# *INDEX SHEET*

Indigenous & Imported
(Revision - 01)

**Electronics Division, Bangalore**

# BHEL - EDN

## TENDER DOCUMENTS

**COVERING, COMMERCIAL TERMS & CONDITIONS & ANNEXURES**

**FOR RFQ. NO. : PKN0000018 DTD:21.11.2013**

**DUE DATE : 18.12.2013**

| |
|---|
| PROJECTS : BELLARY # 3 (1x500 MW), SHIRPUR (2 X 150 MW) & YERAMARUS TPS- (2x800MW) |
| ITEM : LEAD ACID BATTERY- PLANTE TYPE |
| PROJECT LOCATIONS: BELLARY & YERAMARUS IN KARNATAKA, SHIRPUR IN MAHARASTRA. |

# Bharat Heavy Electricals Ltd.,

(A Government of India undertaking)

## Electronics Division

PB No. 2606 , Mysore Road Bangalore , 560026 INDIA

Fax : +91 80 26989217

.

☎ : +91 80 26989086

+91 80 26998377


Date: 21.11.2013

M/s.

Attn. Mr/Ms.

**Sub: Receipt of Tender Enquiry (RFQ) No.: PKN0000017 DATED .**

**with tender specifications for : LEAD ACID BATTERY**

**Project / Destination : BELLARY & YERAMARUS IN KARNATAKA, SHIRPUR IN MAHARASTRA.**

**Due Date for submission of Offer : 18.12.2013**

We are forwarding herewith our Enquiry (Request for Quotation) referred above along with following tender documents:

1 Enquiry header complete with item description, quantity and delivery schedule.

2 Purchase specifications.

3 Instructions to bidders (4 pages).

4 BHEL standard terms & conditions (Indigenous-11 pages & Imported - 7 pages) along with

(a) Loading factors for non-compliance of Commercial Terms & Conditions (8 Pages) Annexure - I

(b) Proforma for performance bank guarantee (for Indigenous-3 Pages & Imported - 2 pages) with instruction for PBG submission and with list of BHEL consortium bankers. Annexure-II, III(a), III(b) & III(C)

(c) Guidelines for Reverse Auction procedure (wherever applicable)- 2 Pages. Annexure - IV.

(d) List of International Airport. Annexure - V.

(e) Procedure for High Sea Sale. Annexure - VI. (f). Guidelines for Agents (Annexure - VII)

Please acknowledge receipt and confirm submission of complete offer within tender due date.

--sd--
PURCHASE EXECUTIVE

# REQUEST FOR QUOTATION

MMI:PU:RF:003

BHARAT HEAVY ELECTRICALS LIMITED
Electronics Division
PB No. 2606, Mysore Road Bangalore - 560026
INDIA

RFQ NUMBER: PKN0000018

RFQ DATE : 21.NOV.2013

**Due Date**
**18.DEC.2013**
**Time: 13:00 HRS**

VENUE : **NEW ENGG. BLDG**

(for all correspondence)
Purchase Executive : P.K Nagaraj
Phone : 2699 8179 / 09483501488
Fax : 080 2698 9227
E-mail: nagarajpk@bheledn.co.in

Please submit your lowest quotation subject to our terms and conditions attached for the material mentioned below. The quotation must be enclosed in a sealed envelope / Fax superscribed with RFQ no.and due date, should reach us on or before the due date by **13.00** hours IST and will be opened on the same day

| Sl No. | Description | Qty | Unit | Delivery qty | Delivery Date * |
|---|---|---|---|---|---|
| 1 | PR0150000072 UPS Battery (Lead Acid Plante)<br>UPS Battery (Lead Acid Plante)<br>DRW PS404249 00<br>Test Certificate<br>QUANTITY BREAK UP:<br>1. BELLARY - 2 SETS<br>2. SHIRPUR - 4 SETS<br>3. YERAMARUS - 4 SET | 10 | NO | 2<br>2<br>2<br>2<br>2 | ~~30.MAR.2014~~<br>~~30.MAR.2014~~<br>~~30.MAR.2014~~<br>~~30.MAR.2014~~<br>~~30.MAR.2014~~ |
| 2 | PR0150000570 Comm. Spares for UPS Battery (Lead Acid)<br>Commissioning Spares for<br>UPS Battery (Lead Acid Plante)<br>Test Certificate | 1 | ST | 1 | ~~30.MAR.2014~~ |

Total Number of Items - 2

Please note that the tender will be opened in the presence of the bidders or his authorised representatives (maximum two per organisation) who choose to be present with authorisation letters. Refer annexure for the terms and conditions.
Preference will be given to vendors who accepts our standard payment terms i.e.100% payment - 30 days after receipt of material at our works subject to acceptance.
Please specify Terms of delivery, Excise duty, sales tax, Ex-BHEL, Ex-works surcharge, Insurance,P&F, Freight and other taxes very clearly .
For evaluation,exchange rate(TT selling rate of SBI) as on scheduled date of tender opening (Part-I bid incase of two part bid) shall be considered.
The offers of the bidders who are on the banned list as also the offer of the bidders, who engage the services of the banned firms, shall be rejected.The list of banned firms is available on BHEL web site www.bhel.com

i). This is only RFQ not an order.
ii). In all correspondence quote RFQ No. & due date.
iii). In Quotation BHEL material code / RFQ Sl. No. should be mentioned clearly.
iv). Quotation Envelope / Fax not superscribed with RFQ No.and due date is liable for rejection.
v). Quotation should remain valid for a minimum peiod of 90 days from due date.
vi). In case of non-receipt of Quotation or regret letter for 3 consecutive RFQs you are liable to be removed from our vendors list.
vii). All Prices should be written in words and numbers.
viii). Excise Chapter Heading should be mentioned for all items where VAT is applicable .

Deliverty: * DELIVERY SCHEDULE: 14 WEEKS FROM THE DATE OF ISSUE OF MANUFACTURING CLEARANCE BY BHEL OR FROM THE DATE OF DOCUMENT APPROVAL, WHICH EVER IS EARLIER

For and On behalf of BHEL.

# ***SPECIAL INSTRUCTION***

(1) In case of bulky, and if you are not able to drop the offers in tender, please submit to following persons :

i) P K Nagaraj
Engineer/ CE-MM-PR
NEB 2nd Floor,
BHEL-EDN,
Bangalore.

i. G. Ponnuguru Packiam,
Sr. DGM/CE-MM-PR,
NEB 2nd Floor,
BHEL-EDN,
Bangalore.

(2) Please quote lumpsum freight charges, project wise.

(3) After receipt of your offers and after BHEL's evaluation, if your offer is found technically & commercially suitable, BHEL will take up with individual customers for approval of your company for supply of this tendered item to the respective projects. Wherever, customer(s) accepts your company name, BHEL will consider your offer also for price bid opening and further evaluation. In case customer (s) are not accepting your company for supply of this tendered items for one or any of the projects, BHEL will not open the price bid for the project(s) for which customer(s) have not accepted your company for supply of material against this tender and priced bids in sealed envelope(s) will be returned back to you after bid evaluation, PO placement and receipt of order acknowledgement from the successful bidder. However, intimation regarding the non-acceptance/consideration of your offer by customer(s) will be given to you by BHEL before price bid opening.

**Bharat Heavy Electricals Ltd.,**
(A Government of India undertaking)
**Electronics Division**
PB No. 2606 , Mysore Road Bangalore , 560026 INDIA

Fax : +91 80 26989217
.
☎ : +91 80 26989086
+91 80 26998377
.

# INSTRUCTIONS TO BIDDERS

BHEL RFQ No.& Date : PKN0000018 DATED:21.11.2013

Due date : 18.12.2013. Project : BELLARY & YERAMARUS IN KARNATAKA, SHIRPUR IN MAHARASTRA.

Item : LEAD ACID BATTERY-PLANTE TYPE FOR EACH PROJECT.

**BIDDER is requested to read the instructions marked as (✓) carefully and submit their quotation covering all the points:**

✓ Deviation to this specification/item description, if any shall be brought out clearly indicating "DEVIATION TO BHEL SPECIFICATION" without fail, as a part of technical offer.

✓ **Quotation shall be submitted in** :

- THREE PART BID (First Part - Pre qualification in a sealed envelope, Second Part - Techno commercial i.e. UN-PRICED offer in a sealed envelope & Third Part - Price offer in a separate sealed envelope alongwith Price Summary. All three sealed envelopes shall be again kept in a single sealed envelope. If priced offer is not submitted alongwith technical offer, offer is liable for rejection.

***Note : BIDDER shall ensure to superscribe all envolepes with RFQ number, RFQ Date, RFQ Due date, Item Description and Project clearly & boldly on each envelope. BHEL standard Commercial Terms and conditions must accompany techno-commercial offer without fail. BHEL standard commercial terms & conditions duly filled, signed & stamped only to be sent. Your standard printed commercial terms not needed and will not be accepted by BHEL.***

✓ ***In three part bids, filled in commercial terms & conditions must accompany unpriced techno-commercial offer, failing which your offer is liable for rejection. Priced offer shall be complete in all respects indicating basic prices, applicable Taxes and Duties, Packing & forwarding charges (if applicable) and Freight & Insurance charges, etc. and compulsarily sent alongwith techno-commercial offer.***

✓ ***In addition Bidder shall also quote for Erection & Commissioning Charges (E&C Charges), Documentation charges, Service Charges, Testing Charges (Type and Routine), Training Charges, Service tax, etc. wherever applicable. The price summary must indicate all the elements clearly, which will be considered for arriving at "Total cost to BHEL".***

✓ ***Tender (quotation) to be dropped in the Tender Box with 3 compartments (Monday / Wednesday/ Friday) kept in our reception area with caption "CE, SC&PV, DEFENCE", before 13.00 Hrs. on due date mentioned on the RFQ (Request for quotation) Monday, Wednesday, Friday. Tenders will be opened on due date and time mentioned on the RFQ. OR tender can be directly sent to BHEL by courier or speed post by mentioning kind attn: Mr.P K NAGARAJ, ENGINEER, CE-MM-PR***

***THE PRICE BID SHOULD BE PROJECT WISE IN THREE SEPARATE SEALED ENVOLOPES SUPER-SCRIBING RFQ NO. & PROJECT NAME. ITEM/PART NUMBER WISE UNIT RATES SHOULD BE QUOTED.***

## *DETERMINATION OF THE "TOTAL COST TO BHEL": (Indigenous Portion)*

***Total basic value + Packing & Forwarding charges + Excise Duty+Education Cess+Sales Tax/VAT + Lumpsum Freight with service tax + Insurance (as per BHEL Insurance premium) + Service Tax (as applicable)+ loading factor value on total basic material value (for deviations to Commercial Terms & Conditions) = "TOTAL COST TO BHEL".***

***Note : In case BHEL customer reimburse any one of the cost element like Excise duty, Sales Tax, Service Tax, Freight & Insurance charges, same will be removed for arriving at "TOTAL COST TO BHEL", in turn the lowest bidder. However vendor has to quote for all the cost components.***

***The lowest technically & commercially acceptable offer arrived as above and meeting BHEL norms will be considered for further processing.***

## *DETERMINATION OF THE "TOTAL COST TO BHEL": (Imported Portion)*

***Total basic value in foreign currency (FCA value) + cost insurance freight + Customs duty+freight from Indian port to project destination + loading factor value on total basic FCA value (for devitation to comercial terms & conditions) ="TOTAL COST OF BHEL".***

***Note : Exchange Rate ruling on the date of tender opening (part -1) will be considerd for converting foreign currency to Indian currency. Exchange rates , which is received from Bank and updated in SAP system of BHEL - EDN will be considered.***

In case PBG, Exchange rate on the date of tender opening (part-1) only will be considered for converting foreign currency to Indian currency and vice versa. Exchange rate received from Bank and updated in SAP system of BHEL - EDN will be considered.

