SECTION-C

TENDER NO. IPR/TN/PUR/TPT/ET/18-19/47 DATED 09/01/2019

TECHNICAL SPECIFICATION

FOR

1500 kW, 600 V, 2500 A Solid State Regulated AC to DC Converter (Rectifier) Unit

INSTITUTE FOR PLASMA RESEARCH
BHAT, GANDHINAGAR – 382 428
GUJARAT, INDIA

SECTION-C

TENDER NO. IPR/TN/PUR/TPT/ET/18-19/47 DATED 09/01/2019

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1. SCOPE OF SUPPLY :

a) Scope of supply includes Design, Engineering, Manufacture, Factory Acceptance Testing, Supply, Installation and Site Acceptance Testing of *1 (one) unit of 1500 kW, 600V, 2500 A Solid State Regulated AC to DC Converter (Rectifier) unit along with accessories and recommended spares* at Institute for Plasma Research (IPR), Gandhinagar as per the technical specifications (including annexures) mentioned in this tender document.

b) The scope of the bidder shall be deemed to include all such items which although are not specifically mentioned in the tender documents and/or in bidder's proposal but are needed to make the system complete in all respects for its safe, reliable, efficient and trouble free operation and the same shall be supplied and erected unless otherwise specifically excluded.

c) Bidders shall confirm total compliance to the specification without any deviation from the technical and quality assurance requirements stipulated in this document**.**

2. SCOPE OF WORK:

The scope of works includes, but not limited to, the following main tasks:

a) Design of regulated rectifier unit as per technical specifications.

b) Submission of detailed engineering design report/documents, drawings, quality plan and manufacturing schedule, FAT & SAT procedures for IPR's review and approval.

c) Material procurement, fabrication, and assembly of the rectifier unit as per functional requirements, and as may be required for complete design and development of 1500 kW, 600 V, 2500 A DC Rectifier unit

d) Arrange the stage wise inspections as per approved Quality Plan and implementation of modifications (if any).

e) Perform the Factory Acceptance Tests (FAT) as per approved acceptance test procedure complying the specifications as specified.

f) Upon receipt of dispatch clearance note from IPR, Pack and Deliver the rectifier unit and recommended spare (if any) at IPR site.

g) Installation of Rectifier system including control system interface integration and input/output power connection etc. at site.

h) Perform the Site Acceptance Tests (SAT) as per approved acceptance test procedures.

i) Provide operational and instruction manuals with full technical details.

j) Provide training of the operation and maintenance for minimum 2 people at IPR.

k) Provide FAT and SAT reports with all tests results, to the IPR before final acceptance.

l) Provide technical support as per warranty clause.

3. APPLICATION DESCRIPTION:

The 500 kV DC Ultra High Voltage Power Supply (UHVPS) System is being developed at IPR for supplying DC Power to Particle Accelerator of rating up to 500 keV / 1000 kW. The UHVPS being developed using three stage power conversion as shown in Fig.-1. The first stage regulated AC to DC Converter (Rectifier) unit (SCOPE OF SUPPLY OF THIS TENDER) will supply DC power to second stage i.e. five modules of regulated DC to AC Converters (Inverter) each rated for 300 kVA, 400 V, 400 Hz, three phase output and are connected in parallel. Each inverter module will drive third stage i.e. one High Voltage AC to DC Converter (HV Rectifier) unit to produce 100 kV DC output. All five high voltage rectifier units will be series connected to produce 500 kV DC output. The 500 kV UHVPS will be course and fine regulated and controlled by first stage rectifier unit and second stage inverter units respectively.

