
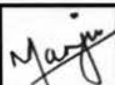
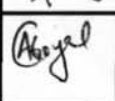


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COPYRIGHT AND CONFIDENTIAL. The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company	<table border="1"> <thead> <tr> <th data-bbox="284 388 349 420">S.NO.</th> <th data-bbox="454 388 641 420">DESCRIPTION</th> <th data-bbox="1144 388 1274 420">PAGE.NO.</th> </tr> </thead> <tbody> <tr><td>1.</td><td>SCOPE OF SUPPLY</td><td>03</td></tr> <tr><td>2.</td><td>APPLICATION</td><td>03</td></tr> <tr><td>3.</td><td>DESIGN CRITERIA</td><td>03</td></tr> <tr><td>4.</td><td>REFERENCE STANDARDS</td><td>04</td></tr> <tr><td>5.</td><td>SYSTEM DESCRIPTION</td><td>04</td></tr> <tr><td>6.</td><td>EXCLUSIONS</td><td>05</td></tr> <tr><td>7.</td><td>OPERATION OF UPS</td><td>05</td></tr> <tr><td>8.</td><td>BATTERIES</td><td>06</td></tr> <tr><td>9.</td><td>STATIC INVERTERS & AUX. EQUIPMENTS</td><td>07</td></tr> <tr><td>10.</td><td>STATIC & MANUAL BYPASS SWITCH</td><td>09</td></tr> <tr><td>11.</td><td>BATTERY CAPACITY & SIZING</td><td>10</td></tr> <tr><td>12.</td><td>CONTROL & INDICATIONS</td><td>11</td></tr> <tr><td>13.</td><td>CUBICLE PROTECTION CLASS & MECH.CONST</td><td>13</td></tr> <tr><td>14.</td><td>PAINTING</td><td>13</td></tr> <tr><td>15.</td><td>CABLE TERMINATIONS</td><td>14</td></tr> <tr><td>16.</td><td>EARTHING</td><td>14</td></tr> <tr><td>17.</td><td>LABELS</td><td>14</td></tr> <tr><td>18.</td><td>THERMAL DESIGN OF UPS PANELS</td><td>14</td></tr> <tr><td>19.</td><td>TESTING & INSPECTION</td><td>15</td></tr> <tr><td>20.</td><td>TEST REPORTS & CERTIFICATES</td><td>17</td></tr> <tr><td>21.</td><td>GUARANTEE</td><td>17</td></tr> <tr><td>22.</td><td>DRAWING & DOCUMENTATION</td><td>17</td></tr> <tr><td>23.</td><td>LIST OF ANNEXURES</td><td>18</td></tr> <tr><td>24.</td><td>ERECTION & COMMISSIONING</td><td>18</td></tr> <tr><td>25.</td><td>PACKING & MARKING</td><td>18</td></tr> <tr><td></td><td>ANNEXURE#1 TO ANNEXURE#8</td><td>19-26</td></tr> </tbody> </table>				S.NO.	DESCRIPTION	PAGE.NO.	1.	SCOPE OF SUPPLY	03	2.	APPLICATION	03	3.	DESIGN CRITERIA	03	4.	REFERENCE STANDARDS	04	5.	SYSTEM DESCRIPTION	04	6.	EXCLUSIONS	05	7.	OPERATION OF UPS	05	8.	BATTERIES	06	9.	STATIC INVERTERS & AUX. EQUIPMENTS	07	10.	STATIC & MANUAL BYPASS SWITCH	09	11.	BATTERY CAPACITY & SIZING	10	12.	CONTROL & INDICATIONS	11	13.	CUBICLE PROTECTION CLASS & MECH.CONST	13	14.	PAINTING	13	15.	CABLE TERMINATIONS	14	16.	EARTHING	14	17.	LABELS	14	18.	THERMAL DESIGN OF UPS PANELS	14	19.	TESTING & INSPECTION	15	20.	TEST REPORTS & CERTIFICATES	17	21.	GUARANTEE	17	22.	DRAWING & DOCUMENTATION	17	23.	LIST OF ANNEXURES	18	24.	ERECTION & COMMISSIONING	18	25.	PACKING & MARKING	18		ANNEXURE#1 TO ANNEXURE#8	19-26
S.NO.	DESCRIPTION	PAGE.NO.																																																																																			
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		PRODUCT STANDARD (HEEP - HARDWAR)	पृष्ठ का Page 3 OF 26

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अधिकारित कराता

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INVENTORY NO.

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दिनांक एवं
हस्ताक्षर
SIGN

समूची सूची संख्या
INVENTORY NO.

P-6448

1) SCOPE OF SUPPLY

1.1 This specification covers the design, manufacture, inspection, testing and supply of 3 Phase Uninterrupted Power Supply (UPS) of suitable rating along with Battery as mentioned in different sections of this specification.

1.2 It is not the intent to specify herein all the details of design to manufacture. However, the UPS shall conform in all respect to high standards of design, engineering and workmanship and shall be capable of performing in continuous operation up to guarantee as specified with the purchase enquiry instructions.

1.3 Deviations, if any, should be brought out very clearly along with the offer, otherwise it will be presumed that the offer is in line with what has been stated/asked for in this specification.

1.4 The offer should be complete with technical data, catalogue, brochures and drawings as applicable.

1.5 Bidder shall refer only the latest revision of the cross-referred national/international standard covered under various clauses of this specification.

1.6 Specific requirements of UPS to be considered are mentioned in "Data Sheet" Annexure-2.

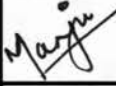
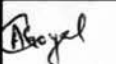
2) APPLICATION

UPS shall be used for supplying 415VAC, 50 Hz Uninterrupted Power supply to continuously run a 3 Phase, 0.75KW rating Squirrel Cage Induction Motor.

3) DESIGN CRITERIA

a) UPS shall be capable for supplying 415VAC, 50 Hz Uninterrupted Power supply to continuously run a 3 Phase, 0.75KW (0.8 pf) rating Squirrel Cage Induction Motor for at least one hour duration.

b) UPS should be capable of catering to the starting current of the motor which is approximately 600% for the duration of 10 seconds in addition to the requirement mentioned at (a).

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			पृष्ठ का Page 4 OF 26

समूची सूची संख्या को
अधिकारित करना
SUPERSEDES
INVENTORY NO.

The detail data sheet of the motor is attached at Annexure-5 of this specification. UPS is expected to meet all the requirements in totality for satisfactory start-up & continuous running of the motor in Emergency condition for the stipulated duration of 1 hour.

c) The detailed design calculation for selection of UPS rating (min 5 KVA) & capacity of the batteries to meet above mentioned design requirements shall be furnished by the vendors along with the offer. **Without these calculations the offer shall not be considered for bid evaluation.**

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4) REFERENCE STANDARDS

The equipment covered under this specification shall, unless otherwise stated, be designed, constructed and tested in accordance with the applicable sections of the latest relevant Indian Standard (IS), International Standards, which should be indicated in the offer.

5) SYSTEM DESCRIPTION

The UPS system shall consist of a single UPS module which shall be located within a fully enclosed, free standing cabinet. The cabinet shall include all components specified below power & control cables, input/output power terminals etc.

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5.1 COMPONENTS

The UPS shall be comprised of the major components listed below:-

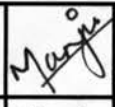

- Insulated gate Bipolar Transistor (IGBT) Converter Section.
- Insulated gate Bipolar Transistor (IGBT) Inverter Section.
- Digital Signal processor (DSP) using Pulse Width Modulation (PWM) control for Direct Digital Control (DDC) of all UPS control and monitoring functions.
- Static bypass switch
- Manual bypass switch
- Isolation transformer at the input side
- Sealed Maintenance free Ni-Cd batteries along with Battery Rack
- Interconnection power cable between UPS and battery
- Foundation bolts for UPS Panel and Battery Rack

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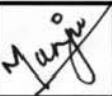
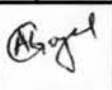
REV 01


समूची सूची संख्या
INVENTORY NO.