✓ As far as possible, the quotations shall be free from corrections/overwriting. Corrections if any should be initialed with your seal. Any typographical error, totalling mistakes, currency mistake, multiplication mistake, summing mistakes observed in your priced bids, BHEL may consider as per existing guidelines for evaluation of the lowest quote. BIDDER shall honour the same in case Order is awarded for the said TENDER ENQUIRY / RFQ.

✓ **RISK PURCHASE CLAUSE** :- The purchaser at his discretion may also make purchase of the materials **NOT** supplied in time at the **RISK & COST** of the supplier. Under such situation, it will be obligatory on the part of the supplier who fails to supply the goods in time to make good to BHEL any loss due to risk purchase.

**FOR INDIGENOUS SCOPE :**

✓ This item is enquired for BELLARY, YERAMARUS & SHIRPUR TPS. projects, which qualifies for following benefits :

i) ~~Deemed export project, Mega power project and contract won against international competitive bidding basis (ICB), hence, Excise duty is fully exempted. Necessary documents for availing Excise duty exemption by suppliers will be furnished by BHEL~~,

1. NO BENIFITS FOR BELLARY PROJECT (NORMAL PROJECT).
2. ED,CST/VAT,LOCAL TAX, ENTRY/EXIT TAX WILL BE REIMBURSABLE BY CUSTOMER FOR SHIRPUR PROJECT.
3 .ED,VAT,LOCAL TAX, ENTRY/EXIT TAX & OCTROI WILL BE REIMBURSABLE BY CUSTOMER FOR YERAMARUS PROJECT.

Zero Customs duty. As per para 8.7 of Hand Book of procedures of EXIM policy, BHEL will part the import licence with the vendors to obtain import licence by themselves and custom clear the raw materials / components by availing zero customs duty. Hence, please furnish list of raw materials / components to be imported by you with Quantity and CIF value (for which BHEL has to share import licence). The benefit due to the above shall be passed on to BHEL and confirmed in the quotation. If there are no imported raw materials / components, same shall be confirmed in the offer.

ii) Deemed Export contract, NOT a Mega Power Project but won against International Competitive Bidding (ICB) and hence this project is eligible for Terminal Excise duty benefit from DGFT as per present EXIM policy. Vendor to submit (a) Disclaimer certificate and (b) Copy of Excise Invoice attested by Suptd.of Central Excise ( Signature in Blue ink with seal)

iii) Physical export contract eligible for complete exemption of Excise duty and Sales tax against submission of necessary documents by BHEL like ARE1 form and Form H.

**FOR IMPORTED SCOPE :**

✓ This item is enquired for BELLARY & SHIRPUR TPS project, which qualifies for following benefits :

a) Deemed Export project eligible for "NIL" customs duty.

b) Physical export project eligible for complete exemption of Customs duty.

c) Project Imports (5+12+3+4) project eligible for concessional customs duty - for BELLARY & YERAMARUS PROJECT.

d) Captive Power plant elgible for Concessional Customs Duty.

e) R & M project eligible for Concessional Customs duty.

f) Merit duty (10+12+3+4) is applicable for SHRIPUR PROJECT.

✓ BIDDER shall ensure to indicate clearly Excise duty, Education Cess, Sales Tax/VAT, Octroi, entry tax, Service Tax and freight charges as applicable, for the quoted items or services. In the absence of the clarity of these, any claim at a later date will not be entertained. Also any changes in taxes and duties after award of the contract, will not be considered except such are those, which are imposed by Govt. notification within the contractual delivery. Please note, seeking price amendments for change in Excise Duty due to crossing of Turnover limits will not be considered, under any circumstances.

✓ Quotations with, payment terms of "Advance" or "Inland letter of credit' will not be considered. & such offer / quotation is liable for rejection commercially.

✓ On award of contract if BIDDER seeks dilution of the ordered specification and if such deviation is acceptable to BHEL, BIDDER shall pass on mutually agreed price reduction to BHEL.

✓ Any dispute arising out of this, shall be referred to the sole arbitration of Head of Dept. (Materials Management-CE-PR), EDN, Bangalore or any other officer nominated by him and his decision shall be final and binding on the parties. The venue of the arbitration in all cases shall be Bangalore.

✓ All suits in respect of this lie in the court of Bangalore only.

✓ BHEL reserves the right to RE-FLOAT/ REJECT / CANCEL this TENDER ENQUIRY (RFQ) without assigning any reason or cause thereof. Quotes received against this TENDER ENQUIRY are subject to and governed by all these terms and conditions. BHEL's decision will be final in awarding of the contract and binding.

- ✓ As per our recent purchase policy, any offer received after due date and time will be treated has "Late offer" and will be rejected. Hence pl. submit offer within due date and time to avoid rejection due to late submission. It is the responsibility of vendor to submit offer in tender box within due date and time. Offer sent by fax/e-mail/courier/post etc. Which is received late will be tearated as late offer and BHEL will not be responsible for late offer. In case of the "Regret to Quote" , it should be submitted in tender box within due date and time. Late offer will be returned to vendors in sealed condition.
- ✓ Forward quotation / offer for this tender within due date and time. In case of 'not quoting' please send 'regret letter' which is a mandatory requirement. In case we do not receive offer / regret letter from you, we treat as 'Regret to quote' for this tender by you. In case of non receipt of "Regret Letter or Offer" it will be treated as "Regret to Quote" for this enquiry.
- ✓ In case of rejection due to (a) pre qualification grounds, (b) commercial grounds or (c) technical grounds, the sealed price bids will be returned back to respective vendors after release of PO and receipt of order Acknowledgement from the successful bidder.
- ✓ PBG to be sent by issuing bank directly to BHEL, Purchase department. PBG shall be from any one of the BHEL consortium banks only.
- ✓ All bank charges to vendors account only,
- ✓ Please quote your best, lowest, competitive, reasonable offer. Please indicate the prices in both figures & words.
- ✓ Please sign the offers. Unsigned bids/offers may not be considered & the offer is liable for rejection.
- ✓ Filled in BHEL standard terms and conditions should be submitted in original only. Zerox copy should not be attached.
- ✓ In case of quotes submitted in multiple currencies, Bidder shall ensure submission of relevant filled in Indigenous/Imported BHEL standard commercial terms & conditions without fail.
- ✓ If an indian representative/associate/liaison office quotes on behalf of a foreign based BIDDER, such representative shall furnish compulsorily the following documents :

i) Authorization letter to quote and negotiate on behalf of such foreign-based BIDDER.

ii) Undertaking from such foreign based BIDDER that such contract will be honoured and executed according to agreed scope of supply and commercial terms and conditions.

iii) Undertaking shall be furnished by the Indian representative stating that the co-ordination and smooth execution of the contract and settlement of shortages/damages/replacement/repair of imported scope till system is commissioned and handedover to customer will be the sole responsibility of the Indian representative/associates/agent/liaison office.

*Note : Either the Indian agent on behalf of the foreign principal or the foreign principal directly could bid in a tender but not both. Further in cases where an agent participants in a tender on behalf of one manufacturer, he will not be allowed to quote on behalf of other manufacturer alongwith first in a subsequent / parallel tender for the same item. Enclosed BHEL guidelines for regulation of agents of Forign principals shall be complied.*

- ✓ Packing list should be provided inside each box.
- ✓ All bank charges (inside and outside of India) are to vendors account only.
- ✓ Customs clearance, customs duty payment will be to BHEL account after the consignment is received at Indian Airport.