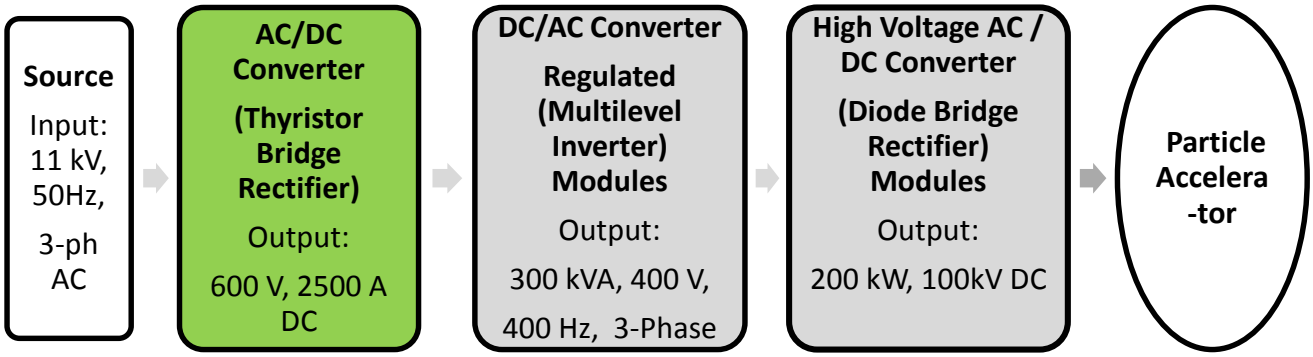

Figure 1: General Block Diagram of 500 kV DC Ultra High Voltage Power Supply (UHVPS)

4. TECHNICAL SPECIFICATIONS:

The Rectifier unit shall be designed and supplied as per the technical specifications defined in Table-1.

Table-1: Technical Specifications

Sr. No.	Parameters	IPR Requirement
1.	**Site Condition**	
a)	Ambient Temperature (maximum/minimum/average (annual))	47 ºC / 4 ºC / 35 ºC
b)	Relative Humidity (maximum / minimum)	90 % / 17 %
c)	Altitude	55 meters above MSL
d)	Installation	Indoor
2.	**Input Supply**	
a)	Input Line Voltage	11 kV ± 10%, 3 phase

b)	Input Line Frequency	50 Hz ± 3 %
c)	Input Line Fault Level	200 MVA
d)	Type of input supply Earthing	Solidly earthed
3.	**Performance Requirement**	
a)	DC output voltage	600 V
b)	DC output current	2500 A
c)	Rated output power	1500 kW
d)	Stability of output Voltage set point	± 1%.
e)	Ripple pk-pk	≤ 10 % @ 20% load
f)	Input Power factor	≥ 0.9 (lag) at rated output power
g)	Efficiency	≥ 90 % at rated output power
h)	Total Harmonic Distortion (THD) % at supply line	as per IEEE 519-1992
i)	Output overloading	100 % for Continuous; 120% for 60 sec.
j)	Control Mode	Constant Voltage (CV)
k)	Voltage Regulation range	20% - 100 %
l)	Control precision	≤ 1 %
m)	Response time	150 msec. or better
n)	Rectifier topology/configuration	Thyristor Bridge Rectifier OR Equivalent
o)	Cooling	Rectifier: Air cooled Transformer: Oil Cooled
p)	Protection class	IP 30
q)	Protection	Over-current, over-voltage, short circuit, Heat-sink over temperature, Semiconductor device Fuse failure, transformer over temperature etc...
4.	**Rectifier Controls, Monitoring and Protections**	
a)	Local Control Panel	• Measurement: AC and DC Voltage and Current • Control Parameters: i. Set Output Voltage: Multi-turn potentiometer (lockable) / HMI ii. Operation/ Mode Section - Local / Remote ; Auto / Manual; Selector switch with keys / illuminated lamp iii. Rectifier ON - Illuminated Push buttons iv. Rectifier OFF/ Emergency stop – Mushroom head Push button v. Fault / Fault reset – Illuminated Push button.

		vi. AC mains ON – Illuminated Push buttons vii. AC mains OFF – Illuminated push button.
b)	Provisions for integration with Remote Master Control Panel (MCP)	• Interface type: i. Fiber Optic cable • Interface signals: ii. All major monitoring and control parameters available at Local control panel.
5.	**Power Supply terminations:**	
a)	Input	11 kV grade XLPE Cable
b)	Output	Suitable Copper Bus bar
c)	Intermediate (between transformer and bridge rectifier)	Suitable Copper bus-bar/bus-duct
6.	**Applicable Standards**	**IEC 60076; IEC 60146 1-4; IEC 61378**

