

	TECHNICAL SPECIFICATION FOR PRE-BID TIE UP OF ELECTROLYSER SYSTEM		Doc No. PY54050
			Date: 16-12-2024
			Rev. No. 00
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1.0 INTENT OF SPECIFICATION

Bharat Heavy Electrical Limited (BHEL), a Govt. of India Undertaking, invites proposals for Design, Engineering, Manufacturing, Fabrication, Packing, Supply, Transport, Freight & Insurance, Handling, Unloading, Construction, Erection, Installation, Integration, Commissioning, Testing, mandatory spares, obtaining statutory approvals including drawings and documents, Training, of the Hydrogen Generation System (Electrolyser System along with its BoP) as per the scope of work & supply detailed in this Specification.

2.0 PROJECT INFORMATION

Power Grid Corporation of India Limited (POWERGRID) intends to set up Green Hydrogen based Micro-grid Project on turnkey basis at POWERGRID's 400/220KV Neemrana Sub Station, Rajasthan to meet the entire captive auxiliary load demands of Neemrana Substation.

The estimated average daily auxiliary load requirements of the Neemrana substation are about 2000kWh, out of which about 40% of the load (i.e. about 800kWh) is required to be catered during solar hours and balance 60% (i.e. about 1200kWh) of the load is required to be catered during non-solar hours.

The Project envisage of setting up a solar plant, a green hydrogen production plant using electrolysis of water, a hydrogen storage facility and fuel cell for generation of electricity to meet both day and night load demands of the substation. The day load shall be met directly through solar energy. The night load/ non-solar hour load of the sub-station shall be met by the electricity produced through fuel cell system.

3.0 POWER SUPPLY

Following power supply voltage levels to be used unless otherwise specified.

- 415V AC, 3ph, 50Hz

The power supply would be directly from Solar Photovoltaic (SPV) and would be intermittent.

4.0 REQUIREMENT OF PRE-BID TIE-UP

As per TENDER document of M/s Power Grid, **Annexure-A (BDS) of Volume -1**, "A legally enforceable undertaking (jointly with the Electrolyser Manufacturer/its channel partner) (as per enclosed format in Section-VI, Volume-I of bidding document) to guarantee quality, timely supply, performance and warranty obligations as specified for the equipment(s) is to be submitted along with the bid stating that Electrolyser Manufacturer shall furnish performance guarantee for an amount of ten (10) % of ex-works price of Electrolyser. This performance guarantee shall be in addition to the Contract Performance security to be submitted by the Bidder."

5.0 BIDDERS' SCOPE OF WORK

- 5.1 Bidder's scope shall be limited to Design, Engineering, Manufacturing, Fabrication, Packing, Supply, Transport, Freight & Insurance, Handling, Unloading, Erection, Installation, Integration, Commissioning, Testing, mandatory spares, obtaining statutory approvals including drawings and documents and Training of the Hydrogen Generation System (Electrolyser and BoP) as per Annexure "C" clause 3.0 (Powergrid Technical specification for Green Hydrogen based Microgrid project).



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- 5.2 The detailed engineering and commissioning plans that is consistent with the scope of the project and Employer's specified objectives, vetted through any India based certified Project Management Consultant (PMC) who have experience in hydrogen-based Project consultancy and Project management should be submitted for review and approval of the employer.
- 5.3 Editable copy of 3D models of entire hydrogen generation plant including control room shall be supplied.
- 5.4 Any other equipment, materials and services whether explicitly stated or otherwise required for setting up and smooth functioning of the Electrolyser plant shall be arranged by the bidder on his own cost.
- 5.5 Defect liability period (DLP) of one year after project commissioning.
- 5.6 Factory and site acceptance testing of the equipment, components and material, hardware, software etc. to be provided for the project.