P-6448

निर्माणकर्ता WORKED BY	MANJU AZAD		20.7.15
जांचकर्ता CHECKED BY	A.K.GOYAL		20/7/15

दिनांक एवं हस्ताक्षर SIGN & DATE		उत्पाद मानक (हीप - हरिद्वर) PRODUCT STANDARD (HEEP - HARDWAR)	TG 60728 पृष्ठ का Page 5 OF 26	
सामग्री सूची संख्या को INVENTORY NO	<p>The UPS system with all components shall have surge withstand capability (SWC) to meet the requirements of ANSI (37.90A) /IEEE standard 587/IEC 62040-2.</p> <p>6) EXCLUSIONS</p> <p>6.1 The following shall be excluded from the scope of supply/works of supplier unless otherwise specified else where in this specification.</p> <ul style="list-style-type: none"> a) Civil works like foundations and trenches, flooring. b) Connection of panels to the station earthing grid. c) External power and control cable from distribution feeder <p>7) OPERATION OF UNINTERRUPTIBLE POWER SUPPLY SYSTEM</p> <p>7.1 Normal: During normal operation, the critical 3 phase A.C load is continuously supplied directly by the UPS Inverter. The UPS converter derives power from the LT distribution board and supplies D.C power to the inverter.</p> <p>7.2 Battery: Upon failure of the input A.C power supply the critical A.C load is supplied by the inverter, which obtains power from the battery. There shall be no interruption in power to the load upon failure or restoration of the main source.</p> <p>7.3 Recharge: Upon restoration of A.C power from the LT distribution board, the UPS converter shall automatically restart and resume supplying power to the inverter and battery charger shall recommence recharging the battery. The UPS converter shall provide a soft start on the return of the A.C power.</p> <p>7.4 Automatic Restart: Upon restoration of A.C power after an A.C power outage, the UPS shall automatically restart and resume supplying power to the connected load via the inverter.</p> <p>7.5 Static Bypass: The static bypass shall provide an alternate path for power to the connected A.C load and shall be capable of operating in the following modes:</p> <ul style="list-style-type: none"> a. Automatic: In the event of a UPS failure or should the inverter overload capacity be exceeded, the UPS unit shall perform an automatic transfer of the connected A.C. load from the inverter to the bypass source. 			
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		जांचकर्ता CHECKED BY A. K.GOYAL		20/7/15

दिनांक एवं हस्ताक्षर SIGN & DATE		उत्पाद मानक (हीप - हरिद्वर) PRODUCT STANDARD (HEEP - HARDWAR)		TG 60728 पृष्ठ का Page 6 OF 26	
सारणी सूची संख्या को अधिकृत करना SUPERSEDES INVENTORY NO.	<p>b. Manual Operation: Should the UPS module need to be taken out of service for limited maintenance or repair, manual activation of the bypass through a manual bypass switch shall cause an immediate transfer of the connected A.C. load from the inverter to the bypass source. Full electrical isolation of the UPS system shall therefore be obtained, without disruption to the critical load, by operation of an integral wrap-around manual bypass switch.</p>				
COPYRIGHT AND CONFIDENTIAL. The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company.	<p>8) BATTERIES</p> <p>8.1 The battery system shall be suitable to support a connected motor load of 0.75KW (0.8 p.f.) for a minimum of 60 minutes continuous duty at an ambient temperature from 5 deg C to 50 deg C.</p> <p>8.2 In addition to clause 8.1 the battery shall be suitable to support the starting current for the starting time of the motor load as specified in the Motor data at Annexure-5.</p> <p>8.3 The batteries shall be Sealed Maintenance free type Ni-Cd batteries.</p> <p>8.4 The battery string of multiple cells shall have its own dedicated means of electrical protection.</p> <p>8.5 Battery Rack shall be supplied along with accessories and devices required for maintenance and testing of batteries(e.g. Hydro meter, Set of Hydrometer syringes suitable for vent holes in different cells, Spanners, Cell testing voltmeter, rubber aprons, Rubber gloves, Temperature indicator and cell lifting facility)</p> <p>8.6 A fully discharged battery system shall be capable of being recharged to 80% of the UPS output capacity within a maximum period of 10 times the normal total discharge time period, and further to 90% of the UPS output capacity within a maximum period of 4 hours.</p>				
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दिनांक एवं SIGNATURE SUPERSEDES INVENTORY No.		उत्पाद मानक (हीप - हरिद्वर) PRODUCT STANDARD (HEEP - HARDWAR)	TG 60728 पृष्ठ का Page 7 OF 26
दिनांक एवं SIGNATURE 21/7/15	दिनांक एवं SIGNATURE 21/7/15	9) STATIC INVERTERS AND AUXILIARY EQUIPMENTS 9.1 The static inverter shall be solid state type using proven pulse width Modulation (PWM)/Quasi square wave/step wave technique. The inverter equipment shall include all necessary circuitry and devices to conform requirements like voltage regulation, current limiting wave shaping, transient recovery, automatic synchronisation, synchronisation limits etc. as specified herein. <i>Vendor may note that <u>Ferro resonant type inverters</u> shall not be acceptable, charges/inverters shall be of IGBT based semiconductor technology, and regulation part of UPS shall be based on microprocessor.</i> 9.2 INVERTER CAPACITY: Each static inverter shall have the following minimum capabilities without causing any damage to the components and with current limits not operating. a. Continuous full load rating: As per approved design calculations but 5 KVA (Minimum) b. Overload capacity: i. 125% for 10 minutes minimum at all specified input voltage. ii. 150% for 60 seconds minimum at all specified input voltage. iii. 600% of motor rated current for 10 seconds minimum at all specified input voltage. The inverter shall have sufficient I^2t capability to clear a slow acting HRC fuse/semiconductor fuse having a continuous current rating equal to at least 20% of the continuous full load current rating of the inverter, while feeding 100% rated loads of the inverter. Bidder should clearly bring out in his offer with detailed scheme and calculation as how this requirement is met.	दिनांक एवं SIGNATURE 21/7/15
दिनांक एवं SIGNATURE 21/7/15	दिनांक एवं SIGNATURE 21/7/15	9.3 STEP LOAD PICK UP: Upon transfer of full load, the inverter output voltage shall not drop below 80% of normal voltage during the first half cycle after transfer and 90% of normal voltage in the next half cycle. The recovery to within $\pm 2\%$ of voltage shall be in less than 50 milliseconds. The Bidder shall furnish test data to BHEL that the equipment offered meets the above requirements.	दिनांक एवं SIGNATURE 21/7/15
दिनांक एवं SIGNATURE 21/7/15	दिनांक एवं SIGNATURE 21/7/15	REV 01	निर्माणकर्ता WORKED BY MANJU AZAD जांचकर्ता CHECKED BY A.K.GOYAL



उत्पाद मानक (हीप - हरिद्वर)

TG 60728

पृष्ठ का
Page 8 OF 26

PRODUCT STANDARD (HEEP - HARDWAR)

दिनांक एवं
हस्ताक्षर

समग्री सूची संख्या
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कि कंपनी के हित में हानिकारक हो न किया जाए

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समग्री सूची संख्या
INVENTORY

9.4 SUPPLY VOLTAGE, VARIATION AND LOSS

Each inverter shall include equipment necessary to protect itself from damage resulting from excursion, loss or restoration of DC input voltage and synchronising voltage.

9.5 OVERLOADS, SHORT CIRCUITS AND LOSS

- a. The inverters shall be provided with suitable fuse- free circuit breakers or fuses at the input and output which will permit proper co-ordination with other protective devices and at the same time protect the inverter against damage due to internal faults. All necessary equipment shall be provided to protect the inverter against over loads, short circuits and 100% loss of load. The inverter shall be self-protecting against damage if energised with full load connected.
- b. The inverter shall be provided with current limiting circuitry which will limits the output current to a value which will not damage the inverter or blow its fuses (or fuse free circuit breakers).

9.6 NON-LINEAR-LOADING

Each inverter shall be capable of operation with nonlinear loads. Vendor should consider a load of non-linear wave form providing a current crest factor of 3.0 occurring coincident with voltage peak. The nonlinearity shall be assumed to consisting of third, fifth and seventh order harmonics. The output waveform of the inverter (S) shall remain within specified limits when operating with nonlinear loads at 100% rated load.




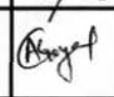
9.7 SOURCE PROTECTION


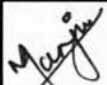
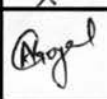
The inverter shall be self-protecting against all AC and DC transients, voltage surges and steady state abnormal voltages and current likely to be encountered in utility power station.



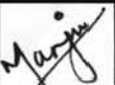
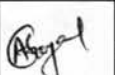
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निर्माणकर्ता WORKED BY	MANJU AZAD	<i>Manju</i>	20/7/15
जांचकर्ता CHECKED BY	A.K.GOYAL	<i>A.K.Goyal</i>	20/7/15