5. DESIGN REQUIREMENTS:

5.1 Step-down Transformer

a) The AC/DC rectifier system shall include step-down transformer to transform the input supply voltage to required output voltage in conjunction with the ac/dc conversion.
b) The step-down transformer shall be designed as per IS 2026 / IEC 60076-5.
c) The transformer shall operate without injurious heating at the rated kVA at any voltage within ± 10% of the rated voltage. The frequency variation is within ± 5 %.
d) The transformer shall be capable of overloading as per IS. The mechanical structure and clamping should be designed for the overload duty also, and detailed analysis to prove that the transformer design meets the requirement shall be submitted before manufacture of the transformers. The manufacturer should guarantee that no deterioration to insulation system or life results on account of such an overloading pattern.
e) The transformer shall be designed for its normal rating with only ONAN, Oil Natural, Air Natural Cooling. Suitable radiator banks to be used. During continuous loading, the winding and oil temperatures should not exceed specified values. No fans to be provided.
f) Transformer, complete with bushings, Bus Ducts/bus-bars shall be designed and constructed to withstand without damage, the effect of external short circuit, as per specified standard.
g) Transformer shall be designed and constructed to withstand forces generated under full short circuit conditions. Design calculations shall be submitted for Purchaser's approval after placement of purchase order.
h) Calculations to demonstrate thermal capability of transformers to withstand short circuit forces shall be submitted.

i) The transformer with protections devices and accessories as appropriate for the type and rating of transformer shall be provided.
j) Bidder shall consider provision of OFF-Load Tap Changer at transformer HV winding shall be considered for lower ripple at low voltage operation.

5.2 AC/DC Conversion (Rectifier) system

k) The AC/DC conversion system shall take the voltage from the secondary windings of the step-down transformer to produce the required dc voltage to supply five units of Inverter and High Voltage transformer rectifier as shown in Fig.-2, Annexure I.
l) The choice of the components and of the topology shall be made by the supplier under its responsibility assuring the compliance to performance requirement defined in Table-1.
m) The Rectifier system shall be made by switching semiconductor devices
n) Each Rectifier bridge shall be complete with all the devices needed to assure the proper working of the Rectifier itself (as, for example, snubbers and clamp networks, etc...) and protection against internal and external faults.
o) The rating of the components and the intervention thresholds of the protection systems shall be designed to avoid any dangerous stress, in terms of voltage, current and temperature of the semiconductors devices.
p) In case of rectifier system fault, e.g. short circuit of a component, the rectifier system shall be able to limit the consequences of the fault avoiding the damage of other components, and driving the system into a safe condition. This shall be obtained by a fast detection of the fault and therefore a fast intervention of the protection system.
q) The ac/dc conversion system shall have some inductance on the output to improve the current sharing among the parallel connected bridges (if present), and to limit the current during the charging of the capacitor banks.
r) The supplier shall thoroughly analyse all the possible failure modes of the rectifier system during the design stage. In particular, but not limited to the following internal faults conditions shall be managed:
    a. Short circuit at one or more bridge terminals;
    b. semiconductor device faults (internal fault);
    c. commutation and misfiring faults;
    d. ac input power failure or phase loss.

   All these fault conditions shall produce the suppression of the programmed timing sequence.
s) Each semiconductor arm shall be protected by an individual fuse. In the case of short circuit at one bridge terminal, this fuse shall not intervene, instead that short-circuit current being cleared by opening of the 11 kV feeder circuit breaker only. The supplier can choose alternative solutions

without fuses, if it justifies that the system is able to withstand the fault condition until 11 kV feeder circuit breaker is opened.

t) Fuses shall be of the indicator type with micro-switches to provide remote alarm indication. Their operation shall cause no damage to the system.

u) A two level heat sink thermostat shall be fitted to provide alarm and trip indication.

v) The firing circuits, and in particular the gate circuits, shall contain provision of self-check the major components and to provide remote indication of faults.

w) The semiconductor firing circuit shall be designed to be fail-safe in the sense that interruption of communication between control and triggering parts or loss of the auxiliary power supply shall lead to the suppression of the firing pulses.

x) In case of commutation and misfiring faults in semiconductor bridges, fuses are permitted to blow as a means of protection.

y) Semiconductor devices and associated protection devices shall be designed to avoid component explosion in any case.

z) The supplier shall provide at each terminal of the ac/dc converters at least the following analog measurements viz. dc output current and dc output voltage.

aa) The voltage at the primary side of the step-down transformer to be utilised for synchronisation of the firing pulses of the semiconductor devices.

bb) The rectifier unit shall be operated within its rated output power levels and integrated with other sub-system viz. inverters, high voltage transformer & rectifiers of 500 kV DC UHVPS System as shown in Figure-2 of Annexure-I.

cc) The rectifier unit shall be of industrial grade and robust in nature, which shall endure all the high voltage conditions.