**PURCHASE EXECUTIVE**

# Electronics Division, Bangalore

## BHEL STANDARD COMMERCIAL TERMS AND CONDITIONS FOR INDIGENOUS SCOPE OF SUPPLY

**RFQ. NO. & DATE : PKN0000018 DATED: 21.11.2013**

| SL. NO. | TERMS | BHEL ACCEPTABLE TERM | BIDDER'S CONFIRMATION | DEVIATION IF ANY |
|---|---|---|---|---|
| 01 | **PRICE BASIS** | Firm i.e., from the date of PO to completion of supply if E&C is not applicable. If E&C is in supplier's scope, then the prices shall remain Firm till commissioning & handing-over of the complete system.<br>**(PVC clause not acceptable).** | **AGREE** | |
| **02** | **VALIDITY** | Valid upto 8 weeks from the date of opening of price Bid **(not technical bid), /date of Reverse Auction.** | **AGREE** | |
| **03** | **TERMS OF DELIVERY** | Ex works (including Packing & Forwarding charges but excludingTaxes and Duties). Packing shall be roadworthy, best suited for multiple transshipments and to take care of transit damages.<br>***Indicate Station of despatch :***<br>***Indicate place of manufacturing:***<br>***Indicate type & method of packing being adopted:*** | **AGREE**<br>_____<br>_____<br>_____ | |
| **04** | **DESTINATION** | Items are for direct despatch to BHEL's customer site located at : BELLARY IN KARNATAKA &,SHIRPUR IN MAHARASTRA.<br>Road Permit if applicable will be issued by BHEL alongwith Despatch Clearance.<br>***Hence, vendor may take a special note to indicate whether Central Sales Tax or Local State Sales Tax or VAT will be applicable.*** | **AGREE** | |
| **05** | **DOCUMENTS**<br>(Pl. see loading Factor) | **Along with quotation :** As called in purchase specification shall be furnished alongwith un-priced bid.<br>If not called in Purchase Specification then vendor shall submit two sets of Original catalogues, Data sheets, Bill of materials, Dimensional drawings, mounting details and any other relevant documents with un-priced bid.<br>**After issue of PO:** As called in Purchase specification for the complete scope of supply within two weeks on receipt of PO for BHEL/ customer/consultant approval.<br>If not called in Purchase Specification then vendor shall submit two sets of Drawings, Bill of materials, data sheets, Catalogues, Quality plan, Test procedure and Type Test Report for the complete scope of supply within **Two weeks** on receipt of PO for BHEL / Customer / Consultant approval. | **AGREE** | |

RFQ No.: PKN0000018 DATED: 21.11.2013

## Electronics Division, Bangalore

**BHEL STANDARD COMMERCIAL TERMS AND CONDITIONS FOR INDIGENOUS SCOPE OF SUPPLY**

| SL. NO. | TERMS | BHEL ACCEPTABLE TERM | BIDDER'S CONFIRMATION | DEVIATION IF ANY |
|---|---|---|---|---|
| 06 | **PENALTY (FOR DELAY IN SUBMISSION OF DOCUMENTS FOR BHEL / CUSTOMER APPROVAL):** (Pl see loading factor) | In the event of delay in submission of complete set of documents (including soft copy wherever applicable) in required sets beyond 2 weeks from receipt of Purchase order (vendor to confirm date of receipt of PO in writing), Penalty @ 2% (two percent) per week but limited to a max. of 10% (Ten percent) value of the basic material value will be applicable.<br><br>Penalty if applicable shall be deducted at the time of settlement of 75% payment.<br>If penalty is applicable for duration of less than a week penalty @ 2% (two percent) of the basic material value will be charged. | **AGREE** | |
| 07 | **EXCISE DUTY & EDUCATION CESS** | To confirm whether applicable. If applicable, indicate prevailing rate of Excise duty and maximum rate of Excise duty (against proof of Excise Invoice) However, for calculation purpose and arriving at **"Total cost to BHEL"** maximum rate of Excise Duty will be considered. In case Excise Duty remain FIRM throughout the contract, the same shall be specifically indicated. Otherwise, maximum Excise duty will be considered for arriving at lowest bidder. However, reimbursement of Excise Duty shall be at actuals against proof of Excise Invoice only. | **AGREE**<br><br>**Excise Duty rate at present ……%**<br><br>**Maximum rate of Excise duty .....%**<br><br>**Education Cess.....%** | |

RFQ No.: PKN0000018 DATED: 21.11.2013

## Electronics Division, Bangalore

**BHEL STANDARD COMMERCIAL TERMS AND CONDITIONS FOR INDIGENOUS SCOPE OF SUPPLY**

| SL. NO. | TERMS | BHEL ACCEPTABLE TERM | BIDDER'S CONFIRMATION | DEVIATION IF ANY |
|---|---|---|---|---|
| 08 | ~~IN CASE PROJECT IS DEEMED EXPORT, MEGA AND NON MEGA AND WON AGAINST INTERNATIONAL COMPITITIVE BIDDING (ICB)~~ | ~~In case vendor is importing any raw materials / components for the enquired item, same are eligible for Zero Customs duty. As per para 8.7 of Hand Book of procedures of EXIM policy, BHEL will part the import licence with the vendors to obtain import licence by themselves and custom clear the raw materials/ components by availing zero customs duty. Hence, please furnish list of raw materials / components to be imported by you with Quantity and CIF value (for which BHEL has to share import licence). The benefit due to the above shall be passed on to BHEL and confirmed in the quotation.~~<br><br>~~If there are no imported raw materials/components, same shall be confirmed in the offer.~~<br>~~Excise duty is fully exempted. Necessary documents for availing Excise duty Exemption by suppliers will be furnished by BHEL.~~ | ~~Agreed~~<br><br>~~Furnished~~<br><br>~~Yes, benefit passed on to BHEL in the quotation.~~<br><br>~~We, confirm that there are no imported components.~~ | |
| ~~09.~~ | ~~IN CASE PROJECT IS DEEMED EXPORT, WON AGAINEST INTERNATIONAL COMPITITIVE BIDDING (ICB) BUT NOT A MEGA PROJECT.~~ | ~~The project is eligible for claiming Terminal Excise duty benefit from DGFT as per present EXIM policy. PL Confirm that you will submit (original)~~<br>~~a) Disclaimer Certificate.~~<br><br>~~b) Copy of Excise Invoice attested by Suptd of Central excise authorities with signature & seal, in Blue ink to enable BHEL to claim terminal Excise duty benefit from DGFT.~~ | ~~CONFIRMED~~ | |
| 10 | **SALES TAX** | To confirm whether applicable. If applicable, indicate current rate of sales tax against form "C"<br>For issue of form "C", vendor has to furnish "E1/E2" form<br><br>**Please confirm that "E1/E2 Sale form" will be submitted**<br><br>For physical export project, Sales Tax is exempted against submision of necessary documents by BHEL. However, vendor to indicate rate of Sales Tax applicable (against form 'C/37') for the item enquired. | **AGREE**<br>**Sales Tax rate at present.....%**<br><br>**CONFIRMED** | |

RFQ No.: PKN0000018 DATED: 21.11.2013

## Electronics Division, Bangalore

**BHEL STANDARD COMMERCIAL TERMS AND CONDITIONS FOR INDIGENOUS SCOPE OF SUPPLY**

| SL. NO. | TERMS | BHEL ACCEPTABLE TERM | BIDDER'S CONFIRMATION | DEVIATION IF ANY |
|---|---|---|---|---|
| | | **Note : Please see the state indicated above Sl. No. 4 (Page 1 of 11) to which materials to be despatched before indicating rate of Sales Tax.**<br>**Furnish following :**<br>**CST Regn No.**<br>**LST Regn No.**<br>**TIN No.** | **INDICATED** | |
| **11** | **VALUE ADDED TAX** | Since it is inter-state movement of goods, VAT is not applicable. Only CST against form C is applicable.<br>OR<br>Both are in the same State, VAT is applicable please indicate VAT applicable @_____% | **AGREE**<br>**QUOTED** | |
| **12** | **OCTROI** | To confirm whether applicable, if applicable indicate current rate of Octroi_____% | **AGREE** | |
| **13** | **SERVICE TAX ON E & C & TRAINING CHARGES** | To confirm whether applicable, if applicable indicate current rate of Service Tax _____%<br>***Furnish following :***<br>***Service Tax Regn. No.***<br>***Confirmation that Service Tax register is maintained.*** | **AGREE**<br>***FURNISHED***<br>***CONFIRMED*** | |
| **14** | **FREIGHT CHARGES** | **Freight charges shall be to vendor's account. Please indicate Freight charges separately as lumpsum charges in priced offer, Plus service tax if any.**<br>Vendor's offer will be evaluated on "Total cost basis" including freight charges.<br>Vendor shall book the consignment through their approved Road carriers on "Freight pre-paid" door delivery consignee copy attached basis, and freight charges to be claimed from BHEL through a | **Agreed and quoted in lumpsum with Service Tax in price bid**<br>**Service Tax _____ %** | |

RFQ No.: PKN0000018 DATED: 21.11.2013

## Electronics Division, Bangalore

**BHEL STANDARD COMMERCIAL TERMS AND CONDITIONS FOR INDIGENOUS SCOPE OF SUPPLY**

| SL. NO. | TERMS | BHEL ACCEPTABLE TERM | BIDDER'S CONFIRMATION | DEVIATION IF ANY |
|---|---|---|---|---|
| | | separate Invoice against proof of L/R copy and original money receipt and transporter bill to vendor received from the Transporter. The freight charges will be reimbursed to vendor, limited to freight quoted by the vendor in his offer or actual payment made to Transporter, whichever is **lower**.<br>Vendor shall furnish following details alongwith Freight payment Bill :<br>a) Net weight<br>b) Gross weight<br>c) Volume of each package<br>d) No. of packages<br>e) Loose items, if any<br>f) Distance from vendor's works to destination.<br>This is needed for justifying freight amount quoted by you. | | |
| **15** | **TRANSIT INSURANCE**<br><br>**(To BHEL A/c)** | By BHEL/BHEL power sector/Customer. Insurance Agency will be indicated in despatch clearance letter/fax/E-mail issued by BHEL. Immediately after despatch of material the vendor should intimate by fax/e-mail/ courier to the insurance agency directly for covering insurance and a copy of such intimation sent to insurance agency Indicated in the despatch instructions directly by vendor should be given to BHEL alongwith despatch documents for payment<br>NOTE : BHEL will not send insurance intimations to insurance company on your behalf. Hence it is your resposibility to intimate to insurance agency. | **AGREE** | |

