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| <br>A4-11 | PURCHASE SPECIFICATION<br>GROUP: PHOTOVOLTAICS | Spec. No     | PS-439-368 |
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TECHNICAL SPECIFICATION  
FOR  
ONLINE UNINTERRUPTED POWER SUPPLY (UPS)  
AT  
ELECTRONICS DIVISION, BHEL, MYSORE ROAD, BANGALORE, INDIA 560026

|                                                       |                |                |                        |
|-------------------------------------------------------|----------------|----------------|------------------------|
| REVISION DETAILS: (01)<br>As indicated at page no. 10 | PREPARED<br>SC |                | DATE<br><br>06.01.2017 |
|                                                       | APPROVED<br>SR | ISSUED<br>ENGG |                        |

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### Introduction

BHEL is inviting tenders for the supply of Online Uninterrupted Power Supply (UPS). The location of the supply and installation is the Electronics Division-BHEL located at Mysore Road, Bangalore, INDIA 560026.

### Pre-Qualification Criteria

| Sl. No | Particulars                                                                                                                                                                                                                                                                                                                                                                                                                       | Bidder's confirmation        |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 1      | Vendor shall have supplied at least one 500 KVA or above or at least 2 Nos of 250 KVA UPS for industrial application during last three years and shall be in working condition as on 31st of October 2016 or later. Certificate from customer to this effect shall be provided. Copy of PO or installation and commissioning certificate shall be enclosed. Certificate issued can be in the name of OEM or the authorized agent. | Submitted /<br>Not Submitted |

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| Sl. No. | TECHNICAL SPECIFICATION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | VENDOR'S<br>CONFIRMATION |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| 1.      | <b>Scope:</b><br>UPS is required for a solar cell manufacturing line. The UPS shall provide safe and reliable power supply to the equipment even with severe incoming supply disturbance.<br>Supplier shall visit the site (BHEL, EDN, Mysore Road) to understand the requirement                                                                                                                                                                                                                                                                                                                                         |                          |
| 2.      | <b>TECHNICAL SPECIFICATION:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                          |
| 2.1     | UPS Rating : 500 KVA x 3 Nos, 3 phase input, 3 phase output<br>Battery: 500 KVA x 2 Nos (Minimum 5,76,000 VAH)<br>Backup time: Minimum 15 minutes on full load<br><u><b>Option to connect the UPS system in Hot standby Mode</b></u> (One 500 KVA will act as redundant as the load requirement is 1000 KVA, battery bank should be connected to 2 Nos of 500 KVA UPS and should automatically switch on to third UPS in case of any fault in one UPS) <u><b>and Parallel Mode (Load Sharing).</b></u>                                                                                                                    |                          |
| 2.2     | <b>General Requirement:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                          |
|         | <ol style="list-style-type: none"> <li>Technology: IGBT/PWM based True online double conversion</li> <li>AC-AC efficiency on online mode: &gt;= 94% at &gt;=50% load</li> <li>Independent phase regulation</li> <li>Low heat loss</li> <li>Forced air cooling fans</li> <li>Excellent output wave form</li> <li>Full software control of all functions and monitoring</li> <li>UPS bypass: Automatic on overload or UPS failure</li> <li>Battery: Good/Bad indication</li> <li>Battery rack: MS battery rack, suitable for relocation with battery to alternate location</li> <li>Operating Temperature 0-40°C</li> </ol> |                          |

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|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|            | 12. Relative Humidity 20-70%<br>13. Noise (dB) < 70 dB at 1 mt. distance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |
| <b>2.3</b> | <b>Input :</b> <ol style="list-style-type: none"> <li>1. Input: 3 phase, 4 wire and earth</li> <li>2. Input voltage range: 380-400-415V selectable</li> <li>3. No. of phase : 3P + N</li> <li>4. Input frequency: 50 Hz</li> <li>5. Frequency tolerance: +/- 2% selectable from front panel)</li> <li>6. Power factor : Better than or equal to 0.98</li> <li>7. Soft start: With zero inrush current (adjustable</li> <li>8. Programmable parameters: Rectifier voltage gain, rectifier current gain, output voltage, input current limit, charge current</li> <li>9. DC voltage programmable between -12.5% to +5% of nominal voltage</li> <li>10. Nominal Power: 500 KVA</li> <li>11. Active Power: 450 KW</li> </ol> |  |
| <b>2.4</b> | <b>Battery</b> <ol style="list-style-type: none"> <li>1. SMF type batteries, 12 V, with 2 years warranty to be provided along with UPS.</li> <li>2. Make of batteries: Exide/ Amra Raja/ Rocket /Hitachi/Panasonic/AMCO (<b>mention the make and model of batteries being provided in the technical bid</b>)</li> <li>3. Parameters programmable: Float voltage, Nominal voltage, Low warning voltage, cut-out voltage, charge current, boost voltage and time, battery temperature co-efficient, Maximum high voltage</li> <li>4. Battery boost: Automatic, monthly and manual auto boost</li> </ol>                                                                                                                    |  |