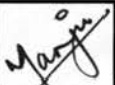
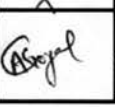
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दिनांक एवं हस्ताक्षर SIGN & DATE		उत्पाद मानक (हीप - हरिद्वर) PRODUCT STANDARD (HEEP - HARDWAR)	TG 60728 पृष्ठ का Page 9 OF 26	
सुपरसेड्स INVENTORY NO. शारीरी सूची संख्या में अंतर्भूत नंबर	<p>9.8 AUTOMATIC SYNCHRONISATION</p> <p>a. Inverter equipment shall include stable solid state circuitry & devices including stable oscillators etc. to enable inverter to operate satisfactorily under various modes specified under clause no. 7 above.</p> <p>b. The D.C. input current shall never exceed the full load current except for a short circuit within the inverter. This limitation applies to transient as well as steady state currents and includes inrush currents upon initial energisation of the UPS, loads energisation short circuits external to the inverter etc. for any value of the load and load power factor drawn by the equipment served. The inverter shall not impose on D.C. source any voltage oscillations in excess of 5 volts (RMS total of all frequencies) or any current oscillations in excess of 3% (RMS total of all frequencies) of the D.C. current at full load.</p>			
COPYRIGHT AND CONFIDENTIAL. The information on this documents is the property of Bharat Heavy Electrical Limited It must not be used directly or indirectly in any way detrimental to the interest of the company	<p>10) STATIC & MANUAL BYPASS SWITCH</p> <p>10.1 The static switch shall be a high speed transfer device comprised of naturally commutated SCR's. It shall be rated for 100% output. It shall be capable of supplying the UPS rated load current and also provide fault clearing. It should work in the following limitations:</p> <ul style="list-style-type: none"> • Inverter output under voltage or over voltage • Overloads beyond the capability of the inverter • DC circuit under-voltage or overvoltage • Final voltage of system battery is reached (bypass source present & available) • System failure <p>10.2 A Manual bypass switch shall be provided for bypass entire UPS system and connecting the loads to normal AC source / the backup source. Necessary interlocks to prevent mal-operation of UPS system by operation of manual bypass switch should be provided.</p> <p>10.3 The manual bypass switch shall have make before break contacts to ensure continuous supply to inverter loads during the operation of this switch.</p>			
स्वतंत्राधिकार एवं गोपनीय इस प्रलेख में दी गई सूचना भारत हेवी इलेक्ट्रिकल्स की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग जो कि कंपनी के हित में हानिकारक हो न किया जाए				
दिनांक एवं हस्ताक्षर & DATE 				
शारीरी सूची संख्या INVENTORY NO. P-6468	REV 01	निर्माणकर्ता WORKED BY MANJU AZAD		20/7/15
		जांचकर्ता CHECKED BY A.K.GOYAL		20/7/15

दिनांक एवं हस्ताक्षर SIGN & DATE		उत्पाद मानक (हीप - हरिद्वर) PRODUCT STANDARD (HEEP - HARDWAR)		TG 60728 पृष्ठ का Page 10 OF 26	
सामग्री सूची संख्या को अधिकारित करें	<p>10.4 Manual bypass switch shall have continuous load carrying capacity equal to 1.25 times of full load inverter current and necessary short term load carrying and interrupting capacity to meet the requirements of the inverter system.</p> <p>10.5 Other items like selector switches, pushbuttons etc. which are required for operation of the UPS system shall be as per supplier's standards.</p> <p>10.6 The following shall also be provided:</p> <p style="margin-left: 40px;">a. Provision of "group fault" for remote indication for UPS system.</p> <p style="margin-left: 40px;">b. Provision of "group alarm" contacts for each feeder.</p> <p style="margin-left: 40px;">Note: For all major components Vendor list (from where the items are procured) shall be submitted for BHEL's Approval</p>				
COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited It must not be used directly or indirectly in any way detrimental to the interest of the company	<p>11) BATTERY CAPACITY & SIZING CRITERIA</p> <p>11.1 The battery shall have sufficient plate per cell and ample ampere-hour capacity to allow the sequence of discharge currents to be supplied from a fully charged battery under maximum as well as minimum ambient temperature conditions encountered at site and specified elsewhere in this specification, 600% of full load current during starting of the motor for 10 sec. duration, 100% Full load current of UPS system for 60 minutes.</p> <p>The Battery capacity calculation shall correspond to the finally selected UPS system rating irrespective of the actual load on UPS.</p> <p>11.2 The battery shall be high discharge performance type to withstand discharge/charge throughout life like without loss of capacity.</p> <p>Bidder shall submit battery sizing calculations, with the offer for BHEL approval.</p> <p>The battery shall be furnished as per sizing calculation approved by BHEL during offer evaluation stage without any Price repercussion whatsoever.</p>				
स्वतंत्राधिकार एवं गोपनीय इस प्रलेख में दी गई सूचना भारत हेवी इंजीनियरिंग्स की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग जो कि कंपनी के हित में हितकारक हो न किया जाए					
दिनांक एवं हस्ताक्षर SIGN & DATE <i>21/7/15</i>					
सामग्री सूची संख्या INVENTORY NO. P-6448	REV 01	निर्माणकर्ता WORKED BY MANJU AZAD		20.7.15	
		जांचकर्ता CHECKED BY A.K.GOYAL		21/7/15	

दिनांक एवं हस्ताक्षर SIGN & DATE		उत्पाद मानक (हीप - हरिद्वर) PRODUCT STANDARD (HEEP - HARDWAR)	TG 60728 पृष्ठ का Page 11 OF 26	
सामग्री सूची संख्या को अधिकारित करता SUPERSEDES INVENTORY NO.	<p>Bidder shall take in to account various correction factors, such as capacity factor, temperature correction factor, aging factor, design margin etc. as per data given below while calculating the size of the battery.</p> <p>Capacity factor one hour rating to ten hour rating : As per recommendation of Original Equipment Manufacturer of battery</p> <p>Temperature correction factor (for min ambient temp) : As per recommendation of Original Equipment Manufacturer of battery</p> <p>Aging factor : 25%</p> <p>Design margin : 10%</p> <p>11.3 Each cell shall be assigned an identification number. Identification number shall be clearly a permanently marked on the front of the battery mounting structure so that individual cells are easily identifiable. In addition, the polarity markers shall be furnished for the end cells.</p> <p>12) CONTROL AND INDICATIONS</p> <p>12.1 UPS shall have the necessary control switches, push buttons and indicating lamps on the front panel door for its independent start up and shut down. It should be possible to isolate the inverter on the input as well as the output side by means of DC & AC MCBs.</p> <p>12.2 Indicating lights with proper actuating devices, circuitry and legend shall be furnished on front of the inverter panels. Even if the abnormal conditions are momentary in nature, these indicating lamps shall continue to glow until cleared by a reset push button provided on the front of the panel.</p> <p>12.3 Indicating lamps shall be of cluster LED type. Following indications shall be provided minimum on UPS panels:</p> <p style="padding-left: 40px;">Fault Indication on LCD Digital Display</p> <ul style="list-style-type: none"> i. Input Single Phasing/Phase reversal ii. Mains Fail iii. Rectifier Over Voltage iv. DC Under Voltage 			
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स्वयंप्रमाणित एवं गोपनीय इस प्रलेख में दी गई सूचना भारत हीवी इलेक्ट्रिकल्स की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग जो कि कंपनी के हित में हानिकारक हो न किया जाए				
दिनांक एवं हस्ताक्षर SIGN & DATE				
सामग्री सूची संख्या INVENTORY NO. P-6448	REV 01	निर्माणकर्ता WORKED BY MANJU AZAD		20/7/15
		जांचकर्ता CHECKED BY A.K.GOYAL		20/7/15

दिनांक एवं हस्ताक्षर SIGN & DATE		उत्पाद मानक (हीप - हरिद्वर) PRODUCT STANDARD (HEEP - HARDWAR)	TG 60728 पृष्ठ का Page 12 OF 26	
सामग्री सूची संख्या को अधिकृतित करती SUPERSEDES INVENTORY NO.	v. Battery Low Pre-alarm vi. Battery Low vii. Booster Over Voltage viii. Converter Over Temperature ix. Output Under Voltage x. Output Over Voltage xi. Output Short Circuit xii. Output Overload xiii. Inverter Over Temperature xiv. Bypass Abnormal			
COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company	Indications on LED Display i) Input isolator ON ii) Rectifier ON iii) Battery on Float iv) Battery on Boost v) Battery Isolator ON vi) Load on Battery vii) Inverter ON viii) Load on Inverter ix) Load on Manual Bypass			
स्वयंसेविकाएक एवं गोपनीय इस दस्तावेज में दी गई सूचना भारत हीवी इलेक्ट्रिकल्स की संपत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग जो कि कंपनी के हित में हानिकारक हो न किया जाए	<p>Note: The above listed indications are only for indicative purpose, other indications which are required for quick trouble shooting of the UPS system or for the purpose as desired by the supplier shall be provided as per vendor's standards.</p> <p>12.4 Following mentioned panel meters shall be provided on front panel of UPS.</p> i) Output voltmeter AC indicating 0-300V scale, (1.5% Accuracy) ii) Output Ammeter AC indicating scale of 0-150% of rated continuous full load of inverter output current of 1.5% Accuracy. iii) * Digital display of 4-1/2 digit for indicating output KW iv) * Digital display of 4-1/2 digit for indicating output Frequency. v) * Digital display of 4-1/2 digit for indicating Power factor.			
दिनांक एवं हस्ताक्षर SIGN & DATE	<p>Note:</p> 1. The meters should be selected with appropriate calibration so as to display accurate readings even at low values of current or voltage. 2. Asterisk (*) marked meters can be part of LCD digital display. 3. All panel meters shall be 90 ° FSD and size of 96mm x 96mm.			
सामग्री सूची संख्या INVENTORY NO. P.6448	REV 01	निर्माणकर्ता WORKED BY MANJU AZAD	जांचकर्ता CHECKED BY A.K.GOYAL	 20/7/15  20/7/15