dd) The rectifier unit shall be provided with suitably rated reactive power compensation and harmonic filters to meet power factor and harmonic limits as per technical specification in input supply lines.

ee) The rectifier unit shall be designed to operate in closed loop and regulate the output voltage according to set values taking into consideration the input line voltage variation. The rectifier controller shall be properly tuned to provide a fast-feedback control.

ff) The rectifier unit shall manage the drifts associated with temperature in control amplifiers, feedback loops, dividers, current shunts, control and monitoring signals, so as to ensure performance integrity.

gg) Grounding/Earthing: The rectifier unit shall have suitable grounding, which ensures safer operation of the system under normal and abnormal conditions. All the lines of power, control (analog and digital) shall be properly terminated to their respective returns.

hh) The rectifier unit shall be double shielded and properly grounded for protection against the electrostatic interferences may cause by 500 kV voltage level equipment installed in vicinity.

ii) The rectifier unit shall be provided with suitably rated DC filter to meet the requirement of ripple voltage at rated load.

5.3 Electrical:

a) All the termination (electrical cables entries) points shall be easily accessible to reduce the complexity while operation, alteration and maintenance activities.
b) All the current carrying parts shall be separated by physical barriers to ensure safety. All the terminals except AC earth shall be electrically isolated. Protecting fuses and Circuit-breakers provided shall be easily accessible and properly rated to facilitate easy replacement.
c) There should be a clear and prominent "DANGER" Marking at the terminal block.
d) All insulated conductors except those within the confines of a PCB assembly, shall be of the suitable ratings, which are enough to withstand the maximum current and voltage during overload and/or fault/abnormal conditions.
e) All wiring shall be neatly secured in position and adequately supported. Where cables/wires pass through the metal panel; suitable size of cable glands shall be used. All the wires and cables used shall be of low smoke fire retardant as per IS 1554 and IS 694 or IEC 61034 with latest amendments and they shall be properly rated to prevent excessive heating. Proper indication on cable shall be provided for all the cables.
f) The associated AC, DC connections, control, alarms and interface cable connecting the unit shall be connected/disconnected easily without causing any interruption in the supply and damage to load or other circuits. All live parts AC, DC, and control, alarm and monitoring cables interconnecting the units shall be easily disconnected by plugs and connectors.

5.4 Assembly and Mounting arrangement:

a) The rectifier unit enclosure shall be made up of rigid and self-supporting structure of suitable steel sheet/profiles and shall be free of sharp edges/corners. The structural strength of the unit shall be such as to withstand its ultimate mechanical load without any deformity. The base of unit shall ensure uniform floor loading. The gauge of steel that is used for the fabrication of rectifier unit shall not be less than 2.5 mm (minimum).
b) Lifting facilities shall be provided by removable eyebolt located at the top of the unit or by any other means which ensure the portability. Top of the unit shall be fully covered except for ventilation and/or cable entries. The necessary arrangement for fixing the unit on the floor shall also be provided.
c) The enclosure sides of the rectifier unit shall have suitable ventilating arrangements. Each air flow vent shall be covered by a gill to prevent the entry of foreign material larger than 2.5 mm.

The front and rear door (if provided shall be of hinged type and shall have proper arrangement for ventilation.

d) The rectifier unit shall be designed for easy operation, maintenance and installation. The unit mounting arrangement shall be such as to provide easy access from front, rear and top for installation and maintenance activities.
e) The rectifier unit shall be made standalone with a rigid framework with bottom clearance of 100 mm.
f) All the doors of the rectifier unit shall be equipped with the cabinet locks with keys (either distinctive or same for all doors). All the doors shall be provided with neoprene rubber gasket to make the panel compartments dust proof.
g) Cooling: Ample number of exhaust/blow fans with proper ratings should be employed; these fans should be of die-cast aluminium painted black with grills.
h) The manufacturer shall ensure good workmanship while manufacturing/fabrication process of the rectifier unit.