5.7 ELECTROLYSER:

- i) Containerized Electrolyser system (hydrogen generation system) shall be provided for generation of hydrogen.
- ii) The broad capacity requirements of the electrolyser system are as below:

Sl.No.	Parameter	Description / Specification
1.	Technology	Alkaline/ PEM etc.: Bipolar type complying to ISO 22734: 2019 or equivalent
2.	Electrolyser Capacity	Minimum 200 Nm ³ /hr.
3.	Specific Energy Consumption of Electrolyser and balance of plant (BoP) (Compressor, DM Water Treatment Plant, Raw Water extraction, chiller, auxiliary load of hydrogen plant control room etc.) BOL - Beginning of life of the system	$\leq 58\text{kWh/kg}$ of hydrogen generated at BOL $\leq 64.5\text{kWh/kg}$ of hydrogen generated at the end of 10 years after successful PG Test <i>Bidder to indicate Specific Energy consumption of Electrolyser and BoP.</i>
4.	Minimum Hydrogen Output at full load	17.85kg/hour. Output Pressure shall be more than 15 kg/cm ² as per OEM design.
5.	No. of Electrolyser Units	2 X 50% or 3 x 34% of total capacity (Independent streams of operation starting from rectifier till separator input)
6.	Hydrogen Purity (meeting requirements of as per ISO 14687:2019)	$\geq 99.995\%$
7.	Production Capacity Dynamic Range (Turn Down Ratio)	30 - 100%. Better turn down ratio with starting value less than 30% shall also be acceptable
8.	Design Life	20 years



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9.	Stack life for continuous Operations	70,000 Hrs.
10.	Cold Start-up time	≤ 35 minutes
11.	Warm start-up time	≤ 5 minutes
12.	Ramp up rate	As per OEM design for safe operation based on offered technology
13.	Ramp down rate	-do-
14.	De-Oxo and Dryer Unit per Electrolyser	As per OEM design for safe operation based on offered technology
15.	Water consumption	≤ 12 Liters/kg H ₂ (DM water)
16.	Noise Level at a distance of 1meter from enclosure	≤ 75dB
17.	Dew Point Temp at ambient conditions	-60°C (Max)

iii) Hydrogen production along with purity curve and SEC of Electrolyser system at part load shall be submitted.

iv) The hydrogen generation system should essentially comply with all relevant National and International Standards for safe and reliable operation including:

ISO 22734:2019 or equivalent latest amendments	Hydrogen generators using water electrolysis- Industrial, commercial, and residential applications
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v) The hydrogen generation system (electrolyser) should be designed to operate in Indian environment on continuous basis to produce desired hydrogen of specified purity and dryness.

vi) The hydrogen generation system (electrolyser) should also have the flexibility to operate on part load of the rated capacity on continuous basis without any disconnection or interruption of operation and without compromising the specified purity and dryness of the hydrogen produced.

vii) The hydrogen generation system (electrolyser) should be able to operate based upon generation of RE power and associated intermittencies from the solar plant.

viii) The System should be able to efficiently separate the H₂ gas from the H₂-water mixture and O₂ from O₂ water mixture for producing H₂/O₂ at specified purity.

ix) PLC based control system having provision for display and monitoring the efficiency, power consumption, quantity and quality (purity and dryness) of hydrogen generated.

x) The Hydrogen Generation Plant shall be equipped with all requisite protections to safely shutdown/trip the plant in case of any exigencies and emergencies with respect to operation of Hydrogen Generation plant and safety of equipment and persons.

xi) Hydrogen leak detection and interlock system shall be provided in the hydrogen generator and hydrogen filling area for alarm and trip of hydrogen generation plant. Provision for Emergency Shut Down (ESD)



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tap-off facility shall also be operatable through OFC cable connection (to be extended up to control room) for remote shutdown of the hydrogen generator.

- xii) All measuring instruments, controller and control valves required for automated remote and safe operation shall be provided.
- xiii) Appropriate Safety devices are to be provided for Hydrogen Generation System for safe release of Hydrogen, pressure build up etc.
- xiv) Proper sealing shall be provided to avoid any leakage of hydrogen to the Rectifier system.
- xv) Water deionization system and two numbers of circulation pump (1Running + 1Standby) for water circulation in Electrolyser system.
- xvi) The Electrolyser design should allow it to be dismantled, cleaned and reassembled easily. Bidder shall provide the cleaning procedure for the Electrolyser.
- xvii) Bidder shall specify the stack and/ or detailed list of components of the Electrolyser system and their quantity required to be replaced/refurbished during 70,000 hrs. of operation
- xviii) Bidder shall also provide the system for safe shutdown of the system in case of insufficient solar generation for prolonged periods. The details may be submitted during detail engineering for approval of BHEL/ POWERGRID.