RFQ No.: PKN0000018 DATED: 21.11.2013

## Electronics Division, Bangalore

**BHEL STANDARD COMMERCIAL TERMS AND CONDITIONS FOR INDIGENOUS SCOPE OF SUPPLY**

| SL. NO. | TERMS | BHEL ACCEPTABLE TERM | BIDDER'S CONFIRMATION | DEVIATION IF ANY |
|---|---|---|---|---|
| 16 | **DELIVERY PERIOD** (Pl. see loading Factor) | Within_14__ weeks from the date of issue of document approval or manufacturing clearance by BHEL, whichever in earlier. | AGREE | |
| 17 | **WARRANTY** (Pl. see loading Factor) | 36 months from the date of despatch or 30 months from the date of commissioning whichever is earlier. | **AGREE** | |
| 18 | **TERMS OF PAYMENT (FOR MATERIAL SUPPLY & TYPE TEST CHARGES)** (Pl. see loading Factor) | a) 75 % basic + 100% Taxes , Duties and freight charges with 45 days credit from the date of receipt of complete set of original despatch documents. Original Performance Bank Guarantee to be sent by issuing bank directly to BHEL.<br><br>Original consignee copy of L/R (lorry receipt) shall accompany the goods.<br>**Note : In case PBG is not furnished only 65 % payment will be released against 75 % claim without the consent of Vendor.**<br>**This 10% basic amount withheld amount towards PBG will be paid against submission of supplementary invoice & Original PBG (or) against supplementary invoice without PBG after 42 months from the date of despatch provided BHEL Commercial Dept. confirms that there is no site issue pending for this P.O. items supplied by you.**<br>b) Balance 10% basic amount with 30 days credit from receipt of materials at site against consignee receipt certificate (CRC). i.e. acknowledgement/seal on backside of the LR for having received the consignment by consignee and proof of supply of O&M manuals in requisite sets, against a supplementary Invoice.<br>c) Balance 15% basic amount with 30 days credit on completion of Erection & commissioning work on pro-rata basis against supplementary Invoice with **"Proof of completion of E&C"** (like MOM, Site protocol, Job completion certificate), signed by BHEL site office or Customer and your representative.<br>***Note : No advance will be paid and no inland L/C will be accepted. Payment thro' bank may not be acceptable to BHEL (as all payments or made thro' EFT only) Hence please avoid payment thro' bank.*** | **AGREE** | |

RFQ No.: PKN0000018 DATED: 21.11.2013

## Electronics Division, Bangalore

**BHEL STANDARD COMMERCIAL TERMS AND CONDITIONS FOR INDIGENOUS SCOPE OF SUPPLY**

| SL. NO. | TERMS | BHEL ACCEPTABLE TERM | BIDDER'S CONFIRMATION | DEVIATION IF ANY |
|---|---|---|---|---|
| | **TERMS OF PAYMENT (FOR E&C)** | 100% Lumpsum E&C / Installation charges with Service Tax (if applicable) shall be paid with 30 days credit on completion of Erection & commissioning work on pro-rata basis against submission of "Proof of completion of E&C"(like MOM, Site protocol, Job completion certificate), signed by BHEL site office or Customer and venders' representative.<br>Separate Invoice shall be submitted for charges towards E&C payment. | **AGREE** | |
| | **TERMS OF PAYMENT (FOR TRAINING)** | 100% payable with 30 days credit on completion of Training. Separate invoice shall be submitted for Training charges | **AGREE** | |
| | **TERMS OF PAYMENT (FOR ENGINEERING & DOCUMENTATION CHARGES)** | 100% with 30 days credit on approval of final documents.<br>Separate invoice to be submitted for Engineering & documentation charges | **AGREE** | |
| **19** | **GENERAL** | BHEL has discontinued cheque payments and all payments will be through Electronic fund Transfer (EFT) only. Please provide necessary details (if you have not furnished earlier) in the BHEL's standard format. | AGREE | |
| **20** | **SHORTAGES / DAMAGES** | In the event of shortage/damage on receipt of goods and on opening of packages at site,all such shortages/ damages shall be made good within reasonable time of such intimation and cost of such material will be reimbursed only on settlement of Insurance claim limited to insurance settled amount. | **AGREE** | |
| **21** | **PENALTY**<br>(Pl. see loading Factor) | In the event of delay in agreed contractual delivery, penalty @ 2 % ( two percent ) per week but limited to a max of 10% (Ten percent) value of undelivered portion (basic material cost) will be applicable.<br>Date of issue of inspection call by vendor along with test certificates / Test Reports / Certificate of Conformance / Calibration reports, as proof of completion of manufacturing will be treated as date of despatch for penalty calculation.<br>In the absence of furnishing such relevant above cited document as proof of completion of manufacturing alongwith inspection call, actual date of Inspection will be considered as date of despatch, and BHEL will not be responsible for delay in actual date of inspection.<br>Hence please issue inspection call with test certificates/ reports compulsorily to avoid penalty. | **AGREE** | |

RFQ No.: PKN0000018 DATED: 21.11.2013

## Electronics Division, Bangalore

**BHEL STANDARD COMMERCIAL TERMS AND CONDITIONS FOR INDIGENOUS SCOPE OF SUPPLY**

| SL. NO. | TERMS | BHEL ACCEPTABLE TERM | BIDDER'S CONFIRMATION | DEVIATION IF ANY |
|---|---|---|---|---|
| | | Penalty will be applicable after 14 (Forteen) weeks from the date of issue of document approval or manufacturing clearance whichever is earlier<br><br>Penalty if applicable shall be deducted at the time of settlement of 75 % payment.<br>If penalty is applicable for duration of less than a week, penalty @2 % ( two percent ) of the basic material value will be charged.<br>In case of vendor availing Duty concession under duty free licence under para No. 8.7 of EXIM policy procedure, any delay in furnishing documents for this purpose by BHEL will be suitably adjusted while calculating penalty. | | |
| 22 | **PERFOR-MANCE BANK GUARANTEE**<br>(Pl. see loading Factor) | Original PBG for 10% of the basic material cost shall be furnished in the BHEL prescribed format only (Annexure-II), directly by issuing bank to BHEL for processing 75% payment.<br>PBG shall be valid for 36 months + 6 months claim period from date of despatch (totally 42 months from the date of despatch)<br>PBG shall be from any of the BHEL consortium Bankers as per Annexure-III(b), and banker should send PBG directly to BHEL please see instruction for PBG submission attached - Annexure - III(a)<br>Please indicate the Banker name from whom PBG will Issuing bank name be furnished without fail.<br>PBG proforma enclosed. If PBG is not submitted as per enclosed BHEL standard proforma, i.e., PBG is submitted in Vendor's format (other than BHEL proforma) or quoted Revolving PBG, it will be treated as Vendor has not agreed for PBG clause (non submission of PBG only) and price will be loaded as per the loading factors enclosed(Annexure - I) to arrive at " total cost to BHEL" and BHEL reserves the right to commercially reject the offer when the item enquired demands performance bank guarantee. | **AGREE**<br><br>**Issueing Bank Name indicated** | |

RFQ No.: PKN0000018 DATED: 21.11.2013

## Electronics Division, Bangalore

**BHEL STANDARD COMMERCIAL TERMS AND CONDITIONS FOR INDIGENOUS SCOPE OF SUPPLY**

| SL. NO. | TERMS | BHEL ACCEPTABLE TERM | BIDDER'S CONFIRMATION | DEVIATION IF ANY |
|---|---|---|---|---|
| 23 | **INSPECTION** | Prior written notice of atleast 7 days shall be given along with 2 sets of internal test certificates/COC and applicable test certificates. Materials will be inspected by BHEL-EDN-QS/CQS or M/s PDIL (BHEL authorised Inspection Agency) or Customer / Consultant or jointly by BHEL & Customer / consultant.<br>All tests have to be conducted as applicable in line with approved Quality plan or QA Checklist or Purchase specification and original reports shall be furnished to BHEL-EDN, Bangalore for verification/acceptance and issue of despatch clearance. | **AGREE** | |
| 24 | **MODE OF DESPATCH** | By road on door delivery Consignee Copy attached basis as per BHEL despatch instructions through your approved transporters, only on receipt of despatch clearance from BHEL. | **AGREE** | |
| 25 | **DESPATCH DOCUMENTS** | Complete set of despatch documents in 3 sets shall be forwarded to BHEL directly. Despatch documents include Commercial Invoice, Excise Invoice (if ED is applicable), Lorry receipt (L/R), Packing list, Warranty certificate, Insurance intimation letter, "NIL" short shipment certificate and<br>Original Performance Bank Guarantee<br>(Directly from issuing bank to BHEL).<br>One set of Invoice, Packing list and L/R shall be faxed immediately after despatch to BHEL-EDN, Bangalore. | **AGREE** | |
| 26 | **O & M MANUALS** | As built Drawings, O & M Manuals and other approved documents in 2 sets shall be furnished immediately after despatch directly to BHEL Purchase Dept., 1 set of above shall also be sent in soft media (CD ROM). Two sets of hard copies of above shall be directly despatched to site along with the material. | **AGREE** | |

RFQ No.: PKN0000018 DATED: 21.11.2013

## Electronics Division, Bangalore

**BHEL STANDARD COMMERCIAL TERMS AND CONDITIONS FOR INDIGENOUS SCOPE OF SUPPLY**

| SL. NO. | TERMS | BHEL ACCEPTABLE TERM | BIDDER'S CONFIRMATION | DEVIATION IF ANY |
|---|---|---|---|---|
| | | **Note : Supply of above documents (O&M) in required No. of sets along with Despatch documents and material shall be indicated in packing list.**<br>**If not mentioned BHEL may insist for submission in required sets once again.** | | |
| 27 | **SPLIT ORDERING** | Though RFQ common for three projects, bid evaluation will be done project wise & contract will be finalised for each<br>**project on a Techno-commercially acceptable**<br>lowest Bidder. | **AGREE** | |
| ~~28~~ | ~~**QUANTITY TOLERANCE**~~ | ~~Please indicate Quantity tolerance applicable in each of the line item wherever Quantity tolerance applicable for the Quoted items.~~ | ~~**CONFIRMED**~~ | ~~**QUANTITY TOLERANCE .....%PER VARIETY**~~ |
| ~~29~~ | ~~**SLAB RATE**~~ | ~~If the price quoted varies based on the quantity to be ordered, then slab rates may be quoted.~~ | ~~**SLAB RATES INDICATED IN OFFER**~~ | ~~**SLAB RATES APPLICABLE/ NOT APPLICABLE**~~ |
| ~~30~~ | ~~**SPECIAL CLASS ( EXCIST DUTY DRAW BACK FROM DGFT )**~~ | ~~Following documents (Original) shall be submitted for availing Excise duty draw back benefit from DGFT along with despatch documents to BHEL-EDN, Bangalore~~<br>~~a) Disclaimer certificate as per the proforma, which will be, sent with the PO.~~<br>~~b) Copy of Excise Invoice duly attested by Suptd of Central Excise ( signature in blue ink & seal )~~<br>~~Pl. refer enclosure to RFQ.~~ | ~~**AGREE**~~ | |
| 31 | **ERECTION & COMMISSION-ING (E & C) / INSTALLATION / ASSEMBLY AT SITE** | Indicate lumpsum charges (includes To & Fro Fare, Boarding, Lodging, Local Conveyance, etc.) for Supervision of Erection, Commissioning and handingover to customer. The quotation shall clearly indicate scope of work, likely duration of commissioning, pre-commissioning check list and service taxes if any to consider for arriving at total cost to BHEL.<br>***Note : If E&C is not quoted (wherever called for in the BHEL purchase specification) BHEL reserve the right to reject your offer.***<br>***If lumpsum charges are not quoted, offer may be rejected.*** | **AGREE & CONFIRMED QUOTED IN LUMPSUM CHARGES IN PRICE BID** | |