5.5 Control, Protection and Monitoring:

a) The rectifier system local controller shall regulate independently its output voltage in close loop feedback to the reference signals either set at the local control panel or provided by remote Master Control Panel (MCP); the regulation shall meet the accuracy and bandwidth requirements..
b) The feedback regulation shall be based on a Proportional Integral Derivative (PID) controller. It shall be possible to set the P, I, D values and in general all relevant parameters for the operation of rectifier system in normal operating conditions and during transients. The PID values shall be configurable by user from Local Control Panel and MCP.
c) The rectifier system local controller shall allow operating the rectifier system in "Remote Control" and in "Local Control". A Remote/Local changeover facility shall be provided at Local Control panels only to switch between these two modes of operation.
d) The rectifier system will normally operate in "Remote Control", from MCP. However, it shall be possible to operate in "Local Control" for the purpose of testing, trouble-shooting and commissioning of the UHVPS into a dummy load.
e) In Local control mode the rectifier system shall be operated only from its HMI and the command from MCP shall be ignored.
f) The rectifier local controller shall derive various protection signals viz. over voltage and over current etc… from the measurement devices/sensors and appropriately command control action including disabling the pulses to rectifier power circuit.

g) In remote mode, the rectifier unit shall be operated remotely through external controller/Computer. The interfaces shall be of fiber optic cable. In this mode all the local panel controls should be disabled apart from Local /Remote selector at local control panel and emergency switch.
h) Various protections setting viz. for over voltage, over current etc. incorporated in rectifier unit shall be user settable/configurable.
i) The rectifier unit shall have protection against overload, arcs and short circuits. The power supply should trip with over current protection, if the operational current is higher than the set over current, for ensuring safe operation.
j) The rectifier unit shall have a dedicated controller either of PLC/DSP/FPGA/any other type of advance controller capable of meeting the specified functional specifications without failure.

6. ACCEPTANCE TESTS

6.1 Factory Acceptance Tests (FAT):

The following are some major tests that are to be performed by the supplier to demonstrate compliance of the rectifier unit as per the technical specifications prior to the shipment. All the related test equipment, fixtures, measuring instruments, test-setup, test load etc., shall be arranged by the supplier. Supplier shall submit a FAT template to IPR for review and approval. The details of the test template and testing procedure shall be done on mutual agreement after the award of contract. IPR representative shall witness the FAT at manufacturer's works.

a) Visual inspection for Dimension, finish and verification of BOM as per approved drawings.
b) Heat run test for 8 hours of continuous operation and its stability measurements at rated power. (In case the full power test load or source is not available; than the test shall be conducted at mutually agreed reduced power level that demonstrate the performance corresponds to full load). During this test, temperature raise of crucial power components shall be monitored / recorded.
c) All routine tests as per standard on converter transformer
d) Tests for compliance of major technical parameters viz. output voltage, power, ripple and efficiency etc. at maximum load feasible.
e) Test for checking voltage at crucial test points inside the rectifier unit along with its output voltage and current/power calibration.
f) Protection and Interlock test to check the inhibition of the pulses.

g) Functional tests for effective operation and protection of rectifier unit. Different faults like over voltage, over current, over temperature and regulation errors shall be checked.
h) Operational check of the feedback control loop with proper tuning of controller.
i) Operational check of the disabling of driving pulses of the semiconductor devices through injection of all the tripping commands as specified in this tender document.
j) Burn-in test on control circuit.

The detailed test report including the test results shall be prepared by the supplier and submitted to purchaser for approval/ acceptance for dispatch clearance.

6.2 Site Acceptance Tests (SAT):

After the installation of Rectifier system at IPR site; the SAT shall be performed in-line with FAT by the supplier. IPR at its discretion may prescribe all or a reduced subset of FAT tests to be performed at the IPR site. The tests shall include but not limited to following tests –

- Visual inspection for Dimension, finish and verification of BOM as per approved drawings.
- Heat run test shall be carried out within rated parameters for 8 hours of continuous operation. During this test crucial performance parameters mentioned in the specification like voltage regulation, overall efficiency etc., shall be checked.
- Operational check of the feedback control loop with proper tuning of controller.
- Operational check of the disabling of driving pulses of the semiconductor devices through injection of all the tripping commands as specified in this tender document.
- Test of fibre optic communication for remote control operation.
- Checking of all monitoring and controlling parameters as listed in this tender document from MCP.

After the completion of SAT, the detailed test report including the test results shall be prepared by the supplier. The representative IPR and Supplier shall jointly sign the SAT test reports.

7. CONTRACT MANAGEMENT

7.1 Contract Execution Schedule:

The required delivery schedule for all the deliverables is <u>on or before 8 months</u> from the date of approval of design and drawings submitted by the bidder after the award of contract. A preliminary project execution schedule which meets the overall delivery duration with major activities and milestones shall be submitted along with the bid. However, the bidder should submit a detailed project execution schedule which meets the targeted delivery time after award of contract. This project execution schedule may include; design, component procurements, manufacturing, FAT, delivery milestone, installation and SAT etc.