5.8 RECTIFIER:

- i) Adequate numbers of rectifiers shall be provided to independently cater to the load of each of the Electrolyser stack. The system shall be designed to have adequate redundancy and reliability in plant operation.
- ii) The Rectifier shall meet the following capacity requirements

Sl.No.	Parameter	Description / Specification
1.	AC Input	415V \pm 10% AC, 50Hz \pm 5%, 3 Phase
2.	DC Output	Vendor to Furnish as per Electrolyser design
3.	Type	IGBT/MOSFET/EQUIVALENT
4.	Current Adjustment	10 – 100%
5.	Operating Condition	Ambient Temperature: 0°C to 55°C
6.	Cooling	Naturally/ Forced Air cooled
7.	Degree of Protection	IP 54 (min.)
8.	Operation	Continuous
9.	Installation	Indoor
10.	% Ripple	Upto 8% at rated load and nominal input
11.	Power Factor	0.9 at rated load and nominal input



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12.	Efficiency	Min. 95% at rated load and nominal input
13.	Input Termination	Vendor to Furnish
14.	Output busbar size (Size & Drawing to be specified)	Vendor to furnish

- iii) The rectifier equipment shall be complete in all respect with rectifier transformer, thyristor converter, electronic control and annunciation, filter choke, etc. mounted in the suitable panel.
- iv) Relevant IS/IEC standards shall be applicable for Rectifier Assembly for Hydrogen Generation Plant.
- v) Harmonics & THD shall be within limits as per IEEE519. If system harmonics/THD more than the specified limit suitable harmonic suppression arrangement and devices shall be considered to limit harmonics.

5.9 MECHANICAL:

- i) Purging/flushing of the system with nitrogen during commissioning and during maintenance work. The required devices and setup for the purging/ flushing shall be in the scope of the bidder.
- ii) All solenoid valves, control valves, critical manual valves shall have feedback mechanism about its status.
- iii) Piping/Tubing
 - a) Pipeline materials, vessels, towers/coolers shall be of superior grade SS materials of high degree safety and capable to withstand hydrogen embrittlement, hydrogen induced cracking etc.
 - b) All piping/tubing must be labelled as per ANSI/ASME A13.1 standard. Associated items such as valves/check valves/filters must be tagged legibly for quick identification.
 - c) Piping/tubing in gaseous and liquid hydrogen service and to pipelines in gaseous hydrogen service as per ASME B31.12:2019 standard.
 - d) All piping systems shall be hydro tested at 1.5 times the design pressure subject to Indian Boiler Regulation-1950, Regulation 374 or ASME B31.12:2019. However, for such systems where it is practically not possible to do hydro tests, the tests as called for in ASME B31.1:2022 in lieu of hydro test shall also be acceptable.
 - e) Piping/Tubing should be cleaned as per ASTM G93/G93M-19 standard on Oxygen side before putting into commissioning/service.
- iv) All vents shall be routed to a safe area and in a manner that gas vented out is blown away from the nearest building. All vents shall be fitted with flame arrestors. Height of vent shall be minimum five (5) meters above ground level. Distance between vent and fence shall be minimum five (5) meters from at least 3 sides as per PESO requirements. It shall arrestor with temperature transmitter to be installed in all venting points. NFPA 2 Hydrogen technologies compliance shall be followed.
- v) Proper canopies, ramp protection to be provided at appropriate locations.
- vi) Piping laid in underground shall have the cathodic protection.



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- vii) Bidder to provide facility for service air and instrument air as per their system and maintenance requirements.
- viii) All tubes and fitting shall comply with EC-79 or better standards.
- ix) Color codes for all equipment's shall be decided during detailed engineering.
- x) Noise level shall not exceed 75dB or Indian and international standards, whichever is less.