RFQ No.: PKN0000018 DATED: 21.11.2013

## Electronics Division, Bangalore

**BHEL STANDARD COMMERCIAL TERMS AND CONDITIONS FOR INDIGENOUS SCOPE OF SUPPLY**

| SL. NO. | TERMS | BHEL ACCEPTABLE TERM | BIDDER'S CONFIRMATION | DEVIATION IF ANY |
|---|---|---|---|---|
| 32 | **REVERSE AUCTION** | Against this enquiry for the subject item/system with detailed scope of supply as per enquir y specifications, BHEL EDN reserves the right to follow **REVERSE** AUCTION **PROCEDURE i.e. ON LINE BIDDING ON NETWORK,** before finalising the Purchase order on technically competent bidders, as per the guidelines given in Annexure-IV.<br><br>In case BHEL does not resort to Reverse Auction, the Price bids and price impacts (if any) already submitted and available with BHEL shall only be opened as per BHEL's standard practice without seeking anymore price impacts on account of BHEL not going for Reverse Auction and process further. | **AGREE** | |
| 33 | **SPECIAL CLAUSE APPLICABLE FOR EXPORT JOB ONLY** | Article packed with raw/solid wood packing material should be treated as per ISPM - 15 (fumigation) and accomplished by Phytosanitory/Fumigation certificate **DESTINATION SEA PORT/ AIRPORT IN INDIA .....** | **AGREE** | |

**THE ABOVE FILLED-IN AND SIGNED DOCUMENT SHALL BE FURNISHED AS PART OF UN-PRICED CUM-TECHNICAL BID WITHOUT FAIL ( IN ORIGINAL).**

**NOTE : LOWEST BIDDER WILL BE DECIDED BASED ON THE *"TOTAL COST TO BHEL"* BASIS INCLUDING LOADING FACTORS (FOR DEVIATIONS TO BHEL STANDARD COMMERCIAL TERMS & CONDITIONS).**

**BHEL-EDN** **VENDOR'S SIGNATURE WITH SEAL**

RFQ No.: PKN0000018 DATED: 21.11.2013

## Electronics Division, Bangalore

**BHEL STANDARD COMMERCIAL TERMS AND CONDITIONS FOR IMPORTED SCOPE OF SUPPLY**

| SL. NO. | TERMS | BHEL ACCEPTABLE TERM | BIDDER'S CONFIRMATION | DEVIATION IF ANY |
|---|---|---|---|---|
| 01 | COUNTRY OF ORIGIN & PLACE OF MANUFACTU - RING | *PL INDICATE FOR THE TOTAL SCOPE OF SUPPLY* ***COUNTRY OF ORIGIN*** ***PLACE OF MANUFACTURING (TOTAL PACKAGES)*** | FURNISHED | |
| 02 | NAME & ADDRESS OF THE BIDDER : A) IN PURCHASE ORDER B) IN LETTER OF CREDIT | | FURNISHED | |
| 03 | NAME ADDRESS OF FOREIGN BANK ACCOUNT NO. & SWIFT CODE | | FURNISHED | |
| 04 | PRICE BASIS & CURRENCY | Firm i.e., from the PO date to completion of supply **(Price variation Clause not acceptable). Currency :** | AGREE | |
| 05 | VALIDITY | Valid up to 8 weeks from the date of opening of price Bid **(not technical bid).** | AGREE | |
| 06. | TERMS OF DELIVERY | Price offered shall be for goods packed and delivered F.C.A. (named International Airport/ Seaport) including Packing, Forwarding, Handling, Ancillary charges like processing of Sight Draft, negotiation of Bank Documents, Export declaration, Certificate of Origin, etc. Packing shall be Airworthy, best suited for transshipment and to take care of transit damages.<br><br>Indicate Name of International Airport<br>Indicate method of packing done: | AGREE | |

RFQ No.: PKN0000018 DATED: 21.11.2013

## Electronics Division, Bangalore

### BHEL STANDARD COMMERCIAL TERMS AND CONDITIONS FOR IMPORTED SCOPE OF SUPPLY

| SL. NO. | TERMS | BHEL ACCEPTABLE TERM | BIDDER'S CONFIRMATION | DEVIATION IF ANY |
|---|---|---|---|---|
| | | ***Note : Name of Airport to be selected from any one of the ports indicated in Annexure-V which are acceptable BHEL ports.***<br>***BHEL will do Customs Clearance after payment of Customs Duty as applicable at the time of customs clearance.*** | | |
| **07** | **DOCUMENTS**<br>(Pl. see loading Factor) | ALONG WITH QUOTATION : As called in Purchase specification shall be furnished alongwith un-price bid.<br>If not called in Purchase Specification then vendor shall submit 2 sets of Original catalogues, Data sheets, Bill of materials, Dimensional drawings, mounting details and any other relevant documents with un-priced bid.<br>**After issue of PO :** As called in Purchase specification. For the complete scope of supply within 2 weeks from receipt of PO for BHEL/ customer/consultant approval.<br>If not called in Purchase Specification then vendor shall submit 2 sets of Drawings, Bill of materials data sheets, Catalogues, Quality Plan, Test procedure and Type Test report for the complete scope of supply within **two weeks** on receipt of PO for BHEL/ Customer/ Consultant approval. | **AGREE** | |
| **08.** | **PENALTY (FOR DELAY IN SUBMISSION OF DOCUMENTS FOR BHEL/ CUSTOMER APPROVAL) :**<br>(Pl. see loading Factor) | In the event of delay in submission of complete set of documents (including soft copy) in required sets beyond 2 weeks from receipt of Purchase order, (vendor to confirm date of receipt of PO in Writing) Penalty @ 2% (Two Percent) per week but limited to a max of 10% (Ten percent) value of the basic material cost will be applicable.<br>Penalty if applicable shall be deducted at the time of settlement of 90% payment.<br>If penalty is applicable for duration of less than a week, penalty @ 2% (Two percent) of the basic material value will be charged. | **AGREE** | |

RFQ No.: PKN0000018 DATED: 21.11.2013

## Electronics Division, Bangalore

**BHEL STANDARD COMMERCIAL TERMS AND CONDITIONS FOR IMPORTED SCOPE OF SUPPLY**

| SL. NO. | TERMS | BHEL ACCEPTABLE TERM | BIDDER'S CONFIRMATION | DEVIATION IF ANY |
|---|---|---|---|---|
| 09 | **TRANSIT INSURANCE** | By BHEL. Insurance Agency Name, Policy No. will be indicated in PO. Vendor to send despatch details by fax to Insurance Agency after items are despatched without fail and copy of same to be submitted along with nagotiable documents. | **AGREE** | |
| 10 | **DELIVERY PERIOD** (Pl. see loading Factor) | Within____14__ weeks from document approval or manufacturing clearance by BHEL. whichever is earlier. | **AGREE** | |
| 11 | **WARRANTY** (Pl. see loading Factor) | 36 months from the date of despatch or 30 months from the date of commissioning whichever is earlier. | **AGREE** | |
| 12 | **TERMS OF PAYMENT (FOR MATERIAL SUPPLY)** (Pl. see loading Factor) | Against **" SIGHT DRAFT"** on presentation of documents to our Bankers.<br><br>The payment terms are as follows :<br><br>a) 90% is payable on negotiation of complete set of original documents including original performance Bank Guarantee,<br>b) Balance 10% on 60th day from the date of Air Way Bill / Bill of Lading & against specific authorisation by BHEL.<br><br>**Note : No advance payment will be made.** | **AGREE** | |
| 13 | **SHORTAGES/ DAMAGES AT CUSTOMER SITE** | In the event of shortage / damage on receipt of goods and on opening of packages at site all such shortages / damages shall be made good within reasonable time of such intimation and cost of such material will be reimbursed only on settlement of Insurance claim limited to insurance settled amount. | **AGREE** | |

RFQ No.: PKN0000018 DATED: 21.11.2013

## Electronics Division, Bangalore

### BHEL STANDARD COMMERCIAL TERMS AND CONDITIONS FOR IMPORTED SCOPE OF SUPPLY

| SL. NO. | TERMS | BHEL ACCEPTABLE TERM | BIDDER'S CONFIRMATION | DEVIATION IF ANY |
|---|---|---|---|---|
| 14 | **PENALTY** (Pl. see loading Factor) | In the event of delay in agreed contractual delivery, penalty @ 2 % ( two percent ) per week but limited to a max of 10% (Ten percent) value of undelivered basic material (excluding packing) portion will be applicable. Date of issue of test certificates / Test Reports / Certificate of Conformance / Calibration reports, as proof of completion of manufacturing will be treated as date of despatch for penalty calculation. Penalty will be applicable after ___14__ weeks from the date of document approval or manufacturing clearance, whichever is earlier.<br><br>Penalty if applicable shall be deducted at the time of settlement of 90% payment. Penalty if any will be indicated in Despatch Clearance letter.<br>If penalty is applicable for duration of less than a week, penalty @2 % ( two percent ) of the basic material value will be charged. | **AGREE** | |
| 15 | **PERFOR-MANCE BANK GURANTEE (PBG)** (Pl. see loading Factor) | PBG for 10% of the basic material cost shall be furnished strictly in the BHEL prescribed format only (Annexure-II), directly to BHEL from issueing bank for payment.<br>Copy of PBG shall be furnished to BHEL.<br><br>PBG shall be valid for 36 months + 6 months claim period (totally 42 months) from the date of despatch<br>PBG proforma enclosed herewith (Annexure-II).<br>If PBG is not submitted as per enclosed BHEL standard proforma, i.e., PBG is submitted in Vendor's format (other than BHEL proforma), it will be treated as Vendor has not agreed for PBG clause (non submission of PBG only) and price will be loaded as per the loading factors enclosed (Annexure - I) to arrive at " total cost to BHEL". | **AGREE** | |