दिनांक एवं हस्ताक्षर SIGN & DATE		उत्पाद मानक (हीप - हरिद्वर) PRODUCT STANDARD (HEEP - HARDWAR)	TG 60728 पृष्ठ का Page 13 OF 26	
SUPERSEDES INVENTORY NO. समग्री सूची संख्या को अधिकारित करता	<p>12.5 In addition to the above indicating lamps, at least one potential free changeover contact shall be made available (wired up to the terminal block) for each of the conditions to be connected to other system in purchaser's scope.</p> <p>12.6 The meters as mentioned in technical data shall be provided as minimum, mounted on the front panel of UPS.</p> <p>12.7 LCD display should be back lit.</p>			
COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited It must not be used directly or indirectly in any way detrimental to the interest of the company	<p>13) CUBICLE PROTECTION CLASS & MECHANICAL CONSTRUCTION OF THE PANELS</p> <p>13.1 Protection class shall be minimum IP32.</p> <p>13.2 The equipment shall be housed in free standing, floor mounted panels designed for indoor service. The panels shall be of CRCS (Cold Rolled Carbon Steel) construction. Sheet steel thickness shall be of minimum 2 mm for front equipment bearing surface, top, bottom, sides and back portions.</p> <p>13.3 Enclosures shall be furnished with concealed hinges. Front and rear doors shall be designed to permit easy access to all components for maintenance or replacement. The enclosures shall be reinforced with formed steel members as required to form a rigid self-supporting structure. Doors shall have three point latches.</p> <p>13.4 Adequate ventilation louvers shall be included. All vent openings shall be covered with corrosion resistant fine screen coverings.</p> <p>13.5 Suitable foundation bolts required for fixing of UPS panel bottom frame shall be supplied with the UPS panel. Bidder shall show necessary grouting details for foundation bolts in OGA drgs of UPS panel.</p> <p>13.6 Anti-vibration pad (Dunlop make) of thickness not less than 15 mm shall be provided.</p> <p>13.7 The panels shall be provided with illumination lamps and anti-condensation heaters.</p>			
स्वतंत्राधिकार एवं गोपनीय इस प्रलेख में दी गई सूचना भारत हेवी इंजीनियरिंग्स की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग जो कि कंपनी के हित में हानिकारक हो न किया जाए	<p>14) PAINTING</p> <p>14.1 The panels shall be chemically cleaned, rinsed, air dried and painted by painting process stoving / powder coating (preferably powder coating)only. The final finished thickness of paint shall be 100Microns.</p>			
दिनांक एवं हस्ताक्षर SIGN & DATE 20/7/15				
समग्री सूची संख्या INVENTORY NO. P-6448	REV 01	निर्माणकर्ता WORKED BY MANJU AZAD	MANJU AZAD	 20/7/15
		जांचकर्ता CHECKED BY A.K.GOYAL	A.K.GOYAL	 20/7/15

दिनांक एवं हस्ताक्षर SIGN & DATE		उत्पाद मानक (हीप - हरिद्वर)	TG 60728
		PRODUCT STANDARD (HEEP - HARDWAR)	पृष्ठ का Page 14 OF 26

समूची सूची संख्या को
INVENTORY NO.

14.2 The colour shade of UPS panel exterior (Front/Rear) / interior shall be as per RAL 9002 (grey white). For rest it shall be as per RAL 5012 (light blue).

15) CABLE TERMINATION

All cable connections in the UPS shall be provided with ring type lugs and designation/cross reference type ferrules for firm connections and easy maintenance. The panels shall be designed to facilitate cable entry from bottom of the panel. Removable un-drilled Hylum sheet 6mm of thickness or aluminum sheet of 5 mm thickness shall be provided for this purpose, and to be drilled at site for fitting the cable glands. Sufficient space shall be provided for avoiding sharp bending and easy connection of cables. A minimum space of 200 mm from the gland plate to the nearest terminal shall be provided.

16) EARTHING

The panel shall be equipped with an earth bus securely fixed along the inside base of the panel. It shall be connected preferably at two points to the outgoing earth studs.

17) LABEL

All components mounted in the panel shall be provided with individual labels with designation engraved on them.

18) THERMAL DESIGN OF UPS PANELS

- 18.1 The Inverter panels shall be designed for not more than 10 degree centigrade temp. rise above ambient during all operating conditions.
- 18.2 When the inverter is in operation the temperature rise in the panel shall not be more than 10 degrees centigrade above ambient for all operating conditions.
- 18.3 All components like SCRs, IGBTs, ICs, capacitors resistors etc., shall be properly chosen and de-rated such that failure rate is reduced to absolute minimum.

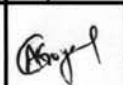
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इस प्रलेख में दी गई सूचना भारत हेवी इंजीनियरिंग्स की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग जो कि कंपनी के हित में हानिकारक हो न किया जाए

दिनांक एवं हस्ताक्षर
SIGN & DATE

समूची सूची संख्या
INVENTORY NO.

REV 01

निर्माणकर्ता WORKED BY	MANJU AZAD		20/7/15
जांचकर्ता CHECKED BY	A.K.GOYAL		20/7/15

दिनांक एवं हस्ताक्षर SIGN & DATE		उत्पाद मानक (हीप - हरिद्वर)	TG 60728
		PRODUCT STANDARD (HEEP - HARDWAR)	पृष्ठ का Page 15 OF 26

समूची सूची संख्या को
अधिकृतित करना
SUPERSEDES
INVENTORY NO.

19) TESTING AND INSPECTION

The complete UPS, including all instruments etc., shall be subjected to standard factory tests as per IEC 62040 – Part III & II. Battery shall be tested as per IS: 10918 and IEC 60623/ IEC 62259.

Type Test Certificates (not older than 5 years from the date of bid opening) of the **type tests** as mentioned in this clause conducted earlier on same rating & type of UPS and same type & make of battery shall be furnished with the offer and same shall be made available during customer inspection to the inspector. **In-case of non-availability of any of the type test certificates, vendor shall carry out the type tests along with routine test as part of main offer without any price implication to BHEL.**

Further all the routine test and type test as mentioned in this clause (as a minimum requirement) shall be carried out as per the BHEL approved Quality Plan. Other tests as per standards those are necessary to be performed for thorough testing of equipment shall also be carried out. All tests shall be witnessed by **BHEL** and customer's representative.

19.1 UPS

A. TYPE TESTS

- 1) Over load capability test
- 2) Short circuit current capability
- 3) Short circuit (fuse clearing) test
- 4) Radio frequency interference test
- 5) Audible noise test
- 6) Frequency regulation test
- 7) Dynamic test
- 8) Efficiency test for converter & inverter at 50% and 100% loads.
- 9) SWC test on complete UPS system.
- 10) Induced over voltage test on transformers and chokes (IEC 60076-11).

B. ROUTINE TESTS & ACCEPTANCE TEST

- 1) Checking of inter connection of cables
- 2) Checking of auxiliary devices(it includes operational check for UPS output, annunciation and inter lock checks)
- 3) Insulation resistance test(IR test)

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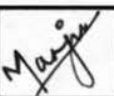
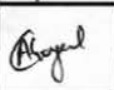
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SIGN & DATE
[Signature]
21/7/15


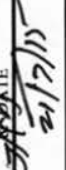
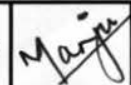

समूची सूची संख्या
INVENTORY NO.
P.6448

REV 01

निर्माणकर्ता WORKED BY	MANJU AZAD
जांचकर्ता CHECKED BY	A.K.GOYAL

<i>[Signature]</i>	20.7.15
<i>[Signature]</i>	21/7/15

दिनांक एवं हस्ताक्षर SIGN & DATE		उत्पाद मानक (हीप - हरिद्वर) PRODUCT STANDARD (HEEP - HARDWAR)		TG 60728 पृष्ठ का Page 16 OF 26	
सुपरसेडिज INVENTORY NO. संश्लेषण क्रमांक संश्लेषण क्रमांक	<ol style="list-style-type: none"> 4) High voltage (HV) test (2000V AC RMs for 1 minute) 5) Checking of correct firmware and parameters of software 6) Adjustment of measuring circuits 7) Output voltage adjustment range 8) Output frequency adjustment range 9) Light load test 10) AC input failure and return test 11) Restart test with battery 12) Total harmonic distortion (content) measurement 13) Transfer test 14) Full load test 15) Asynchronous transfer test Short circuit test 16) Input voltage variation test 17) Inverter output voltage regulation test 18) Frequency regulation test 19) Current limiting test 20) Transient response test 21) Meter Accuracy Test 22) Synchronisation test 23) Efficiency test 24) Continuous energised condition for 48 hours (it includes temperature rise test of transformers, chokes , Thyristor and IGBTs. 25) Burn in and rapid temperature cycling tests on PCBs.(vendor shall made available during inspection , the internal test certificates of burn-in test conducted on the modules for the project during stage testing) 				
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स्वयंपादिकाएँ एवं गोपनीय इस प्रलेख में दी गई सूचना भारत की इलेक्ट्रिकल्स की संपत्ति है इसका प्रयोग एवं प्रकाशक रूप से किसी भी तरह प्रयोग जो कि कंपनी के हित में हितकारक हो न किया जाए	<p>19.2 BATTERY</p> <p>a. TYPE TESTS</p> <ol style="list-style-type: none"> 1) Verification of constructional requirements 2) Verification of markings 3) Verification of dimensions 4) Test for Capacity test – Test for voltage during discharge 5) Ampere-hour and watt-hour efficiency tests 6) Test for loss of capacity on storage 7) Endurance Test 8) Retention of charge test 9) Short circuit current and internal resistance test <p>b. ROUTINE TESTS & ACCEPTANCE TEST</p> <ol style="list-style-type: none"> 1) Visual Inspection 2) Verification of markings 3) Verification of dimensions 4) Test for voltages during discharge 5) Open circuit Voltage and polarity 				
दिनांक एवं हस्ताक्षर SIGN & DATE 21/7/15					
संश्लेषण क्रमांक INVENTORY NO. AC448	REV 01	निर्माणकर्ता WORKED BY MANJU AZAD	20/7/15		20/7/15
		जांचकर्ता CHECKED BY A.K.GOYAL			21/7/15