7.2 Quality Assurance Plan (QAP):

The Rectifier unit shall be manufactured in conformance with the international and/or national standards/codes to assure the quality and reliability of the Rectifier unit. Bidder should specify all the applicable standards followed. Bidder shall prepare a QAP or a manufacturing inspection plan which ensures the operational quality of the deliverables items under this contract. The same shall be submitted to IPR of its review and approval. QAP shall provide details of inspections/tests that will be carried out at various stages of the contract like design, engineering, procurements, manufacturing, assembly and testing.

7.3 Design and Drawings submission:

After the award of purchase order / contract, within 30 days the supplier must submit an Engineering Design and Drawings for the Rectifier unit based on the technical proposal submitted during the bid for IPR approval. This report shall include following minimum submission documents -

a) Design calculations (electrical, thermal, capability of transformers to withstand short circuit forces, mechanical etc.) and simulation reports including selection, and sizing of components shall be submitted
b) Engineering design and drawings including GA drawings and electrical schematic drawings.
c) Control block and schematic diagrams indicating Local / Remote controller interface etc.
d) Cabling diagram and cable schedule with proper terminal block numbering.
e) List of all accessories, and bill of materials (BOM).
f) Data sheets/Catalogue of all the selected bought-out major components viz. semiconductor devices; heat sinks, passive components like capacitors, resistors, inductors; current/voltage measuring sensors, protective elements, etc. used for making of Rectifier unit shall be provided.
g) FAT & SAT procedures

7.4 Factory Acceptance Tests (FAT):

FAT shall be performed by the supplier to demonstrate compliance of the Rectifier unit as per contract specifications before effecting the shipment, as per Section-6.1.

7.5 Operating and Instruction Manual:

The supplier shall submit 3 sets of document / technical literature in English language with complete layout, GA Drawings, detailed block diagrams and circuit diagrams of its assembly with test voltages at different test points of the unit. All aspects of installation, operation, maintenance and troubleshooting instructions as specified below shall be covered in this manual.

a) Safety measures to be observed in handling of the equipment.
b) Illustration of internal and external mechanical parts.
c) Precautions at the time of installation, operation and maintenance.
d) Procedures for trouble shooting, replacement and routine/preventive maintenance.

e) Steps of remedial measures for troubleshooting the faults.
f) Required Test Jigs and fixtures.
g) Test instruments, test fixtures, accessories and tools required for maintenance and repair.
h) List of replaceable parts used with the sources of procurement.
i) A table giving details of sizes and dimensions of cable used
j) Remedial steps for typical faults.

7.6 Material Dispatch/Packing and Delivery:

After the review and approval of FAT report, a Dispatch Clearance Note shall be issued to supplier by IPR. All the deliverables (hardware and documents) shall be dispatched only after receiving a dispatch clearance note from IPR. However, a mere clearance issued by IPR will not relieve the supplier from the liability of proper functioning of Rectifier unit at IPR Laboratory.

Appropriate safe packing, transportation (including Insurance) to IPR site are under the scope of the supplier, which shall include (but not limited to) a necessary list of documentation and appropriate packing, markings, labelling for the deliverables items. It must be noted that IPR shall not be liable for any of the damages cause during transit of the deliverables. The detailed packaging and transportation scheme shall be submitted to IPR well in advance.

7.7 Site Description:

The laboratory/delivery site is located in the **Institute for Plasma Research Campus, Near Indira Bridge, Bhat, Gandhinagar – 382 428, Gujarat, India**. The laboratory, where the HFPS unit is to be installed is situated at ground floor level in IPR New Auxiliary Building.

7.8 Unloading and Storage:

Bidder is responsible for unloading of the Rectifier unit and Accessories at proper locations at the site and verification of unit for damages and short supplies, making good all such damages and short supplies. The Rectifier unit and accessories shall be stored at Bidder's responsibility until final acceptance and taking over by IPR.