RFQ No.: PKN0000018 DATED: 21.11.2013

## Electronics Division, Bangalore

**BHEL STANDARD COMMERCIAL TERMS AND CONDITIONS FOR IMPORTED SCOPE OF SUPPLY**

| SL. NO. | TERMS | BHEL ACCEPTABLE TERM | BIDDER'S CONFIRMATION | DEVIATION IF ANY |
|---|---|---|---|---|
| 16 | **TEST REPORTS / CALIBRATION REPORTS** | Shall be furnished / faxed immediately on completion of testing to BHEL for verification<br><br>All tests have to be conducted as applicable in line with approved Quality plan or QA Checklist or Purchase specification and original reports shall be furnished to BHEL-EDN, Bangalore for verification / acceptance and issue of despatch clearance. | **AGREE** | |
| 17 | **MODE OF DESPATCH** | BY SEA freight on receipt of despatch clearance from BHEL and through BHEL approved Consolidator / freight Forwarder. | **AGREE** | |
| 18 | **DOCUMENTS DESPATCH** | Complete set of despatch decuments shall be forwarded to BHEL directly. Despatch documents include AWB, Invoice, Packing list, Country of origin certificate, Original performance Bank Guarantee, Warranty certificate, O & M manuals and Insurance intimation letter.<br>One copy of Invoice, Packing list and Air Way Bill shall be faxed immediately after despatch. Also one copy of packing list to be kept inside each box for easy identification of material at site.<br>**Note : The Invoice shall be complete with item Nomenclature, Description, Unit, Quantity as per Purchase Order. Deviation to these will lead to financial losses to BHEL during Custom Clearance, which will have to be borne by Vendor only.** | **AGREE** | |
| 19<br>a)<br>b)<br>c) | **WEIGHT & VOLUME** | Please indicate following for calculating Freight charges **(approximate) :**<br>**Total Net Weight of the package/s.**<br>**Total Gross weight of the package/s.**<br>**VOLUME : Length (L) X Breadth (B) X Height (H) in feet X No. of packages. Please keep one copy of packing slip inside box.** | **FURNISHED** | |
| 20 | O & M **MANUALS** | As built Drawings, O&M Manuals and other approved documents in 2 sets shall be furnished immediately after despatch to BHEL directly.<br>1 set of above also shall be sent in soft media (CD ROM) wherever called in specification<br>Two sets of hard copies shall be directly despatched to site alongwith the material.<br>Refer Specification for details. | **AGREE** | |

RFQ No.: PKN0000018 DATED: 21.11.2013

## Electronics Division, Bangalore

### BHEL STANDARD COMMERCIAL TERMS AND CONDITIONS FOR IMPORTED SCOPE OF SUPPLY

| SL. NO. | TERMS | BHEL ACCEPTABLE TERM | BIDDER'S CONFIRMATION | DEVIATION IF ANY |
|---|---|---|---|---|
| | | Note : Supply of above documents (O&M) in required No. of sets along with Despatch documents and material shall be indicated in packing slip.<br>If not metioned, BHEL may insist above in required No. of sets. | | |
| 21 | **SPLIT ORDERING** | Though RFQ common for tree projects, bid evaluation will be done project wise & contract will finalised for each project on a Techno-commercially acceptable lowest bidder. | **AGREE** | |
| ~~22~~ | ~~**QUANTITY TOLERANCE**~~ | ~~Wherever Purchase specification indicate quantity tolerance, it is to be confirmed. It may be confirmed as per Vendor's company norms. This is applicable for items having running length like Impluse Pipes, Cables, etc.For Impluse/ seamless pipes one random length of (+) plus 6 metres applicable for each variety.~~ | ~~**CONFIRMED**~~ | ~~**QUANTITY TOLERANCE .....% PER ITEM**~~ |
| ~~23~~ | ~~**SLAB RATE**~~ | ~~If the price quoted varies based on the quanity ordered, then slab rates may be quoted.~~ | ~~**AGREE**~~ | |
| 24 | **PARTIAL SHIPMENT** | NOT ALLOWED WITH IN A PROJECT | **NOTED** | |
| 25 | **TRANSHIPMENT** | ALLOWED | **NOTED** | |
| 26 | **DESPATCH CLEARANCE** | BHEL will issue despatch clearance on receipt Test Certificates/calibration reports/ Certificates of Conformance and review / vertification of the same.<br>Goods shall not be despatched without obtaining despatch clearance from BHEL. | **AGREE** | |
| 27 | **REPAIR OF COMPONENTS** | For imported items, during commissioning/ warranty period, repair of failed components will be undertaken by your Indian representative M/s._____ and if repair is not possible in India, then free replacement of components will be made by Foreign vendor without any commercial implications to BHEL. | **AGREE**<br>**INDIAN REPRESENTATIVE NAME INDICATED** | |

RFQ No.: PKN0000018 DATED: 21.11.2013

## Electronics Division, Bangalore

**BHEL STANDARD COMMERCIAL TERMS AND CONDITIONS FOR IMPORTED SCOPE OF SUPPLY**

| SL. NO. | TERMS | BHEL ACCEPTABLE TERM | BIDDER'S CONFIRMATION | DEVIATION IF ANY |
|---|---|---|---|---|
| 28 | **REMARKS** | Please note all the above will form part of Purchase Order and in case Vendor asks for payments, through letter of credit, all the above agreed terms will form part of letter of credit.<br>In case Indian representative quotes on behalf of their Foreign counterpart, acceptance to the above terms are to be confirmed in writing by foreign vendor without fail and such confirmation shall be furnished as part of the un-priced bid. | **AGREE** | |
| 29 | **REVERSE AUCTION** | Against this enquiry for the subject item/system with detailed scope of supply as per enquiry specification, BHEL EDN may resort to REVERSE AUCTION PROCEDURE i.e. ON LINE BIDDING ON NETWORK, before finalishing the Purchase order on technically competent and lowest bidder, as per the guidelines given in Annexure-VI.<br>Reverse Auction procedure to decide the lowest bidder. In case BHEL does not resort to Reverse Auction, the Price bids and price impacts (if any) already submitted and available with BHEL shall only be opened as per BHEL's standard practice without seeking anymore price Impacts on account of BHEL not going for Reverse Auction. | **AGREE** | |
| 30 | **SPECIAL CLAUSE** | Articles packed with raw/solid wood packing material should be treated as per ISPM-15 and accomplished by a phytosanitory Certificate. | **AGREE** | |

**THE ABOVE FILLED-IN AND SIGNED DOCUMENT SHALL BE FURNISHED AS PART OF UN-PRICED CUM-TECHNICAL BID WITHOUT FAIL.**

**NOTE : LOWEST BIDDER WILL BE DECIDED BASED ON THE *"TOTAL COST TO BHEL"* BASIS INCLUDING LOADING FACTORS (FOR DEVIATIONS TO BHEL STANDARD COMMERCIAL TERMS & CONDITIONS).**

**BHEL-EDN** **VENDOR'S SIGNATURE WITH SEAL**

**Electronics Division, Bangalore**

## ANNEXURE-I

## LOADING FACTORS SHEET (8 pages)

**BHEL RFQ NO. & DATE: PKN0000017 DATED**

***DEVIATIONS ARE LIMITED TO FOLLOWING ONLY, FURTHER DEVIATION ON ANY OF THE FOLLOWING MAY LEAD BHEL TO REJECT THE OFFER UNILATERALLY ON COMMERCIAL GROUNDS.***

***NOTE: THIS LOADING FACTOR INDICATED BELOW WILL BE ADDED ON QUOTED PRICE TO EVALUATE THE LOWEST QUOTE (IN CASE OF DEVIATION TO BHEL'S TENDER SPECIFIED TERMS AGAINST EACH TENDER).***

| SL NO | COMMERCIAL TERMS | BHEL STANDARD TERM | IF YOU QUOTE | LOADING FACTOR FOR NON-COMPLIANCE OF BHEL STANDARD TERM |
|---|---|---|---|---|
| **A.** | FOR INDIGENOUS SCOPE OF SUPPLY. | | | |
| 1 | TERMS OF PAYMENT (WHERE SCOPE INCLUDES E&C): | a) 75% basic + 100% taxes, duties & frieght charges with 45 days credit from the date of receipt of complete set of original despatch documents including Original Performance Bank Guarantee for 10% of the basic material value. (If applicable) to BHEL. b) Balance 10% with 30 days of receipt of materials at site and proof of supply of O&M manuals in required sets, against a supplementary Invoice and c) Balance 15% with 30 days credit from the date of completion of Erection & commissioning work on pro-rata basis against supplementary Invoice with "Proof of completion of E&C" (like MOM, Site protocol, Job completion certificate, signed by BHEL site office or Customer and your representative. | 90% WITH 45 DAYS CREDIT ALONGWITH ADDITONAL BG FOR 15% OF THE BASIC MATERIAL VALUE VALID TILL COMPLETION OF COMMISSONING APART FROM PBG 10% OF THE BASIC MATERIAL VALUE. BALANCE 10% OF MATL COST WITH CREDIT 30 DAYS FROM THE DATE OF RECEIPT OF CONSIGNEE RECEIPT CERTIFICATE | NIL |
| | | -SAME AS ABOVE- | 100% WITH 45 DAYS CREDIT ALONGWITH ADDITIONAL BG. FOR 25% OF THE BASIC MATERIAL VALUE VALID TILL COMPLETION OF COMMISSIONING APART FROM PBG 10% OF THE BASIC MATERIAL VALUE | NIL |

## Electronics Division, Bangalore RFQ No.: PKN0000017 DATED

| SL NO | COMMERCIAL TERMS | BHEL STANDARD TERM | IF YOU QUOTE | LOADING FACTOR FOR NON-COMPLIANCE OF BHEL STANDARD TERM |
|---|---|---|---|---|
| | | -SAME AS ABOVE- | 90% - WITH 45 DAYS CREDIT WITHOUT ADDITIONAL BG. BALANCE 10% OF MATL COST WITH CREDIT 30 DAYS FROM THE DATE OF RECEIPT OF CONSIGNEE RECEIPT CERTIFICATE | 15% OF THE BASIC MATERIAL VALUE. |
| | | -SAME AS ABOVE- | 100% WITH 45 DAYS CREDIT WITHOUT ADDITIONAL BG | 17% OF THE 100% BASIC MATERIAL VALUE. |
| | | -SAME AS ABOVE- | 75% WITH LESS THAN 45 DAYS CREDIT. BALACE 10% OF MATL COST WITH CREDIT 30DAYS FROM THE DATE OF RECEIPT OF CONSIGNEE RECEIPT CERTIFICATE BAL. 15% WITH CREDIT 30 DAYS FROM THE DATE OF RECEIPT OF COMMISSIONING COMPLETION CERTIFICATE | 1.5% OF THE 75% BASIC MATERIAL VALUE. |
| | | -SAME AS ABOVE- | 90% WITH LESS THAN 45 DAYS CREDIT WITHOUT ADDITIONAL BG. BALANCE 10% OF MATL. COST WITH CREDIT 30 DAYS FROM THE DATE OF RECEIPT OF CONSIGEE RECEIPT CERTIFICATE | 16.35% OF THE BASIC MATERIAL VALUE (I.E. 15% +1.5% OF THE 90% BASIC MATERIAL VALUE) |