दिनांक एवं हस्ताक्षर SIGN & DATE		उत्पाद मानक (हीप - हरिद्वर) PRODUCT STANDARD (HEEP - HARDWAR)	TG 60728 पृष्ठ का Page 17 OF 26																		
सुपरसेडस INVENTORY NO. शारीरी सूची संख्या में अंकित/लिखित अक्षर	<p>20) TEST REPORTS AND CERTIFICATES</p> <p>Four (4) copies of test reports/certificates of all the type/routine tests shall be sent to the BHEL for approval and furnished to Inspectors at supplier's works, prior to dispatch of equipment's from the works.</p> <p>The routine and type test reports of miscellaneous and bought out components shall also be furnished. On approval, the manufacturer shall furnish six (6) sets of bound test certificates as approved by the BHEL.</p> <p>21) GUARANTEE</p> <p>The equipment should be guaranteed for 18 months after dispatch from supplier's works or 12 months from date of commissioning of the equipment, whichever is earlier.</p> <p>22) DRAWING & DOCUMENTATION</p> <p>22.1 The drawing and documentation required are listed in Annexure-4.</p> <p>22.2 The following drawing/documents shall be approved by the purchaser during various stages.</p> <ol style="list-style-type: none"> a. Block diagram, Schematic diagram. b. Outline General diagram & Door mounted components layout diagram. c. Quality assurance program. d. Details of tests conducted. e. Calibration, Accuracy of various components. f. Deviations. g. Test reports. h. Draft O&M manual for approval along with dimensional drgs of UPS. <p>22.3 The supplier shall furnish the drgs/documents as per following tentative distribution.</p> <table border="1" style="width:100%; margin-top: 10px;"> <thead> <tr> <th style="width:10%;">Sl.No.</th> <th style="width:60%;">Category of Drawing</th> <th style="width:30%;">No. of Prints/ Copies</th> </tr> </thead> <tbody> <tr> <td>i)</td> <td>For approval</td> <td>4</td> </tr> <tr> <td>ii)</td> <td>For final distribution(after approval)</td> <td>6</td> </tr> <tr> <td>iii)</td> <td>As built drawings</td> <td>6</td> </tr> <tr> <td>iv)</td> <td>*O & M manual for final distribution. (Hard copies)</td> <td>10</td> </tr> <tr> <td>v)</td> <td>O&M Manuals in soft-form(on CDROMS)</td> <td>2</td> </tr> </tbody> </table> <p>* Note: 1) Draft of O&M Manual (UPS & Battery) shall be submitted to BHEL for approval. O&M Manual for final distribution should be only submitted after approval by BHEL.</p>			Sl.No.	Category of Drawing	No. of Prints/ Copies	i)	For approval	4	ii)	For final distribution(after approval)	6	iii)	As built drawings	6	iv)	*O & M manual for final distribution. (Hard copies)	10	v)	O&M Manuals in soft-form(on CDROMS)	2
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स्वयंसेवक एवं गोपनीय इस पत्रक में दी गई सूचना भारत हीन इलेक्ट्रिकल्स की सम्पत्ति है इसका प्रयोग एवं प्रकाशक रूप से किसी भी तरह प्रयोग जो कि कंपनी के हित में हितकारक हो न किया जाए	<p>COPYRIGHT AND CONFIDENTIAL</p> <p>The information on this documents is the property of Bharat Heavy Electrical Limited It must not be used directly or indirectly in any way detrimental to the interest of the company</p>																				
दिनांक एवं हस्ताक्षर SIGN																					
शारीरी सूची संख्या INVENTORY NO. P-6448	REV 01	निर्माणकर्ता WORKED BY MANJU AZAD	 20/7/15																		
		जांचकर्ता CHECKED BY A.K.GOYAL	 20/7/15																		

सामग्री सूची संख्या में
INVENTORY NO.

23) LIST OF ANNEXURES ATTACHED TO THIS SPECIFICATION

Annexure No.	Description	No. of Pages
1.	Scope of Supply	1
2.	Data Sheet	2
3.	Site Conditions	1
4.	Documentation	2
5.	Motor Data	1
6.	Schedule of Prices – UPS & BATTERIES	
7.	Schedule of prices - Supervision of erection & commissioning	
8.	Schedule of Prices– Mandatory Spares	

24) ERECTION & COMMISSIONING

- 24.1 Supplier shall separately quote for supervision of complete erection and commissioning of the UPS system and battery.
- 24.2 The necessary commissioning spares shall be in supplier's scope as part of main offer.

25) PACKING AND MARKING

All the items should be conserved suitably against damages/corrosion during transportation & storage. Packing box should be reusable type i.e. its top and planks should be held together by fasteners. Equipment should be packed in proper water proof and sound package to avoid damage during transit. Package should be legibly marked with following details:

- Purchase order number & date
- Description of equipment
- Name of supplier
- Net/Gross weight

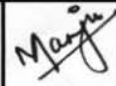
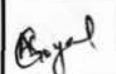
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 इस पत्रके अंतर्गत दी गई सूचना भारत हीवी इलेक्ट्रिकल्स की सम्पत्ति है इसका प्रयोग एवं प्रतियोगिता से किसी भी तरह प्रयोग जो कि कंपनी के हित में हितकारक हो न किया जाए

दिनांक एवं हस्ताक्षर
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सामग्री सूची संख्या
INVENTORY NO.
P.6448

REV 01

निर्माणकर्ता WORKED BY	MANJU AZAD	 20.7.15
जांचकर्ता CHECKED BY	A.K.GOYAL	 20/7/15

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		PRODUCT STANDARD (HEEP - HARDWAR)	पृष्ठ का Page 19 OF 26

समस्त सूची संख्या को अधिकारित करें	SUPERSEDES INVENTORY NO.
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ANNEXURE-1

SCOPE OF SUPPLY

SL NO.	DESCRIPTION	QUANTITY
01	Stand- alone 3 Phase UPS system with sealed maintenance free Ni-Cd batteries, along with foundation bolts, Anti Vibration pads, fully assembled and wired. (Rating of the UPS shall be as per approved design calculations subject to min. rating of 5KVA)	1 Set (Bidder to furnish price offer as per Annexure- 6)
02	Commissioning Spares quantity sufficient for commissioning of UPS system (part of the main offer)	1 Set (Bidder to furnish list a/w price offer as per Annexure-6)
03	Supervision of Erection & Commissioning Charges	1 set (bidder to furnish price offer as per Annexure-7)
04	Mandatory Spares	1 Set As per List given in "Schedule of prices – Mandatory Spares for UPS & Battery" (bidder to furnish price offer as per Annexure-8)

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इस परलेख में दी गई सूचना भारत हेवी इलेक्ट्रिकल्स की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग जो कि कंपनी के हित में हानिकारक हो न किया जाए

दिनांक एवं हस्ताक्षर DATE	22/7/15
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समस्त सूची संख्या INVENTORY NO. P-6648	REV 01	निर्माणकर्ता WORKED BY	MANJU AZAD		20/7/15
		जांचकर्ता CHECKED BY	A.K.GOYAL		20/7/15

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TG 60728

पृष्ठ का
Page 20 OF 26

PRODUCT STANDARD (HEEP - HARDWAR)

SUPERSEDES
INVENTORY NO.