5.10 MISCELLANEOUS:

- i) Bidder has the responsibility to get the plant layout approved from PESO. Before submission of the plant layout to PESO, bidder must get it approved from BHEL / POWERGRID. Any changes suggested by PESO must be again submitted to BHEL / POWERGRID for its approval before re-submission to PESO.
- ii) Cable ducts/ slits, cable trenches with covers etc. wherever required within Container/ Skids, cable/pipe supporting arrangement, Water drainage system in and around all structures and connecting it to the owner's drain system shall be responsibility of the bidder.
- iii) Supply of all materials, tools & tackles, safety equipment, personal protective equipment required for construction of the project shall be in the scope of the bidder.
- iv) Bidder shall arrange the appropriate lifting arrangements for the equipment for unloading and placement at site.
- v) Special Requirements:
 - a) For corrosion protection, painting is to be applied following the corrosive Category as per ISO 12944-2:2017.
 - b) The rainfall data in one hour (in mm) in wettest month in the last 5 years as per meteorological data from IMD shall be considered for the design of the drainage.
- vi) The Sample Water Test Report of Bore water is provided at **Annexure-V**.

5.11 STANDARDS AND SAFETY SYSTEMS

- i) Adequate safety systems are to be installed for proper monitoring and ensuring healthiness of every equipment and personnel safety on continuous basis. The certification of all equipment to be done on a regular basis, maintaining the OEM guidelines as well as Indian and International standards. The last date of certification/calibration should be mentioned on the equipment.
- ii) The contractor shall take necessary regulatory approvals from Petroleum and Explosives Safety Organization (PESO) for the layout of hydrogen production.
- iii) Proper operation of hydrogen gas leak detection system (with 100% redundancy) should be tested before starting trial operation by applying sample gas. The leak detection system should be calibrated and checked between its interface and the control system at Site.
- iv) Gas leakage determination and ventilation are based on IEC/EN 60079 standards. Response time of sensor shall be as minimum as possible. It shall have 100% redundancy at all installation of the equipment's.



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- a) Point detection devices for the confined space and covering Electrolyser system.
- b) Ultrasonic leak detection devices for open space of Electrolyser system.
- c) Flame detection devices

- v) All panels, distribution boards, junction boxes, pushbutton stations, control cabinet, instruments installed in hazards zone shall be flameproof and explosive proof. It shall comply with ATEX and IECEx directives.
- vi) All high-pressure joints shall be of welded constructions and radiographed.
- vii) All piping/tubing must have integrity of continuity to avoid static energy generation. Accordingly, all piping/tubing must have grounding/bonding provisions.
- viii) All major isolation and critical valves should have/must be installed for easy/proper LOTO (Lock-out/Tag-out) provisions.
- ix) All necessary instrumentation, isolation valves and safety equipment like safety valves etc., to be provided for the safe operation of the pressure vessel. All the Safety Valves shall be ASME UV code stamped.

6.0 SCOPE DIVISION

6.1 Bidder's Responsibility:

- i. Supply of Electrolyser system along with spares, erection, testing and commissioning of the system
- ii. The capacity of Electrolyser module/s to be supplied shall be minimum 17.85 Kg/hr or more. Bidder's to quote the capacity of Electrolyser module/s to be supplied.
- iii. Supply of all the consumables for 3 months of operation.
- iv. Training of owner's Engineers for the operation and maintenance of the plant.
- v. Performance Guarantee Test Run (PGTR) of Electrolyser plant.
- vi. Statutory / PESO clearances for Electrolyser Plant
- vii. Warranty of the Electrolyser system.
- viii. AMC for 9 years after defect liability period.

6.2 BHEL's Responsibility:

- i. Raw water/ Cooling water / Fire water shall be provided.
- ii. Power supply at Rectifier Transformer input terminal
- iii. Complete civil execution of the project.
- iv. Fire protection system of entire plant
- v. 415V Power supply: Green Power will be supplied at 415V feeder.
- vi. Solar Plant, Hydrogen Compressor, Storage and Fuel cell and Integrated Control System
- vii. O&M of the Plant for 10 years.

7.0 QUALITY ASSURANCE

- i) The bidder shall submit the Quality Assurance Plan (QAP) for all components of Electrolyser for review and approval of BHEL / POWERGRID immediately on award of contract.