**Electronics Division, Bangalore RFQ No.: PKN0000017 DATED**

| SL NO | COMMERCIAL TERMS | BHEL STANDARD TERM | IF YOU QUOTE | LOADING FACTOR FOR NON-COMPLIANCE OF BHEL STANDARD TERM |
|---|---|---|---|---|
| | | -SAME AS ABOVE- | 100% WITH LESS THAN 45 DAYS CREDIT WITHOUT ADDITIONAL. BG. | 26.5% OF THE BASIC MATERIAL VALUE (I.E. 25% +1.5% OF THE 100% BASIC MATERIAL VALUE) |
| | | -SAME AS ABOVE- | 75% THROUGH BANK. BALANCE 10% OF MATL COST WITH CREDIT 30 DAYS FROM THE DATE OF RECEIPT OF CONSIGNEE RECEIPT CERTIFICATE BAL 15% WITH CREDIT 30 DAYS FROM THE DATE OF RECEIPT OF COMMISSIONING COMPLETION CERTIFICATE | 10% OF THE 75% BASIC MATREIAL VALUE |
| | | -SAME AS ABOVE- | 90% THROUGH BANK. ALONGWITH BG FOR 15% OF THE BASIC MATERIAL VALUE VALID TILL COMPLETION OF COMMISSIONING APART FROM PBG 10% OF THE BASIC MATERIAL VALUE. BALANCE 10% OF MATL COST WITH CREDIT 30 DAYS FROM THE DATE OF RECEIPT OF CONSIGNEE RECEIPT CERTIFICATE | 10% OF THE 90% BASIC MATERIAL VALUE |
| | | -SAME AS ABOVE- | 100% THROUGH BANK. ALONGWITH BG FOR 25% OF THE BASIC MATERIAL VALUE VALID TILL COMPLETION OF COMMISSIONING APART FROM PBG 10% OF THE BASIC MATERIAL VALUE. | 10% OF THE 100% BASIC MATERIAL VALUE |

**Electronics Division, Bangalore RFQ No.: PKN0000017 DATED**

| SL NO | COMMERCIAL TERMS | BHEL STANDARD TERM | IF YOU QUOTE | LOADING FACTOR FOR NON-COMPLIANCE OF BHEL STANDARD TERM |
|---|---|---|---|---|
| | | -SAME AS ABOVE- | 90% THROUGH BANK WITHOUT ADDITIONAL BG BALANCE 10% OF THE MATL COST WITH CREDIT 30 DAYS FROM THE DATE OF RECEIPT OF CONSIGNEE RECEIPT CERTIFICATE | 24% OF THE BASIC MATERIAL VALUE (I.E. 15% + 10% OF THE 90% BASIC MATERIAL VALUE) |
| | | -SAME AS ABOVE- | 100% THROUGH BANK WITHOUT ADDITIONAL BG | 35% OF THE BASIC MATERIAL VALUE (I.E. 25% +10% OF THE 100% BASIC MATERIAL VALUE |
| 2. | **TERMS OF PAYMENT (WHERE SCOPE DOES NOT INCLUDE E&C)** | a) 90% with 45 days credit from the date of receipt of complete set of original dispatch documents including Original Performance Bank Guarantee for 10% of the basic material value (If applicable) toBHEL. b) Balance 10% with 30 days credit from the date of receipt of materials at site and prof of supply of O&M manuals in required sets, against a supplementary Invoice. | 100% WITH 45 DAYS CREDIT ALONGWITH ADDITIONAL BG FOR 10% OF THE BASIC MATERIAL VALUE VALID TILL RECEIPT OF MATERIAL AT SITE APRT FROM PBG 10% OF THE BASIC MATERIAL VALUE. | NIL |

**Electronics Division, Bangalore RFQ No.: PKN0000017 DATED**

| SL. NO. | COMMERCIAL TERMS | BHEL STANDARD TERM | IF YOU QUOTE | LOADING FACTOR FOR NON-COMPLIANCE TO BHEL STANDARD TERM |
|---|---|---|---|---|
| | | -SAME AS ABOVE- | 100% WITH 45 DAYS CREDIT<br>WITHOUT ADDITIONAL BG. | 10% OF THE 100% BASIC MATERIAL VALUE |
| | | -SAME AS ABOVE- | 100% WITH LESS THAN 45 DAYS CREDIT WITHOUT ADDITIONAL BG. | 11.5% OF THE BASIC MATERIAL VALUE (I.E. 10% + 1.5% OF THE 100% BASIC MATERIAL VALUE) |
| | | -SAME AS ABOVE- | 90% THROUGH BANK BALANCE 10% OF MATL COST WITH CREDIT 30 DAYS OF CONSIGNEE RECEIPT CERTIFICATE | 10% OF THE 90% BASIC MATERIAL VALUE |
| | | -SAME AS ABOVE- | 100% THROUGH BANK ALONGWITH ADDITIONAL BG FOR 10% OF THE BASIC MATERIAL VALUE VALID TILL RECEIPT OF MATERIAL AT SITE APRT FROM PBG 10% OF THE BASIC MATERIAL VALUE | 10% OF THE 100% OF THE BASIC MATERIAL VALUE |
| | | -SAME AS ABOVE- | 100% THROUGH BANK WITHOUT ADDITIONAL BG. | 20% OF THE BASIC MATERIAL VALUE (I.E. 10% + 10% OF THE 100% BASIC MATERIAL VALUE) |
| | Note : Payment terms like (a) Advance (b) Inland L/C (c) Proforma Invoice (d) Against Exchange of dispatch documents (e) CAD i.e. Cash against documents and (f) High sea sales will not be accepted. It may lead to commercial rejection of your offer. | | | |
| B. | FOR IMPORTED SCOPE OF SUPPLY : | | | |
| | TERMS OF PAYMENT (WHERE SCOPE DOES NOT INCLUDE E&C) | Against “SIGHT DAAFT” on presentation of dispatch documents to our Bankers. The payment terms are as follows; a) 90% of the FCA value is payable on negotiation of | 100% AGAINST SIGHT DARFT | 10% OF THE 100% FCA VALUE. |

| | | | | |
|---|---|---|---|---|
| | | complete set of original documents including original Performance Bank Guarantee for 10% of the FCA value (if applicable), b)Balance 10% of the FCA value on 60th day from the date of Air Way Bill or Bill of Lading & against specific authorization by BHEL. | | |
| | | -SAME AS ABOVE- | 90% THROUGH LETTER OF CREDIT. BALANCE 10% FOR THE FCA VALUE ON 60TH DAY FROM THE DATE OF AIR WAY BILL OR BILL OF LADING & AGAINST SPECIFIC AUTHORISATION BY BHEL. ALL BANK CHARGES OUTSIDE INDIA TO BENEFICIAY'S A/C. | 2.5% OF THE 100% FCA VALUE |
| | Note : Payment terms like (a)Advance (b) Telegraphic transfer (T/T) (c) Confirmed L/C (d) CAD i.e. Cash against documents and (e) High sea sales will not be considered. It may lead to commercial rejection of your offer. | | | |
| C | PENALTY FOR DELAY IN SUBMISSION OF DOCUMENTS FOR BHEL / CUSTOMER'S APPROVAL (COMMON FOR INDIGENOUS / IMPORTED) | In the event of delay in submission of complete Set of documents (including soft copy) in required sets beyond 2 week from receipt of Purchase Order (supplier to confirm date of PO in writing), penalty @ 2% (two percent) per week but limited to a max. of 10% (Ten percent) value of PO will be applicable. | If not agreed. | 10% OF THE BASIC MATERIAL VALUE. |
| | | -SAME AS ABOVE- | If max. 5% is agreed. | 5% OF THE BASIC MATERIAL VALUE. |
| | | -SAME AS ABOVE- | If @ ½% (half percent) per week but limited to a max. of 10% (Ten percent) is agreed. | 7.5 % OF THE BASIC MATERIAL VALUE |
| | | -SAME AS ABOVE- | If @ ½% (half percent) per week but limited to a max. of 5% (Five percent) is agreed. | 10% OF THE BASIC MATERIAL VALUE. |
| | | -SAME AS ABOVE- | If @ 1% (one percent) per week but limited to a max. of 10% (Ten percent) is agreed. | 5% OF THE BASIC MATERIAL VALUE. |
| | | -SAME AS ABOVE- | If @ 1% (one percent) per week but limited to a max. of 5% (Five percent) is agreed. | 7.5 % OF THE BASIC MATERIAL VALUE. |
| D | PENALTY FOR DELAY IN DELIVERY (COMMON FOR | In the event of delay in agreed contractual delivery, penalty @ 2% (two percent) per week | IF NOT AGREED | 10% OF THE BASIC MATERIAL VALUE. |