समकी सूची संख्या को
अधिकतम बढ़ाएं

ANNEXURE-2

DATA SHEET FOR UPS AND BATTERY

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इस संकेत में ही यह सूचना भारत हीवी इलेक्ट्रिकल्स की सम्पत्ति है इसका प्रयोग एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग जो कि कंपनी के हित में हानिकारक हो न किया जाए

दिनांक एवं हस्ताक्षर
SIGN & DATE

20/7/15

समकी सूची संख्या
INVENTORY NO.
P-6648

REV 01

निर्माणकर्ता
WORKED BY
MANJU AZAD

जांचकर्ता
CHECKED BY
A.K.GOYAL

Manju
20-7-15

Gojal
20/7/15

SL. NO.	TECHNICAL SPECIFICATION	DATA
01	INPUT	
(a)	Nominal Voltage	415VAC Three phase, 3 Wire
(b)	Voltage Range	Min.+10%, -15% with battery charging Min.+10%, -25% without battery charging
(c)	Frequency	50Hz +/- 6%
(d)	Input Power Factor	>0.9 (at input full load & input nominal voltage)
02	RECTIFIER	
(a)	Type	IGBT based full wave rectifier
03	DC BUS CHARGER	
(a)	Type	SMPS based
(b)	Voltage	305 to 425 Vdc
(c)	Nominal Voltage Regulation	+/- 1 %
(d)	Max. DC bus ripple without Battery	2% RMS
(e)	Charging Method	Constant Voltage Constant Current (CVCC) Auto & Manual
04	BATTERY	
(a)	Battery Voltage	240 V dc
(b)	Type	Maintenance free Ni-Cd
(c)	Rating (AH)	As per approved design calculations
(d)	No. of batteries	As per approved design calculations
(e)	Battery Charging capacity	To be specified by the bidder
(f)	Model	To be specified by the bidder along with catalog in the offer
(g)	No. of Cells	To be specified by the bidder
(h)	Whether in built or separately mounted in the stand	To be specified by the bidder
(i)	Back up Time	1 hour during continuous running of the motor
05	OUTPUT/INVERTER	
(a)	Power capacity	Min. 5KVA or greater (as per approved design calculations)
(b)	Load Power Factor	0.7 lag to Unity within KVA & KW rating
(c)	Nominal Voltage	415 VAC, 3Phase, 3 Wire
(d)	Voltage Regulation (Steady State) at all input voltage and power factors	+/- 1 %
(e)	Voltage Regulation (Dynamic State)	+/- 5 %
(f)	Recovery time to 98%	<50 msec
(g)	Load Crest Factor	3 : 1

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TG 60728

पृष्ठ का
Page 21 OF 26

PRODUCT STANDARD (HEEP - HARDWAR)

SUPERSEDES
INVENTORY NO.

समकी सूची संख्या में
अभिलेखित करें

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स्वतंत्रताधिकार एवं गोपनीयता
इस दस्तावेज में दी गई सूचना भारत हीवी इलेक्ट्रिकल्स की संपत्ति है इसका प्रयोग एवं अपर्याय रूप से किसी भी तरह प्रयोग जो कि कंपनी के हित में हानिकारक हो न किया जाए

दिनांक एवं हस्ताक्षर
SIGN & DATE

(h)	Frequency for all conditions of input supply loads & temperature occurring simultaneously or in any combination. (Automatically controlled)	50Hz (+/- 0.25Hz in Free running mode) 50Hz (+/- 3Hz) in Synchronous mode
(i)	Slew rate	1 Hz/Sec
(j)	Waveform	True Sine Wave
(k)	Total Harmonic Distortion	< 3% for 100% Linear Load < 5 % for non Linear Load
(l)	Overload Capacity	a) 125% for 10 minutes minimum at all specified input voltage. b) 150% for 60 seconds minimum at all specified input voltage c) 600% for 10 seconds minimum for starting of the motor at all specified voltage
(m)	Inverter	IGBT based PWM with INSTANTANEOUS SINEWAVE CONTROL
(n)	Dynamic Response	For 0-100% step load change the output shall remain within +/- 5% & recover to 98% within 2-3 cycles
(o)	Duty	Continuous
06 ENCLOSURE		
(a)	Construction	2mm thick CRCA steel sheet
(b)	Protection Class	Minimum IP 32
(c)	Application	Indoor
(d)	Finish	Panel exterior / interior(front & rear) shall be as per RAL 9002 (grey white). For rest it shall be as per RAL 5012 (light blue).
(e)	Ventilation	Forced Air (Internal Fans)
(f)	Cable Entry	Bottom
(g)	Panel Dimensions	To be specified in the offer
(h)	System Configuration	Stand alone
07 STATIC BYPASS SWITCH		
(a)	Frequency Sync. Band	+/- 3 Hz
(b)	Slew rate	0.1Hz./Sec
(c)	Transfer (Inverter to Bypass)	0 msec. In Sync Mode <10 msec. In Async. Mode
(d)	Retransfer (Bypass to Inverter)	0 msec. In Sync.Mode In Async.Mode-N/A
08 MANUAL BYPASS SWITCH		
(a)	Manual Bypass	Make before Break
(b)	Voltage rating	440V AC
(c)	Current Capacity	Not less than 1.25 times of UPS output and rated current

समकी सूची संख्या
INVENTORY NO

REV 01

निर्माणकर्ता WORKED BY	MANJU AZAD	<i>Manju</i>	20.7.15
जांचकर्ता CHECKED BY	A.K.GOYAL	<i>Gojal</i>	20/7/15

SUPERSEDES INVENTORY NO
 समूची सूची संख्या को
जिम्मेदारि लेता

ANNEXURE-3

SITE CONDITIONS

1. CLIMATIC CONDITIONS

The climatic conditions at site are given below.
 All equipment supplied shall be designed and suitable for satisfactory working under these conditions:

Sl. No.	Description	Value
1.	Max. temperature of the air	50 deg. C
2.	Min. temperature of the air	5 deg. C
3.	Average relative humidity	maximum 95%
4.	Altitude	Less than 1000 M above MSL

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ANNEXURE-4

DOCUMENTATION

A. Documents required along with quotation (2 sets)

- i. Block diagram and Schematic diagram.
- ii. Functional write up and detailed specification of UPS system.
- iii. Outline general diagram showing cutout for cable entry, painting details, fixing arrangement, foundation details, and overall dimensions.
- iv. Quality Assurance Program. (Typical)
- v. Details of tests conducted both type tests and Routine tests. Certified copies of Type test certificates for the type test conducted earlier on similar type, size and rating (or higher rating) shall be enclosed along with the offer.(It is a mandatory requirement)
- vi. Diagram showing components mounted on the door along with labeling information.
- vii. Catalogs of major components used clearly stating ratings, calibration, accuracy's chosen.
- viii. Vendor list for bought out components.
- ix. Reference list.
- x. UPS Rating and BATTERY sizing calculation





B. Documents required within 2 weeks after placement of Order (4sets for approval and 6 sets after approval)


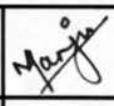

- i) OGA Drawing & list of tests conducted on sub-assemblies and equipment.
- ii) Detailed schematic diagram of sub-assemblies and circuit diagrams.

स्वत्वाधिकार एवं गोपनीय
 इस प्रलेख में दी गई सूचना भारत हिंदी इलेक्ट्रिकल्स की सम्पत्ति है इसका प्रयोग एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग जो कि कंपनी के हित में हितकारक हो न किया जाए

दिनांक एवं हस्ताक्षर
SIGN & DATE

समूची सूची संख्या INVENTORY NO. 26448	REV 01	निर्माणकर्ता WORKED BY MANJU AZAD		20.7.15
		जांचकर्ता CHECKED BY A.K.GOYAL		20/7/15

दिनांक एवं हस्ताक्षर SIGN & DATE		उत्पाद मानक (हीप - हरिद्वर) PRODUCT STANDARD (HEEP - HARDWAR)	TG 60728 पृष्ठ का Page 23 OF 26	
सुपरसेडस INVENTORY NO. समग्री सूची संख्या को अधिस्थानित करना	iii) Functional write ups of equipment, Electronic modules sub-assemblies, giving full description of design and operation. iv) Detailed Bill of Material. v) Catalogs of all the components used. vi) General arrangement drawing showing the mounting details of components inside the panel. vii) Quality Assurance Program (project specific) viii) Test Schedule (Brief testing procedure shall be given in Test Schedule) ix) Certified copies of Type test certificates for the type test conducted earlier on similar type, size and rating of UPS and Battery. x) UPS Rating and BATTERY sizing calculation			
COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company	<p align="center">C. After the dispatch of equipment - 10 sets</p> <p>Vendor shall prepare the draft O&M Manual, organized in to various sections covering the following aspects clearly and submit draft O& M manuals 2 sets for approval of BHEL.</p> i) Operation, maintenance, troubleshooting instructions. (List of operation and maintenance spares shall also be included) ii) Data Sheets of Electronic cards used in the Equipment (without giving any proprietary information like Component tag No. and make etc.) iii) Installation and commissioning instruction. iv) Tests reports of tests conducted on sub-assemblies and equipment's. v) Storage for prolonged duration. vi) Unpacking. vii) OGA and constructional features with schematic diagrams. viii) Copies of product Catalogue of all components/spare parts liable to be replaced during the life of panel.			
स्वतंत्राधिकार एवं गोपनीय इस प्रलेख में दी गई सूचना भारत हेवी इलेक्ट्रिकल्स की सम्पत्ति है इसका प्रयुक्त एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग जो कि कंपनी के हित में हानिकारक हो न किया जाए	Vendor shall submit the O&M manual in 10 copies after obtaining the approval of draft O&M manual from BHEL. The O & M copies shall be legible, clear and properly bound in folder.			
दिनांक एवं हस्ताक्षर SIGN & DATE  20/7/15				
समग्री सूची संख्या INVENTORY NO. P-6448	REV 01	निर्माणकर्ता WORKED BY MANJU AZAD 	जांचकर्ता CHECKED BY A.K.GOYAL 	20-7-15 20/7/15