7.9 Installation:

The scope of work includes the installation of the following items-

i. Step-down Transformer
ii. AC/DC Converter (Rectifier) unit.
iii. Bus bar connection between Step-down Transformer and Rectifier
iv. Local Control Panel (if any)
v. Laying and termination of all type of interface cables viz. PVC insulated control cables, fibre optic cable, communication cables etc. between the Rectifier and Local Control Panel

Any material or accessory which may not have been specifically mentioned but which is necessary shall be supplied at no extra cost to IPR. ***The installation must complete within 15 days after the material is delivered at site.***

7.10 Site Acceptance Tests (SAT):

SAT shall be performed by the supplier to demonstrate compliance of the Rectifier unit as per contract specifications after effecting the installation, as per Section-6.2. ***The SAT must complete within 15 days after the material is installed at site.***

7.11 Final Acceptance:

A final acceptance note shall be issued by IPR to the supplier after successful completion of SAT (and after resolving issues completely, if any) at site and submission of "As-built" marked-up drawings incorporating all modifications/changes made during manufacturing, testing and installation of the Rectifier unit. The date of issuance of final acceptance note shall be considered as the date of final acceptance.

7.12 Training:

The supplier has to arrange technical training of IPR representatives at IPR premises to familiarize about various sub-systems, operation and maintenance of this power supply.

7.13 Warranty:

Supplier should provide a minimum of one year standard warranty for all the deliverables (Rectifier unit and all its accessories) thereof from the date of final acceptance issued by IPR.

Additionally, an optional one year extended warranty from the date of expiry of above specified minimum warranty is to be quoted separately.

