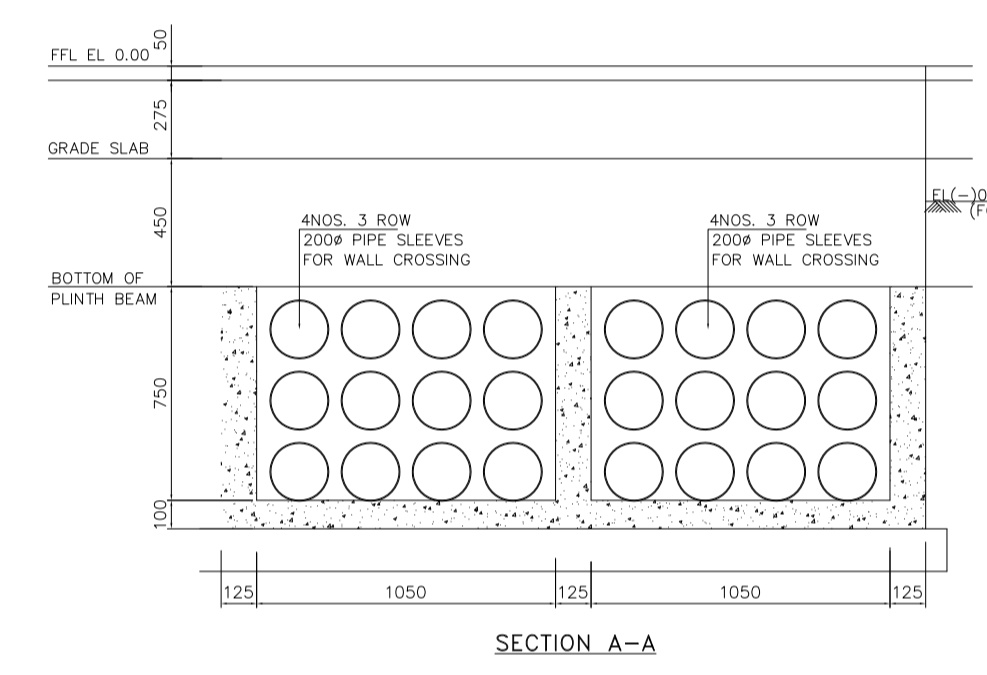
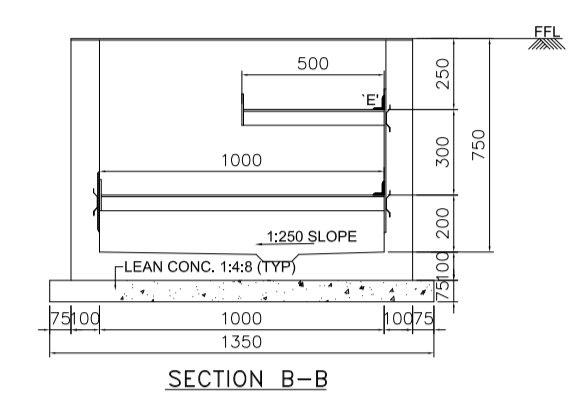
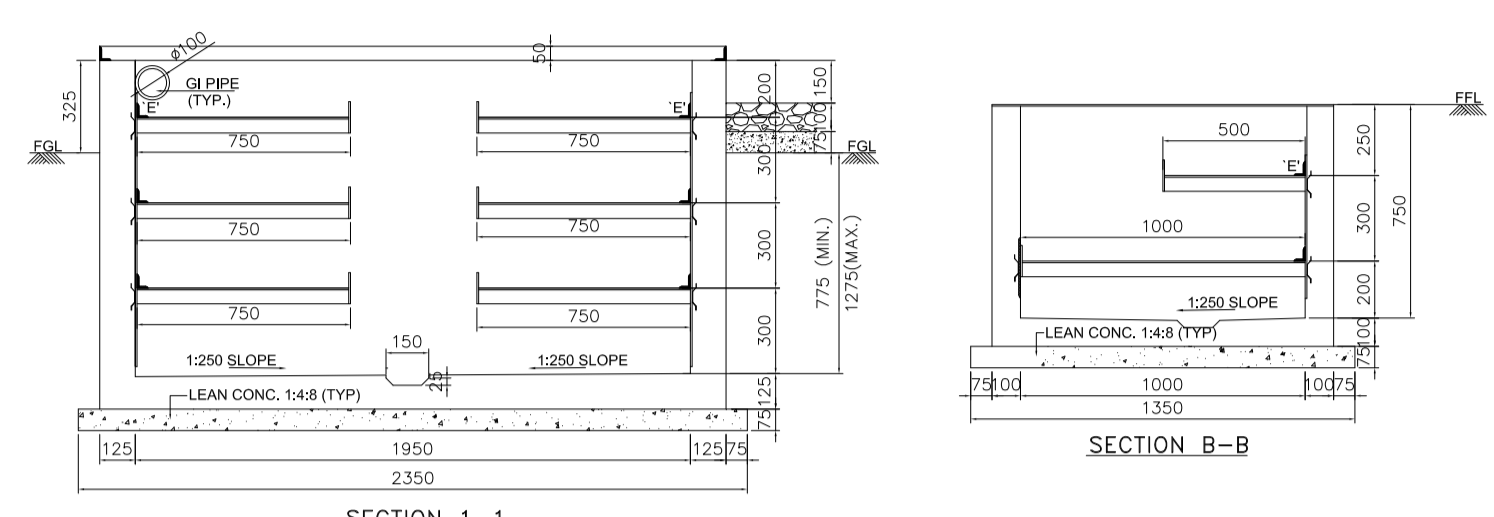