दिनांक एवं हस्ताक्षर SIGN & DATE		उत्पाद मानक (हीप - हरिद्वर) PRODUCT STANDARD (HEEP - HARDWAR)	TG 60728 पृष्ठ का Page 24 OF 26																																													
सामग्री सूची संख्या को INVENTORY NO	Annexure-5																																															
MOTOR DATA																																																
MOTOR : 3 Phase Squirrel Cage Induction Motor to IS: 325 (TEFC TYPE)																																																
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स्वाम्यधिकार एवं गोपनीय इस प्रलेख में दी गई सूचना भारत हेवी इलेक्ट्रिकल्स की संपत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग जो कि कंपनी के हित में हितकारक हो न किया जाए																																																
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ANNEXURE- 6

SCHEDULE OF PRICES – UPS & BATTERIES

S. No.	DESCRIPTION	TOTAL (Nos)	UNIT PRICE Rs.
1	Stand- alone 3 Phase UPS system with sealed maintenance free Ni-Cd batteries, along with foundation bolts, Anti Vibration pads, fully assembled and wired. (Rating of the UPS shall be as per approved design calculations subject to min. rating of 5KVA)	01 set	
2	Commissioning Spares quantity sufficient for commissioning of UPS system (part of the main offer)	01 set	

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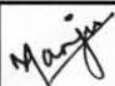
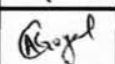
स्वल्पाधिकार एवं गोपनीय
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ANNEXURE-7

SCHEDULE OF PRICES – SUPERVISION OF ERECTION & COMMISSIONING

Sl. No.	DESCRIPTION	UNIT PRICE Rs.
1.	SUPERVISION OF ERECTION & COMMISSIONING CHARGES AT SITE	

दिनांक एवं हस्ताक्षर
 SIGN & DATE


समाप्ति सूची संख्या INVENTORY P.6448	REV 01	निर्माणकर्ता WORKED BY MANJU AZAD	 20/7/15
		जांचकर्ता CHECKED BY A.K.GOYAL	 20/8/15

SUPERSEDES INVENTORY NO.
 शारीरी सूची संख्या में परिवर्तित करें

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दिनांक एवं हस्ताक्षर
SIGN & DATE

शारीरी सूची संख्या
INVENTORY NO.
P.6448

ANNEXURE-8

**SCHEDULE OF UNIT PRICES –
MANDATORY SPARES FOR UPS & BATTERIES**

Sl. No.	DESCRIPTION	QUANTITY	UNIT PRICE Rs.	TOTAL PRICE Rs.
	UPS			
1.	HRC fuses / MCB's of each type and rating	2 sets		
2.	Semi-conductor fuses of each rating	4 sets		
3.	Electronic cards/modules of each type & function	2 nos.		
4.	Thyristors and Power Transistors of each type	1 no.		
5.	Power diodes of each rating	2 sets		
6.	Auxiliary relays of each type & rating	2 nos.		
7.	Filter Capacitors	1 set		
8.	Filter chokes	1 set		
9.	Cooling fans	1 no.		
10.	AC & DC Switches of each type & rating	2 nos.		
11.	D.C. Ammeter	1 no.		
12.	A.C. Ammeter	1 no.		
13.	D.C. Voltmeter	1 no.		
14.	A.C. Voltmeter	1 no.		
15.	Push Buttons	5 nos.		
16.	Special Cables of each type	1 no.		
	BATTERY FOR UPS			
17.	Cell Insulators	10 nos.		
18.	Connectors with nuts and bolts	50 nos.		
19.	Battery Cell	5 nos.		

Note: Any item in the above list if not applicable for the offered UPS system may be clarified along with suitable reason.

REV 01	निर्माणकर्ता WORKED BY MANJU AZAD	 20/7/15
	जांचकर्ता CHECKED BY A.K.GOYAL	 20/7/15

MANUFACTURER'S NAME AND ADDRESS		STANDARD QUALITY PLAN					TO BE FILLED BY BHEL		TO BE FILLED BY BHEL					
BHEL	VENDOR'S NAME AND ADDRESS	ITEM	3 PHASE UNINTERRUPTED POWER SUPPLY (UPS) SYSTEM WITH MAINTENANCE FREE NI - CD BATTERIES		QP. NO.:	QA/BE/QP/331								
			REV. NO.:	04										
			DRG. NO.:	AS PER P.O										
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			SPEC. NO.:	TG 60728										
REV. NO.:	00	Page 1 of 5												
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY			REMARKS		
1	2	3	4	5	6	7	8	9	D	M	B	N	10	11

1.0 IN COMING MATERIALS:													
1.1	- IGBTs (for both converter & Inverter Section) - Digital Signal Processor (DSP) , with Pulse width Modulation (PMW) - Static & Manual Bypass Switch - Isolation Transformer - Interconnection Power Cables - ICs, Capacitors Resistors, etc.	Visual , make , model, rating , routine and type tests reports	Major	Visual	100%	TG 60728	TG 60728/ Approved Data Sheet	TC	√	P	V	-	
1.2	BATTERY												
1.2.1 TYPE TESTS (FROM BATTERY MANUFACTURER)													
1.2.1.1		Verification of constructional requirements	Major	Verification	IEC 60410/ IS 8320	TG 60728	IS 10918 & IEC 60623	Test report	√	P	V	-	
1.2.1.2		Verification of markings	Major	Visual	IEC 60410/ IS 8320	TG 60728	IS 10918 & IEC 60623	Test report	√	P	V	-	
1.2.1.3		Verification of dimensions	Major	Dimensional	IEC 60410/ IS 8320	TG 60728	IS 10918 & IEC 60623	Test report	√	P	V	-	
1.2.1.4		Test for capacity test – test for voltage during discharge	Major	Electrical	IEC 60410/ IS 8320	TG 60728	IS 10918 & IEC 60623	Test report	√	P	V	-	
1.2.1.5		Ampere –hour and watt-hour efficiency tests	Major	Electrical	IEC 60410/ IS 8320	TG 60728	IS 10918 & IEC 60623	Test report	√	P	V	-	

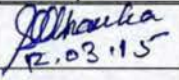
MANUFACTURER'S SUBCONTRACTOR'S वी.एच.ई.एल., हरिद्वार/BHEL, Haridwar	12-03-15 S.K. Chauhan प्रबंधक/Manager (QAX)	LEGEND: ! RECORDS IDENTIFIED WITH 'TICK' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION. M: MANUFACTURER / SUBCONTRACTOR B: BHEL / NOM. INSPECTION AGENCY N: CUSTOMER INDICATE 'P' PERFORM 'W' WITNESS AND 'V' VERIFICATION ALL 'W' INDICATED IN COLUMN 'N' SHALL BE 'CHP' OF CUSTOMER	FOR CUSTOMER USE APPROVED BY

74

MANUFACTURER'S NAME AND ADDRESS		STANDARD QUALITY PLAN					TO BE FILLED BY BHEL		TO BE FILLED BY BHEL				
BHEL	VENDOR'S NAME AND ADDRESS	ITEM	3 PHASE UNINTERRUPTED POWER SUPPLY (UPS) SYSTEM WITH MAINTENANCE FREE Ni - CD BATTERIES		QP. NO.:	QA/BE/QP/331							
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1.2.1.6		Test for loss of capacity on storage	Major	Electrical	IEC 60410/ IS 8320	TG 60728	IS 10918 & IEC 60623	Test report	√	P	V	-	
1.2.1.7		Endurance test	Major	Electrical	IEC 60410/ IS 8320	TG 60728	IS 10918 & IEC 60623	Test report	√	P	V	-	
1.2.1.8		Retention of charge test	Major	Electrical	IEC 60410/ IS 8320	TG 60728	IS 10918 & IEC 60623	Test report	√	P	V	-	
1.2.1.9		Short circuit and internal resistance test.	Major	Electrical	IEC 60410/ IS 8320	TG 60728	IS 10918 & IEC 60623	Test report	√	P	V	-	
1.2.2	ROUTINE AND ACCEPTANCE TESTS												
1.2.2.1		Visual inspection	Major	Visual	IEC 60410/ IS 8320	TG 60728	IS 10918 & IEC 60623	Test report	√	P	W	-	
1.2.2.2		Verification of makings	Major	Visual	IEC 60410/ IS 8320	TG 60728	IS 10918 & IEC 60623	Test report	√	P	W	-	
1.2.2.3		Verification of dimensions	Major	Dimensional	IEC 60410/ IS 8320	TG 60728	IS 10918 & IEC 60623	Test report	√	P	W	-	
1.2.2.4		Test for voltage during discharge	Major	Electrical	IEC 60410/ IS 8320	TG 60728	IS 10918 & IEC 60623	Test report	√	P	W	-	
1.2.2.5		Open circuit voltage and polarity test	Major	Electrical	IEC 60410/ IS 8320	TG 60728	IS 10918 & IEC 60623	Test report	√	P	W	-	
1.3	PANELS												
1.3.1		Dimensional, Finish, Mounting of BOIs & their Layout, Color, & Paint Thickness (DFT)	Major	Physical	100%	TG 60728	TG 60728 / Approved Data Sheet	COC	√	P	V	-	
1.3.2		Anti-Vibration Pad	Major	Visual	100%	TG 60728	TG 60728	-	-	P	V	-	
1.3.3		Protection class test	Major	IP 32	100%	TG 60728	TG 60728	Test reports	√	P	V	-	