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- ii) The QAP shall essentially cover raw material inspection, process parameters, performance test etc.
- iii) All comments of BHEL/ POWERGRID shall be incorporated suitably in the QAP without any cost and time overrun. All inspection and testing shall be as per approved QAP or relevant codes/ standards/ statues at the discretion of BHEL/ POWERGRID.
- iv) Any or all the tests, shall be witnessed by BHEL/ POWERGRID authorized inspection agency/personnel.
- v) Inspector(s) will have the liberty to inspect assembly to verify the dimensions as per the approved drawings.
- vi) Bidder shall ensure availability of all documentation, testing procedures, calibrated test equipment during inspection including at various sub-vendors premise as required.
- vii) No material shall be dispatched before getting quality clearances from BHEL/ POWERGRID.

8.0 TRIAL TEST OF THE PROJECT

- i) Upon successful completion of the project after construction and integration stage, Trial Test (Trial Operation) shall be carried out to check the health and working of various systems and subsystems including BoP and their integration to achieve the desired output.
- ii) The responsibility for conducting the trial test (Trial Operation) shall be of the Bidder. The Bidder shall arrange all material, equipment and expert manpower, specified or otherwise required to carry out Trial Test at his own cost.
- iii) The trail operation of compete Micro-grid project may be planned simultaneously. The Bidder shall submit the detailed plan and procedure for trial operation of the electrolyser system accordingly for approval of BHEL/ POWERGRID.
- iv) The safety check list for and during trial testing shall be prepared and submitted by the Bidder for approval of the BHEL/ POWERGRID during detailed engineering.
- v) The calibration of instruments used in the test shall be carried out by a Govt. approved test laboratory and should be valid during the period of test.
- vi) All safety aspects must be adhered to during trial test.
- vii) The trial operation shall be considered successful only if the system runs trouble-free for 3 consecutive days, producing the desired amount of hydrogen and meet all the desired parameters of the project including working of the Control and instrumentation, safety and emergency switches etc. as per specifications with all relevant input and data available in the control room.
- viii) A day's operation means requisite amount of hydrogen generation, compression and storage during solar hours and dispensing through fuel cell during non-solar hours to meet electrical load demands of auxiliary system of sub-station or its equivalent in one day.
- ix) Errors and issues shall be identified and resolved by the contractor as on case basis.
- x) The observations and data during the trial testing shall be recorded and detailed report shall be submitted to the BHEL/ POWERGRID.



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- xi) The necessary modifications required as per the scope of bidder, if any, observed during trial operation, shall be in the scope of the contractor without any cost overruns

9.0 PERFORMANCE GUARANTEE TEST (PG TEST)

- i. Consequent upon successful completion of Trial Operation, Performance Guarantee Test (PG Test) for the Electrolyser system shall be carried out by the Bidder. The bidder may have to be collaborated with BHEL so that PG Test of Electrolyser System shall be completed along with the other packages of Microgrid project.
- ii. The Performance Guarantee test shall be considered successful only if the system runs trouble free for a continuous period of 96 hours and all the desired parameters are met as per this specification at clause 5.7 that includes but not limited to: -
 - Working of Electrolyser and BoP for production of desired amount of hydrogen at the rated values of input energy and water
 - The Control and instrumentation should be able to run the plant as per specifications.
 - Working of Control system and availability of all the instrumentation and control in the control room including display of all relevant data of the running system on real time basis. The Control and instrumentation should be able to run the plant as per specifications.
 - Additionally, separate exhibit of automatic and manual start/stop operation of the entire system, emergency stop operations etc. and vice versa shall also be part of PG test.
- iii. The Performance Guarantee Test (PG test) requirements and the procedure for PG test shall be submitted by the Bidder for approval of BHEL/ POWERGRID during detail Engineering Stage and BHEL/ POWERGRID's decision in this regard shall be final.
- iv. The calibrated instruments and any other measuring devices and tools etc. required for carrying out the PG test shall be in the scope of the bidder.
- v. If the supplier fails to achieve the guaranteed performance levels, the contractor shall at its own cost rectify all the defects identified during the test and take necessary steps/efforts to pass the PG Test within the stipulated time span. Subsequent to rectification, the PG test will be restarted and performance of the PG Test shall be re-measured. In case of destruction due to component failure the test shall be repeated.
- vi. The continued failure or shortfall in intended performance will invite imposition of liquidated damages of maximum 10% of the total contract value (exclusive of Freight & insurance charges) and other measures as applicable as per the contract.
- vii. There shall be no incentive/ reward for positive performance deviation.
- viii. If the guarantees specified in to the technical specification are not established, then the Employer shall, at the his discretion either
 - a) reject the equipment, or
 - b) accept the equipment after assessing liquidated damages in accordance with the provision in the SCC against the Contractor and such amounts shall be deducted from the Contract Price or otherwise recovered from the Contractor.