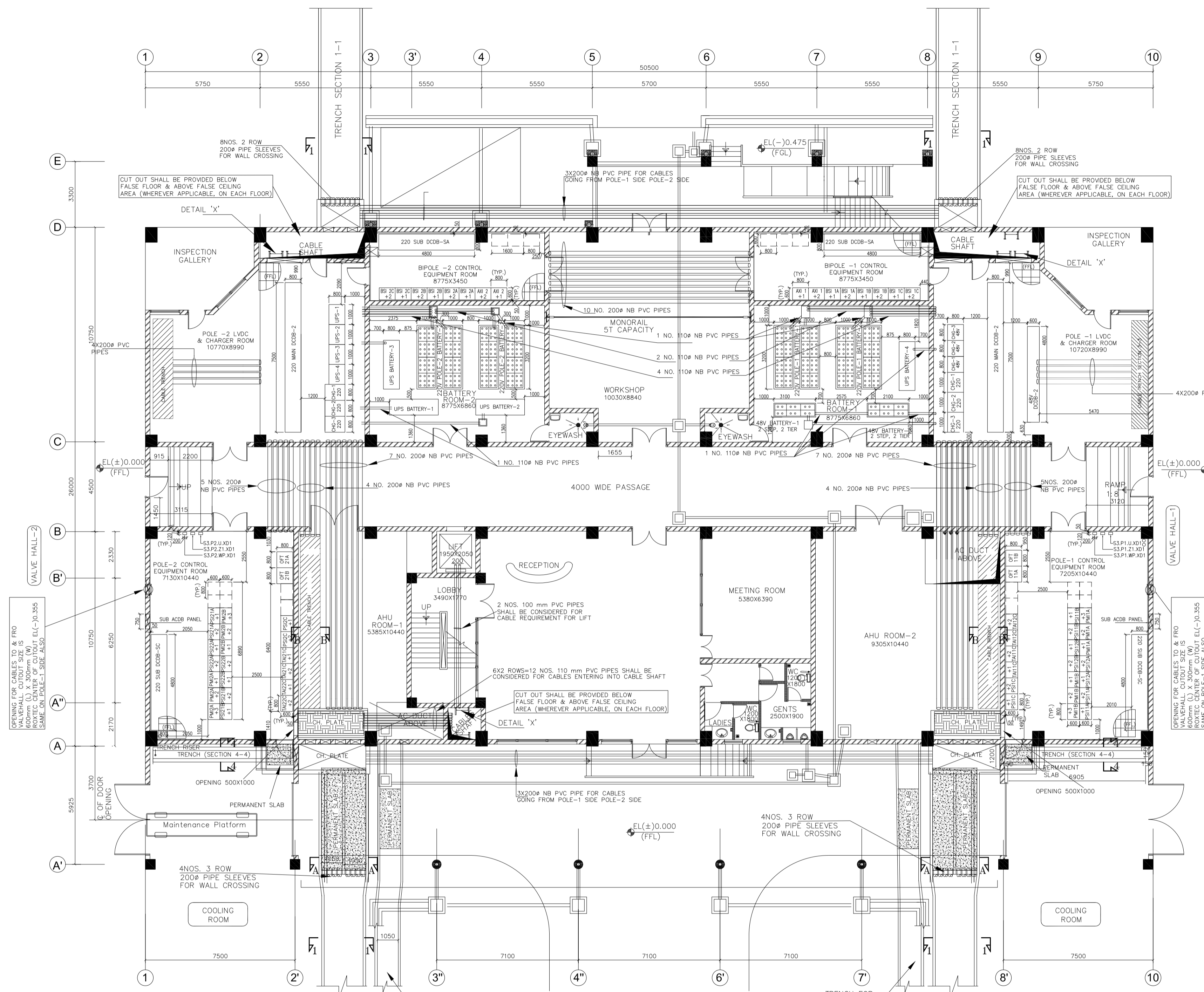
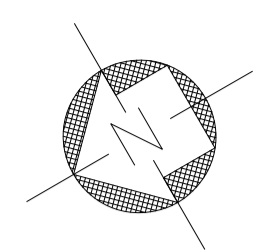
OUT GOING FEEDERS (TOTAL 40 NOS INCLUDING SPARES)