2.0	FINAL TESTS ON 3 PHASE UNINTERRUPTED POWER SUPPLY (UPS) SYSTEM INCLUDING ALL INSTRUMENTS:											
2.1	TYPE TESTS											

MANUFACTURER/SUBCONTRACTOR	 R.03.15	LEGEND: ! RECORDS IDENTIFIED WITH 'TICK' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION. M: MANUFACTURER / SUBCONTRACTOR B: BHEL / NOM. INSPECTION AGENCY N: CUSTOMER INDICATE 'P' PERFORM 'W' WITNESS AND 'V' VERIFICATION ALL 'W' INDICATED IN COLUMN 'N' SHALL BE 'CHP' OF CUSTOMER	FOR CUSTOMER USE	APPROVED BY		

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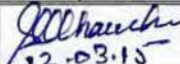
2.1.1		Over load capability	Major	Electrical	IEC 62040-III	TG 60728	IEC 62040 - III	Test report	√	P	V	-	
2.1.2		Short circuit current capability	Major	Electrical	IEC 62040-III	TG 60728	IEC 62040 - III	Test report	√	P	V	-	
2.1.3		Short circuit (fuse clearing) test	Major	Electrical	IEC 62040-III	TG 60728	IEC 62040 - III	Test report	√	P	V	-	
2.1.4		Radio frequency interference test	Major	Electrical	IEC 62040-III	TG 60728	IEC 62040 - III	Test report	√	P	V	-	
2.1.5		Audible noise test	Major	Electrical	IEC 62040-III	TG 60728	IEC 62040 - III	Test report	√	P	V	-	
2.1.6		Frequency regulation test	Major	Electrical	IEC 62040-III	TG 60728	IEC 62040 - III	Test report	√	P	V	-	
2.1.7		Dynamic test	Major	Electrical	IEC 62040-III	TG 60728	IEC 62040 - III	Test report	√	P	V	-	
2.1.8		Efficiency test for converter & inverter at 50% and 100% loads.	Major	Electrical	IEC 62040-III	TG 60728	IEC 62040 - III	Test report	√	P	V	-	
2.1.9		SWC test on complete UPS system	Major	Electrical	IEC 62040-III	TG 60728	IEC 62040 - III	Test report	√	P	V	-	
2.1.10		Induced over voltage test on transformers and chokes.	Major	Electrical	IEC 62040-III	TG 60728	IEC 62040 - III	Test report	√	P	V	-	
2.2	ROUTINE TESTS												
2.2.1		Checking of interconnection of cables	Major	Electrical	100%	TG 60728	IEC 62040 - III	Test report	√	P	W	-	
2.2.2		Checking of auxiliary devices (it include operational check for UPS output annunciation and inter lock checks)	Major	Electrical	100%	TG 60728	IEC 62040 - III	Test report	√	P	W	-	
2.2.3		Insulation resistance test (IR test)	Major	Electrical	100%	TG 60728	IEC 62040 - III	Test report	√	P	W	-	
2.2.4		High voltage (HV) test	Major	Electrical	100%	TG 60728	IEC 62040 - III	Test report	√	P	W	-	

MANUFACTURER/SUBCONTRACTOR	<i>12-03-15</i> LEGEND: ! RECORDS IDENTIFIED WITH 'TICK' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION. M: MANUFACTURER / SUBCONTRACTOR B: BHEL / NOM. INSPECTION AGENCY N: CUSTOMER INDICATE 'P' PERFORM 'W' WITNESS AND 'V' VERIFICATION ALL 'W' INDICATED IN COLUMN 'N' SHALL BE 'CHP' OF CUSTOMER	FOR CUSTOMER USE	
			APPROVED BY

12

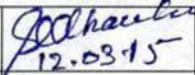
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		(2000V AC RMs for 1 minute)											
2.2.5		Checking of correct firmware and parameters of software	Major	Electrical	100%	TG 60728	IEC 62040 - III	Test report	√	P	-	-	Verified Through System Performance
2.2.6		Adjustment of measuring circuits	Major	Electrical	100%	TG 60728	IEC 62040 - III	Test report	√	P	W	-	If Applicable
2.2.7		Output voltage adjustment range	Major	Electrical	100%	TG 60728	IEC 62040 - III	Test report	√	P	W	-	
2.2.8		Output frequency adjustment range	Major	Electrical	100%	TG 60728	IEC 62040 - III	Test report	√	P	W	-	
2.2.9		Light load test	Major	Electrical	100%	TG 60728	IEC 62040 - III	Test report	√	P	W	-	
2.2.10		AC input failure and return test	Major	Electrical	100%	TG 60728	IEC 62040 - III	Test report	√	P	W	-	Conducted at site.
2.2.11		Restart test with battery	Major	Electrical	100%	TG 60728	IEC 62040 - III	Test report	√	P	W	-	Conducted at site
2.2.12		Total harmonic distortion (content) measurement	Major	Electrical	100%	TG 60728	IEC 62040 - III	Test report	√	P	W	-	
2.2.13		Transfer test	Major	Electrical	100%	TG 60728	IEC 62040 - III	Test report	√	P	W	-	
2.2.14		Full load test	Major	Electrical	100%	TG 60728	IEC 62040 - III	Test report	√	P	W	-	
2.2.15		Asynchronous transfer test	Major	Electrical	100%	TG 60728	IEC 62040 - III	Test report	√	P	W	-	
2.2.16		Input voltage variation test	Major	Electrical	100%	TG 60728	IEC 62040 - III	Test report	√	P	W	-	
2.2.17		Inverter output voltage regulation test	Major	Electrical	100%	TG 60728	IEC 62040 - III	Test report	√	P	W	-	
2.2.18		Frequency regulation test	Major	Electrical	100%	TG 60728	IEC 62040 - III	Test report	√	P	W	-	
2.2.19		Current limiting test	Major	Electrical	100%	TG 60728	IEC 62040 - III	Test report	√	P	W	-	
2.2.20		Transient response test	Major	Electrical	100%	TG 60728	IEC 62040 - III	Test report	√	P	W	-	
2.2.21		Meter accuracy test	Major	Electrical	100%	TG 60728	IEC 62040 - III	Test report	√	P	W	-	

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BHEL	VENDOR'S NAME AND ADDRESS	ITEM	3 PHASE UNINTERRUPTED POWER SUPPLY (UPS) SYSTEM WITH MAINTENANCE FREE NI - CD BATTERIES		QP. NO.:	QA/BE/QP/331								
			REV. NO.:	04										
			DRG. NO.:	AS PER P.O										
			REV. NO.:	AS PER P.O										
			SPEC. NO.:	TG 60728										
REV. NO.:	00	Page 5 of 5												
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY			REMARKS		
1	2	3	4	5	6	7	8	9	D	M	B	N	10	11

		(Not applicable for LCD display type)												
2.2.22		Synchronisation test	Major	Electrical	100%	TG 60728	IEC 62040 - III	Test report	√	P	W	-		
2.2.23		Efficiency test	Major	Electrical	100%	TG 60728	IEC 62040 - III	Test report	√	P	W	-		
2.2.24		Continuous energised condition for 48 hours (it includes temperature rise test of transformers, chokes, Thyristor & IGBTs)	Major	Electrical	100%	TG 60728	IEC 62040 - III	Test report	√	P	W	-		
2.2.25		Burn in and rapid temperature cycling tests on PCBs.	Major	Thermal / Electrical	100%	TG 60728	IEC 62040 - III	Test report	√	P	W	-		
2.2.26		Cables Terminations	Major	Visual	100%	TG 60728	IEC 62040 - III	Inspection Report	√	P	W	-		
2.2.27		Earthing Terminal	Major	Visual	100%	TG 60728	IEC 62040 - III	Inspection Report	√	P	W	-		
2.2.28		Labeling	Major	Visual	100%	TG 60728	IEC 62040 - III	Inspection Report	√	P	W	-		
3.0	IDENTIFICATION,, PACKING & MARKING:													
3.1		Identification	Major	Visual	100%	TG 60728	TG 60728	Internal records	-	P	V	-		
3.2		Packing & Marking	Major	Visual	100%	TG 60728	TG 60728	Internal records	-	P	V	-		

MANUFACTURER/SUBCONTRACTOR	 12.03.15	LEGEND: ! RECORDS IDENTIFIED WITH 'TICK' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION. M: MANUFACTURER / SUBCONTRACTOR B: BHEL / NOM. INSPECTION AGENCY N: CUSTOMER INDICATE 'P' PERFORM 'W' WITNESS AND 'V' VERIFICATION ALL 'W' INDICATED IN COLUMN 'N' SHALL BE 'CHP' OF CUSTOMER	FOR CUSTOMER USE	
				APPROVED BY