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10.0 Specific Energy Consumption (SEC) for Electrolyser System (Electrolyser and BoP) to be quoted for 10 years' period: -

Sl.No.	End of the Year	Hydrogen SEC (kWhr/kg)
1.	Y1	
2.	Y2	
3.	Y3	
4.	Y4	
5.	Y5	
6.	Y6	
7.	Y7	
8.	Y8	
9.	Y9	
10.	Y10	

Performance Shortfall =

(Difference of Actual Specific Energy Consumption and Guaranteed Energy Consumption)/ Guaranteed Energy Consumption

Handing over of System at the end of O&M Period

Electrolyser: The output of electrolyser at full load should not be less than 200 Nm³ /hr and the specific energy consumption should not deteriorate to more than 64.5 kWh/kg including the BOP during a period of 10 years of operation.

11.0 WARRANTY CLAUSE

Warranty of all systems and modules shall be for 12 months as per requirements as specified in this technical specifications. The warranty start date shall commence from date of commissioning of the project. The Bidder shall be solely responsible for the same (replacement and operation) without any additional cost.

Comprehensive Annual Maintenance Contract (AMC) from Original Equipment Manufacturer (OEM). or OEM authorized service provider for all the bought out items of Electrolyser package shall be provided by Bidder. AMC shall start from the end of defect liability period of 12 months.

Replacement of items, if required, within the O&M period of 10 years.

In case of any issue related to failure and repair of Electrolyser, the Bidder/ Contractor and the OEM of ELECTROLYSER / ITS CHANNEL PARTNER shall ensure the following:



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The OEM of ELECTROLYSER/ ITS CHANNEL PARTNER's Service Engineer(s) shall be deputed to concerned site within 24 Hours plus actual journey time to attend the problem after receiving the information of the same from the Employer.

12.0 PENALTY CLAUSE

The output of Electrolyser at full load should not be less than 200 Nm³ /hr and the specific energy consumption should not deteriorate to more than 64.5 kWh/kg including the BOP while handing over the plant to Customer.

Liquidated damages based on quoted degradation parameters of specific energy consumption for Electrolyser output degradation for the respective years shall be leviable as under for Electrolyser Plant:

- Performance Shortfall = (Difference of Actual Specific Energy Consumption and Guaranteed Energy Consumption)/Guaranteed Energy Consumption
- Liquidated damage = (Yearly AMC Charges for the respective year) x 40% x (Performance Shortfall)

13.0 MANDATORY SPARES

The supply of Mandatory Spare Parts, if any, shall be included in the Contract. Beside the aforesaid Mandatory Spares parts, the Bidder shall list of spare parts required for the operation and maintenance of the Facilities to the Employer for a period of 10 years from Completion of the Facilities.

14.0 TRAINING

Bidder will provide on-site training on various systems, Control, operation, maintenance and troubleshooting of Electrolyser system to Owner's personnel if desired by Owner.

15.0 TERMINAL POINTS (TP)

- TP1. Electrical/Substation:** Required input power at 415V shall be provided.
- TP2. Raw Water/ Cooling Water:** Water shall be provided by BHEL at one point near the container.
- TP3. Hydrogen outlet:** H₂ Outlet of Electrolyser system to feed the H₂ compressor.

16.0 DOCUMENTATION AFTER PLACEMENT OF P.O

Submission of following documents shall be included in the bidder's scope:

- Layout of Electrolyser Plant including control room with all dimensions, simulation model etc.
- Relevant drawings, specifications, datasheets etc. of complete system
- All mechanical, electrical, instrumentation design data and calculations, drawings etc.
- All necessary third-party certificates for all the critical components