OUTGOING FEEDER DETAILS

- 3 PH 63A – 5 NOS.
- 3 PH 32A – 5 NOS.
- 1 PH 10A – 30 NOS.

UPS SYSTEM
(SLD FOR ONE SET)

SKETCH-1



PLAN AT EL(+0.275M LVL)
(SCALE 1:100)

NOTE:-

- ALL DIMENSION ARE IN MM.
- DIMENSIONS OF INABB PANELS, DCDB, BATTERY AND CHARGER ARE INDICATIVE ONLY. ACTUAL DIMENSIONS AWAITED.
- NO. OF PIPES BASED ON 40% FILL CRITERIA. 60%VOID (MAX 40% FILLING) SHALL BE MAINTAINED IN EACH CONDUIT.
- CABLE TRENCH SECTION SHOWN IN THE DRAWING FOR REFERENCE ONLY. CIVIL CONSTRUCTION DRAWING SHALL BE FOLLOWED FOR CONSTRUCTION OF CABLE TRENCH.
- ALL PVC PIPE SHALL BE HEAVY DUTY TYPE.
- AFTER LAYING THE CABLES THE ENDS OF PIPES PREFERABLY BE SEALED TO PREVENT INGRESS OF WATER INSIDE THE PIPE.
- CONTROL CABLES, FIBER OPTICS CABLES & POWER CABLES MUST BE LAID IN SEPARATE PVC PIPES.
- THE PURPOSE OF TRENCH LAYOUT DRAWING IS FOR USE AS FOLLOWS:
 - TO BE USED AS CIVIL INPUT FOR CABLE TRENCHES.
 - FOR CABLE LAYING.
- ALL CABLE SHAFTS & AC DUCTS SHALL BE PROVIDED WITH A MAINTENANCE DOOR FOR ENTRANCE/EXIT IN ANY ONE FLOOR (I.E. GROUND FLOOR OR FIRST FLOOR)

ADDITIONAL INFORMATION W.O.No. STATUS OF DRAWING DISTRIBUTION OF PRINTS		ग्राहक/परियोजना का नाम NAME OF CUSTOMER/PROJECT POWER GRID CORPORATION OF INDIA LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ±800KV, 600MM, HVDC MULTI-TERMINAL NR/WR INTERCONNECTOR -I PROJECT	
REV. DATE ALTERED CHECKED APPROVED 01 14.06.13 CHECKED NK APPROVED AG		भारत हेवी इलेक्ट्रिकल्स लिमिटेड BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION PROJECTS DIVISION	
REV. DATE ALTERED CHECKED APPROVED ZONE AS PER DISCUSSION WITH POWERGRID DATED 12.06.13		नाम /NAME रस्ता./SIGN. दि./DATE RK NK AG 24.05.13	
REV. DATE ALTERED CHECKED APPROVED ZONE		अनुपात / SCALE कार्ड कोड CARD CODE	
REV. DATE ALTERED CHECKED APPROVED ZONE		विभाग DEPT. कोड CODE शीर्षक/TITLE PANEL LAYOUT SERVICE BUILDING (GROUND FLOOR) AGRA	
REV. DATE ALTERED CHECKED APPROVED ZONE		कुर्डीग.क./DRAWING NO. TB-1-306-316-230 पुनः/REV. 01	
REV. DATE ALTERED CHECKED APPROVED ZONE		पृष्ठ कं./SHEET No. 01 अगला पृष्ठ/NEXT SHEET 02	

COMPUTER DRG. PATH NAME :
 REF. DRG. No.
 SIGN. & DATE
 INVENTORY No.

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