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|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|            | <ol style="list-style-type: none"> <li>5. Max. current: Programmable, Battery condition indication</li> <li>6. Front panel fault indication</li> <li>7. –</li> <li>8. Minimum VAH required is 5,76,000</li> <li>9. Interconnecting link, DC cables, Bus bar enclosure to be included</li> <li>10. Software for battery monitoring and management to be provided</li> <li>11. Battery Online monitoring and manual monitoring provision to be made</li> <li>12. Battery breaker or isolator with SFU to be provided</li> <li>13. Dimension and weight of each battery rack to be provided</li> </ol>                                                                                                                                                                                                                                                         |  |
| <b>2.5</b> | <b>Output</b> <ol style="list-style-type: none"> <li>1. Regulation: Programmable per phase</li> <li>2. Max. Output current: RMS and Peak current programmable</li> <li>3. IGBT and hardware supervision option to be provided</li> <li>4. Field upgradable for Parallel operation of UPS</li> <li>5. Output Voltage Transient 5%</li> <li>6. Voltage THD (Total Harmonic Distortion) THD &lt; 1% (linear load), THD &lt; 3% (nonlinear load)</li> <li>7. Power Factor 0.9</li> <li>8. Frequency Tracking Range 50 Hz <math>\pm</math> 3 Hz, adjustable</li> <li>9. Frequency Precision (free running) <math>\pm</math> 0.05%</li> <li>10. Phase Tolerance 120° <math>\pm</math> 1° (balance and unbalance load)</li> <li>11. Voltage Unbalance Degree (100% unbalance load): <math>\pm</math> 1%</li> <li>12. Frequency Tracking Speed: 0.5 Hz/s</li> </ol> |  |

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|            | 13. Crest Factor: 3:1 at full load (I <sub>peak</sub> /I <sub>rms</sub> )<br>14. Overload ≥ 150% for 1 min<br>15. Current distortion: < 3% THDi (at full load)<br>16. Voltage distortion: < 1% with linear load<br>< 3% for nonlinear loads<br>17. Frequency stability with battery: 0.05%<br>18. Static bypass and manual bypass provision to be provided |  |
| <b>2.6</b> | <b>Standards</b> <ol style="list-style-type: none"> <li>1. IP 20</li> <li>2. EMI: IEC62040-1-1</li> <li>3. EMS: IEC61000-4-2(ESD), IEC61000-4-3(RS), IEC61000-4-4 (EFT), IEC61000-4-5 (Surge)</li> <li>4. Insulation Resistance &gt; 1M (500 V DC)</li> <li>5. Voltage Frequency independent : IEC 62040-3</li> </ol>                                      |  |
| <b>2.7</b> | <b>Interface:</b> <ol style="list-style-type: none"> <li>1. RS233 port</li> <li>2. Modbus 485 for BMS compatibility</li> <li>3. Parallel interface</li> <li>4. Modem interface</li> <li>5. Modular I/O interface</li> <li>6. Remote alarm interface</li> </ol>                                                                                             |  |
| <b>2.8</b> | <b>Protection circuits for following functions to be provided</b> <ol style="list-style-type: none"> <li>1. Input phase reversal</li> <li>2. Back feed</li> <li>3. 1:1 Galvanic Isolation transformer (Should be covered) at the UPS output after the bypass switch with K13 Copper Winding</li> <li>4. Breakers</li> </ol>                                |  |

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|             | 5. EMI, RFI filters/ Surge filters<br>6. Fault display: Front panel LCD                                                                                                                                                                                             |  |
| <b>2.9</b>  | <b>Expansion/Deletion for parallel strings</b><br>Addition & deletion without shutting down the load or UPS bypass operation to be provided                                                                                                                         |  |
| <b>2.10</b> | <b>Options &amp; Accessories</b><br>Offer shall include all options & accessories required for meeting the specification                                                                                                                                            |  |
| <b>3.0</b>  | <b>Acceptance</b><br>Acceptance for equipment will be provided after two weeks of continuous running of equipment for the rated parameters                                                                                                                          |  |
| <b>4.0</b>  | <b>Service</b><br>Service engineer shall be stationed in Bangalore. Supplier shall depute his service engineer within the same day of reporting of faults. For all calls made after 5 pm, service engineer shall be deputed not later than 9 am on following day.   |  |
| <b>5.0</b>  | <b>Calibration Certificates</b><br>Supplier shall provide list of instruments/indicators that required to be calibrated periodically along with the offer. Calibration certificates for these items shall be provided. Procedure for calibration shall be provided. |  |
| <b>6.0</b>  | <b>Preventive Maintenance Activities</b><br>Supplier shall carryout Preventive maintenance activities during the warranty period & during the AMC period. Calibration of instruments/indicators as applicable shall also be carried out as per specified schedule   |  |
| <b>7.0</b>  | <b>Warranty:</b> The equipment shall carry full onsite warranty for a period of TWO YEAR from the date of commissioning for all items supplied including consumables.                                                                                               |  |