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- Factory/laboratory calibration certificates of devices/instrument/ panels etc.
- Ingress Protection (IP) standard compliance certificates
- Write-up on various statutory requirements and their compliance for various facilities and systems etc.
- All ownership certificates should be in the name of employer.
- User's manual, operating manual, vendor manuals, product catalogues, wiring diagrams, drawings, termination drawing and interconnecting schematic diagram etc. for the Electrolyser system besides their soft copies.
- Process flow diagram (PFD), Piping & instrumentation diagram (P&ID) and Heat & Mass Balance
- Instrument indexes, Instrument loop diagram (ILD), Instrument specification sheet, Calculation sheet
- Process and equipment data sheet
- GAD, As built and Isometric drawings
- Civil inputs
- Vendor documents (brought out items)
- Safety documentation (safety case, safety manual)
- Maintenance procedures
- As-built deliverables (representing accurate record of the plant)
- Commissioning records
- Loop and logic diagrams, Instrument data sheets, Instrument connection and wiring list, Instrument hoop-up diagrams, Instrument wiring layout, Instrument air piping layout
- Control room panel layout
- Electrical Schematics/SLD, design Calculation, load list, Datasheets, power & Control wiring diagram, cable sizing and schedule datasheets
- System panel layouts (DCS)
- Sub vendor list.
- List of mandatory spares, commissioning spares, consumables & O&M spares.
- PG test procedure.
- Test reports as per approved Quality plan.
- Requirement/Location of Hydrants in the plant equipment layout as per PESO Norms.
- Additional requirements, as defined by Bidder/Customer/BHEL.

17.0 DOCUMENTS REQUIRED FROM BIDDER ALONG WITH TECHNICAL - BID

- A. Documents in support of PQR
- B. Electrical Load list of the Electrolyser System



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- C. Equipment Layout of the Electrolyser System along with terminal points
- D. Un-priced Price Bid format with “Quoted” in respective cell
- E. Technical data sheet for hydrogen generation plant- Annexure A
- F. Duly signed No Deviation format- Annexure B
- G. Details of terminal points



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ANNEXURE-A

TECHNICAL DATA SHEET FOR HYDROGEN GENERATION PLANT

(To be filled by Bidder)

1.	Capacity of proposed Hydrogen Plant	17.85 kg/hr (min) or more
2.	Technology	<i>Bidder to specify</i>
3.	Type of enclosure proposed	Containerized
4.	No. of Electrolyser Units	2 X 50% or 3 X 34% of total capacity (<i>Bidder to specify</i>)
5.	Rating of each Electrolyser Module (with Model No.)	<i>Bidder to specify</i>
6.	Redundancy Configuration for both rectifier and Electrolyser Stack	<i>Bidder to specify</i>
7.	Water requirement (≤ 12 Liters/kg H ₂ (DM water))	<i>Bidder to specify</i>
8.	Details of startup and commissioning spares	<i>Bidder to specify list wise</i>
9.	Details of mandatory spares	<i>Bidder to specify list wise</i>
10.	Hydrogen Purity	H ₂ purity:
11.	Hydrogen pressure at outlet of Electrolyser system	<i>Bidder to specify</i>
12.	Power Supply Requirement (AC), Total power requirement of Electrolyser system, No. and rating of feeders	<i>Bidder to specify</i>
13.	Electrical Load list for auxiliaries	<i>Bidder to specify</i>
14.	Civil Input:	
a)	Load Data of Electrolyser in Kg	<i>Bidder to specify</i>
b)	No. of Containers, with size and their weight in Kg	<i>Bidder to specify</i>
15.	Stack Life for continuous operations (>70,000 hrs.)	<i>Bidder to specify</i>

Specific Energy Consumption (SEC) for Electrolyser System to be quoted for 10 years' period: -

Sl. No.	End of the Year	Hydrogen SEC (kWhr/kg)
1.	Y1	
2.	Y2	
3.	Y3	



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4.	Y4	
5.	Y5	
6.	Y6	
7.	Y7	
8.	Y8	
9.	Y9	
10.	Y10	



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ANNEXURE-B

NO DEVIATION FORMAT

Bidder to write any deviation only here. Deviation indicated anywhere in the specification other than this annexure will not be entertained.

- 1)
- 2)

Certify that there is no deviation from the tender specification.

Name, Signature and Stamp of Bidder



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RECORD OF REVISIONS

Rev	Date	Revision Details	Revised By	Approved By
00	16-12-2024	First issue	AKS	MSPB