SECTION-C

TENDER NO. IPR/TN/PUR/TPT/ET/18-19/47 DATED 09/01/2019

ANNEXURE – I

TENDER NO. IPR/TN/PUR/TPT/ET/18-19/47 DATED 09/01/2019

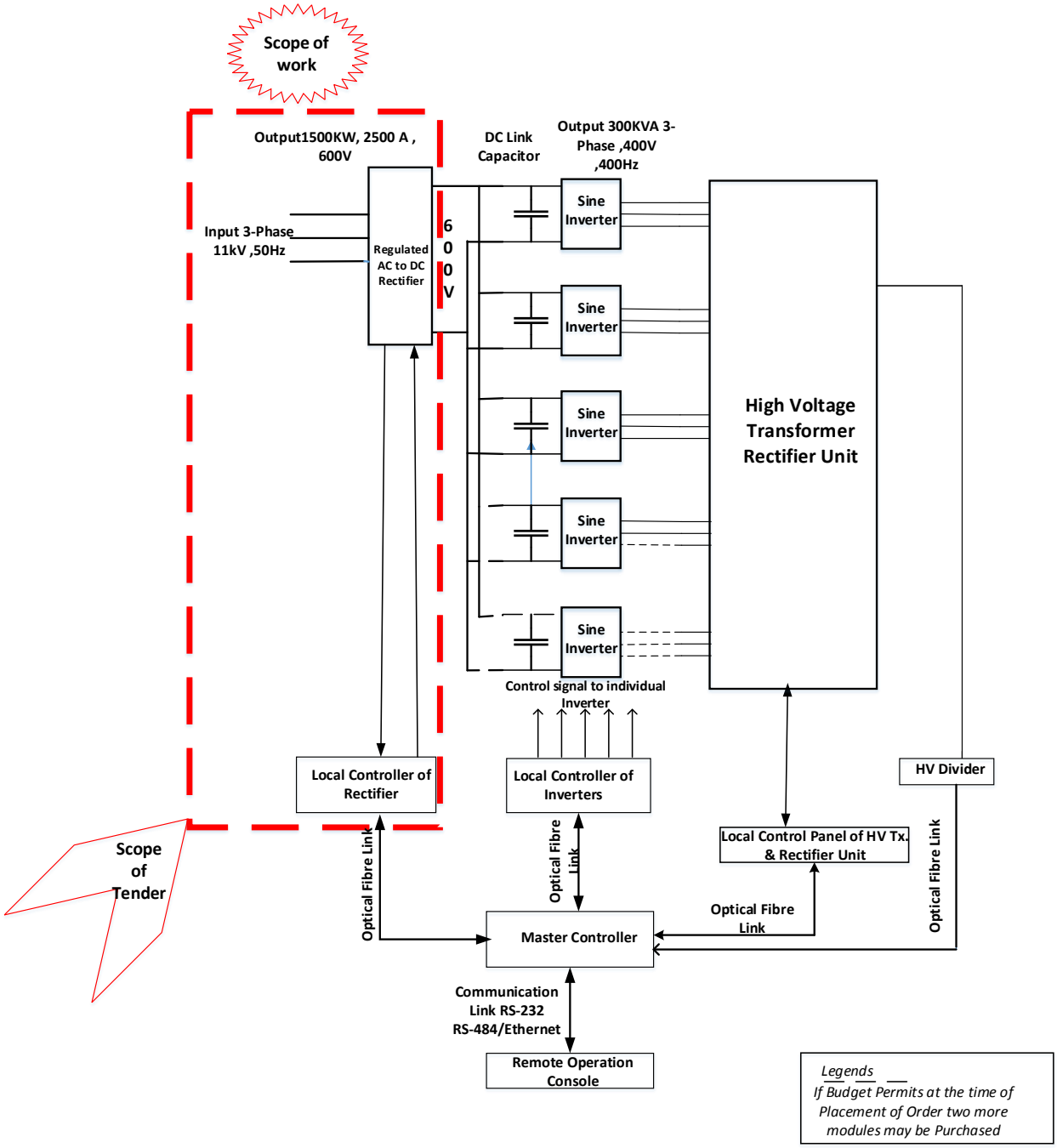

Figure-2: Schematic Block Diagram of 500 kV DC Ultra High Voltage Power Supply (UHVPS) System

TENDER NO. IPR/TN/PUR/TPT/ET/18-19/47 DATED 09/01/2019

ANNEXURE – II

TECHNICAL BID COMPLIANCE

Bidder must submit along with the bid the following documents –

a) Conceptual technical proposal including GA drawings, Block Diagrams etc.
b) Thermal analysis and basis of components selection
c) Tentative Bill of material (BOM)
d) Proof of concept/topology together with simulation report/results
e) Justification of topology for critical technical parameters.
f) Suggested spares.
g) Data sheet duly filled in data against each parameter. Just filling "complied" shall not be accepted, the actual value have to be indicated.
h) Tentative contract execution schedule defining major activities / milestones

During the evaluation of technical bids, IPR shall review the submitted technical proposal and may seek further clarifications/discussions with the bidder to ascertain feasibility or viability of the same. If the proposal is found to be incapable of meeting the technical specifications, the bid shall be technically disqualified.

Table-2: Data Sheet

Sr. No.	Parameters	Bidder's Data
1.	**General**	
a)	Name of Manufacturer	
b)	Input Line Voltage	Volt
c)	Input Frequency	Hz
d)	Operating Temperature	^{o}C
e)	Relative Humidity	%
2.	**Design**	
a)	Design Topology/Configuration	Provide tentative schematic design drawing and simulation results
b)	Nominal output Power	kVA
c)	Nominal output Voltage	Volt
d)	Nominal output Current	Ampere
e)	Voltage Ripple at rated condition	%
f)	Current Ripple at rated condition	%
g)	Output voltage control/regulation range	%

h)	Output voltage set resolution	%
i)	Output voltage line regulation (for input voltage variation)	%
j)	Output voltage load regulation (for load variation from no load to full load)	%
k)	Output long term (8 Hrs.) voltage stability(for input voltage variation in full load and upto 5 ^{o}C temperature variation within the specified operating temperature range)	%
l)	Output overloading	
m)	Overall efficiency	%
n)	Cooling	Forced / Natural Air
o)	Power Panel Design (Degree of Protection)	
p)	Control Mode	
q)	Control range linearity	%
r)	Protection	List all protections provided
s)	Rectifier power panel overall dimensions & shipment weight	meters / kg
3.	**Termination**	
a)	Input	
b)	Output	
c)	Intermediate (between transformer and bridge rectifier)	
4.	**Transformer**	
a)	Rating	kVA
b)	Ratio	Primary/Secondary
c)	Vector Group	
d)	Type	
e)	Cooling	
f)	Overall shipment dimensions and weight	
5.	**Local Control Panel Design**	
a)	Make and Type	
b)	Mode of Operation	Local/Remote
c)	Measurements and Display	List all Measurement and Display provided
d)	Control Mode	
e)	Controller Type, Manufacture	
f)	Interface signals for remote controller	List all monitoring and control interface signals provided

g)	Industrial Touch Panel Display (HMI) provided: if yes Type, model no. , make, processor, memory, screen display size. etc…	
h)	Local Control Panel Design (Degree of Protection)	
i)	Cooling	Forced/Natural Air
j)	Dimension & Shipment Weight	Meter / kg
6.	**Applicable standards**	List all applicable standards