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| 8.0  | <b>AMC: Comprehensive</b> Annual Maintenance Contract for a period of 2 years after expiry of warranty period shall be quoted as an option. This will be taken into for arriving at L1                                                                                                                                                                                                                                                                                      |                                      |
| 9.0  | <b>Floor Space and weight Requirement</b><br>Vendor shall provide foot print diagram of the equipment along with approximate weight of the equipment (for UPS and individual battery racks)                                                                                                                                                                                                                                                                                 | <b>UPS:</b><br><b>Battery racks:</b> |
| 10.0 | <b>Note:</b> <ol style="list-style-type: none"> <li>(1) Any deviation from the above spec. &amp; General conditions shall be clearly brought out by the supplier in their offer and clause wise deviation list to be provided.</li> <li>(2) Vendor's shall fill up in 'VENDOR'S CONFIRMATION' column against each of above specification.</li> <li>(3) Reference list to be submitted indicating the customer's name, rating of UPS supplied and date of supply.</li> </ol> |                                      |

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#### GENERAL CONDITIONS:

01. Three sets of operation and maintenance manual in English shall be supplied along with the equipment. The manual shall include circuit diagram, component layout, PCB art work, troubleshooting chart indicating symptoms, checks and preventive maintenance schedule to be carried out, suggested remedy for all items including the bought out items. This shall also include all mechanical /pneumatic /hydraulic diagrams for the components /systems used in the equipment. Two sets of as built and approved drawing should be submitted
02. The equipment shall be designed taking into account all safety and OHSAS requirements. Hazards connected with operation & maintenance of the equipment shall be brought out explicitly and instructions for minimizing the hazards (environmental / safety) to be indicated.
03. The equipment shall be aesthetically fabricated.
04. List of spares, part numbers, and address of original suppliers of spares/subsystems shall be provided.
05. Service facilities required, Environmental requirements and their tolerance limits may be furnished.
06. The offer shall include adequate training on operation & maintenance of the equipment to BHEL personnel and Inspection of the Equipment at supplier's works. Offer shall also include satisfactory installation, commissioning and performance trials of the equipment at BHEL works by the supplier.
07. Equipment shall be rated for 415 V / 3 phase / 50 Hz / 5 wire system only.
08. Service Engineers deputed by the supplier for installation of the equipment at BHEL works shall comply with safety regulations and precautions, and have had adequate training in Environmental / Health / Safety hazards associated with the installation and operation of the equipment. Service Engineers deputed to BHEL for installation, commissioning and subsequent servicing shall have necessary ESI/PF/ESIC/Accident insurance policies as applicable that shall be in line with statutory requirements.

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The following are the revisions in the Technical Specification for Online Uninterrupted Power Supply (UPS)

| S. No. / Pg No.<br>as per Spec.<br>PS-439-368 | Existing                                                                                                                                                                                                                                                                                                                                                                           | Revised                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Supplier<br>Confirmation<br>(Yes / No) |
|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| 2.1 / Pg. 3                                   | UPS Rating : 500 KVA x 3 Nos, 3 phase input, 3 phase output<br>Battery: 500 KVA x 2 Nos (Minimum 5,76,000 VAH)<br>Backup time: Minimum 15 minutes on full load<br>One 500 KVA will act as redundant as the load requirement is 1000 KVA, battery bank should be connected to 2 Nos of 500 KVA UPS and should automatically switch on to third UPS in case of any fault in one UPS. | UPS Rating : 500 KVA x 3 Nos, 3 phase input, 3 phase output<br>Battery: 500 KVA x 2 Nos (Minimum 5,76,000 VAH)<br>Backup time: Minimum 15 minutes on full load<br><b><u>Option to connect the UPS system in Hot standby Mode</u></b><br>(One 500 KVA will act as redundant as the load requirement is 1000 KVA, battery bank should be connected to 2 Nos of 500 KVA UPS and should automatically switch on to third UPS in case of any fault in one UPS) <b><u>and Parallel Mode (Load Sharing).</u></b> |                                        |
| 2.4 / Pg 5                                    | 7. Battery end cell voltage: 1.75V, 105V for 12V battery                                                                                                                                                                                                                                                                                                                           | 7. <b>Deleted</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                        |
| 2.8 / Pg. 6                                   | 7. Isolation transformer 1: 1 in built                                                                                                                                                                                                                                                                                                                                             | 3. 1:1 Galvanic Isolation transformer (Should be covered) at the UPS output after the bypass switch with K13 Copper Winding                                                                                                                                                                                                                                                                                                                                                                               |                                        |

**All other details remain same as per Specification PS-439-368 Rev. 00.**

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