| | | | | |
|---|---|---|---|---|
| | INDIGENOUS / IMPORTED) | but limited to a max of 10% (Ten percent ) value of undelivered portion will be applicable. | | |
| | | -SAME AS ABOVE- | If max. 5% is agreed. | 5% OF THE BASIC MATERIAL VALUE. |
| | | -SAME AS ABOVE- | If @ ½% (half percent) per week but limited to a max. of 10% (Ten percent) is agreed. | 7.5 % OF THE BASIC MATERIAL VALUE |
| | | -SAME AS ABOVE- | If @ ½% (half percent) per week but limited to a max. of 5% (Five percent) is agreed. | 10% OF THE BASIC MATERIAL VALUE. |
| | | -SAME AS ABOVE- | If @ 1% (one percent) per week but limited to a max. of 10% (Ten percent) is agreed. | 5% OF THE BASIC MATERIAL VALUE. |
| | | -SAME AS ABOVE- | If @ 1% (one percent) per week but limited to a max. of 5% (Five percent) is agreed. | 7.5 % OF THE BASIC MATERIAL VALUE. |
| E | DELIVERY & PENALTY (COMMON FOR INDIGENOUS/IMPORTED) | Within 14……weeks from the date of issue of document approval or manufacturing clearance by BHEL. (or) Within……weeks from the date of issue of po (in case document approval is not applicable). | IF NOT AGREED FOR THE STIPULATED DELIVERY IN THE ENQUIRY (RFQ) BUT AGREED FOR PENALTY CLAUSE AS PER BHEL RFQ. | 2% PER WEEK UPTO MAX OF 10% OF THE BASIC MATERIAL VALUE FOR THE QUOTED DELIVERY BEYOND THE STIPULATED DELIVERY IN THE ENQUIRY. |
| | | -SAME AS ABOVE- | IF SPECIFIED DELIVERY IN ENQUIRY (RFQ) IS AGREED BUT PENALTY CLAUSE IS NOT AGREED. | 10% OF THE BASIC MATERIAL VALUE. |
| | | -SAME AS ABOVE- | IF SPECIFIED DELIVERY IN ENQUIRY (RFQ) IS AGREED & PENALTY CLAUSE IS AGREED BUT GRACE PERIOD IS SOUGHT. | 2% PER WEEK UPTO MAX OF 10% OF THE BASIC MATERIAL VALUE FOR THE QUOTED GRACE PERIOD BEYOND THE STIPULATED DELIVERY IN THE ENQUIRY. |
| | | -SAME AS ABOVE- | IF BOTH DELIVERY & PENALTY NOT AGREED, AS PER BHEL TERMS. | 10% OF THE BASIC MATRIAL VALUE PLUS 2% PER WEEK DELIVERY QUOTED BEYOND STIPULATED DELIVERY PERIOD |
| | Note : Any delivery quoted beyond 5 weeks from the stipulated delivery, offer is liable for rejection. | | | |
| F | PERFROMANCE BANK GUARANTEE ( COMMON FOR INDIGENOUS / IMPORTED ) | PBG for 10% of the basic material cost shall be furnished in the BHEL prescribed format only, along with 75 / 90% Invoice directly to the purchase dept. from the Bank. | IF NOT AGREED | 10% OF THE BASIC MATERIAL VALUE. |

| | | | | |
|---|---|---|---|---|
| | | -SAME AS ABOVE- | IF 5% IS AGREED | 5% OF THE BASIC MATERIAL VALUE. |
| | | -SAME AS ABOVE- | OTHER THAN THE ABOVE | (10% MINUS THE AGREED MAX. %) OF THE BASIC MATERIAL VALUE WILL BE LOADED |
| | | -SAME AS ABOVE- | PBG for 10% of the basic material cost furnished in Supplier's standard format, alongwith 75 / 90% Invoice directly to Purchase dept. | 10% OF THE BASIC MATERIAL VALUE |
| G | WARRANTY | 36 months from the date of despatch or 30 months from the date of commissioning whichever is earlier. | IF NOT AGREED FOR THE STIPULATED WARRANTY PERIOD IN THE ENQUIRY. | 0.5% OF THE BASIC MATERIAL VALUE PER MONTH FOR THE DIFFERENCE IN PERIOD. |

**Electronics Division, Bangalore**

**PROFORMA OF PERFORMANCE BANK GUARANTEE**

**(FOR INDIGENOUS PURCHASE ORDERS)**

# ANNEXURE-II

**Note : 1) To be executed in Rs. 200/- Non-Judicial stamp paper.**

**2) To be submitted by issuing bank to purchase Dept. directly. Please give BHEL address to banker.**

**3) Do not enclose with Bank document.**

**4) Modification & Ommissions to this are not permitted.**

---

## PERFORMANCE GUARANTEE
## (PROFORMA OF BANK GUARANTEE)

**THIS DEED OF GUARANTEE made and executed on the _____ day of _____ (year), by the _____ (Bank), registered under the Companies Act 1956/Nationalised Bank constituted under the Banking Companies (acquisition and transfer of undertakings) Act constituted under the State Bank of India Act / Subsidiary Banks, Act, having its registered / head office at _____ represented herein by its Branch Manager / authorised representatives Sri._____ & Sri._____ (Hereinafter called 'guarantor' which term shall mean and include its successors and assigns)**

## IN FAVOUR OF BHARAT HEAVY ELECTRICALS LIMITED

**_____ (Buyer's Name), a company registered under the companies Act, 1956 having its registered office at BHEL House at Siri Fort, New Delhi-110 049 and its Electronics Division at Mysore Road, Bangalore - 26 (hereinafter referred to as the 'Company' Which term shall include its successors and assigns):**

**Whereas the company has placed an order on _____ (State the name of the company / firm and its address) (hereinafter referred to as the 'Supplier' which term shall mean and include its liquidators, successors and assign) for the supply of system under order / Contract No_____ Dt _____.**

**AND WHEREAS the supplier has agreed to supply the materials and carryout the works as detailed and in accordance with the terms set out in the said order / contract.**

**Electronics Division, Bangalore**

**PROFORMA OF PERFORMANCE BANK GUARANTEE**
**(FOR INDIGENOUS PURCHASE ORDERS)**

**AND WHEREAS the company is not required to pay to the supplier a sum of Rupees _____ being the 10% of the value of the goods supplied / Works performed / Services rendered under the said order / contract between the supplier and the company, till the company is satisfied with the mechanical Warranties and the performance standards stipulated in the said order / contract between the company and the supplier has been duly fulfilled, except, against a Bank Guarantee for the said sum of Rs._____ in favour of the company by reputed Bank, in which case the company has agreed to make payment to the supplier of the said sum of Rupees_____ being (.....%) of the value of the goods supplied / Works performed / Services rendered under the agreement between the supplier and the company and the Guarantor has at the request of the supplier, agreed to furnish this Guarantee subject to the terms and conditions stated below :**

**NOW THIS DEED WITNESSES THAT IN pursuance of the above said agreement, the guarantor hereby agrees and covenents with company is as follows:-**

1) **That during the period this contract of Guarantee remains effectual, the guarantor shall be liable in respect of the amount due and owing to the company in respect of the payments to the extent of Rs_____ (in words) _____ against any loss or damage caused to or suffered by the company by reasons of any breach of the terms of the said order / contract / Agreement by the supplier.**

2) **The Guarantor hereby undertakes to pay the amounts and payable under this guarantee without any demur, merely on demand from the company intimating that the amount claimed is due by way of loss or damage caused to or suffered or would be caused or suffered by the supplier of any terms contained in the said order / contract. Any such demand made on the guarantor shall be conclusive as regards the amount due and payable by the Guarantor irrespective of the fact whether the Contractor / supplier admits or denies.**

3) **The Guarantor further agrees that the agreement herein contained shall remain in force and effect till all the supplies to be made / Works to be performed/Services to be rendered under the said order / contract / agreement are completed to the entire satisfaction of the company or till company certifies that the terms and conditions of the said order / contract / agreement have been fully and properly carried out by the said supplier and accordingly**

**Electronics Division, Bangalore**

**PROFORMA OF PERFORMANCE BANK GUARANTEE**
**(FOR INDIGENOUS PURCHASE ORDERS)**

**discharges the Guarantee. Unless a demand or claim under this guarantee is made on the guarantor in writing on or before the expiry of claim period indicated in clause 6 below, the guarantor shall be discharged from all the liability under this guarantee thereafter.**

**4) The guarantor further agrees with the company that the company shall have the fullest liberty without the consent of the guarantor and without effecting in any manner the obligations of the guarantor hereunder to vary any of the terms of the said order / contract / agreement or extend the time of performance by the said supplier from time to time or refrain from exercising the power exercisable by the company against the said supplier or to forebear or omit to enforce any of the terms and conditions relating to the said order / contract / agreement, and the guarantor shall not be relieved of its liability in whole or in part, by reason of any act, commission or forbearance on the part of the company or by reason of any such variation, or extension being granted to the said supplier or by reason of any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving the guarantor.**

**5) The guarantor undertakes not to revoke this guarantee during its currency except with the previous consent of the company in writing.**

**6) Notwithstanding anything herein above obtained, the liability of the guarantor under these presents is restricted to Rs._____. The guarantee shall be in force till its expiry on _____ unless a demand is made on the guarantor within SIX months from the date of expiry, all the liability of the guarantor under this guarantee shall stand fully discharged. The decision of the claimant in regard to breach of contract is final and binding on the Bank.**

**IN WITNESS whereof, the guarantor, acting through it authorised representative has executed this deed of Guarantee on the day, month and year first above written.**

**(Seal of the Bank to be affixed)**

**WITNESS**

**1.**

**2.**

**Electronics Division, Bangalore**

**PROFORMA OF PERFORMANCE BANK GUARANTEE**
**(FOR FOREIGN PURCHASE ORDERS)**

# ANNEXURE-III (a)

---

## BANK NAME AND ADDRESS

**Electronic Division**
**Bharat Heavy Electricals Limited, (B.H.E.L.)**
**Mysore Road, P.B. No. 2606**
**BANGALORE - 560 026**

**Dear Sir,**

**Ref : CONTRACT PERFORMANCE GUARANTEE.**

**WHEREAS you have entered into a contract reference No & PO NO._____ Date_____ with M/s _____ having its registered office at _____ for the supply of _____ as detailed in your purchase order No. _____ which is hereinafter referred to as "the said contract" and WHEREAS M/s _____ has undertaken to produce a Bank Guarantee for 10% (Tern Percent) of the contract price amounting to _____ (_____) to secure its obligatios to Electronics Division, BHEL having its registered office at New Delhi for the performance of the contract including the warranty of the equipment supplied, We_____ Bank, _____ hereby expressly, irrevocably and unreservedly undertake and guarantee as principal obligors on behalf of M/s_____ that in the even Bharat Heavy Electricals Ltd. (B.H.E.L.) declares to us in writing that M/s_____ has not fulfilled any obligation according to the contractual obligation of the said contract, to pay you on demand and without demur to Bharat Heavy Electricals Ltd., Electronics Division, Mysore Road, P.B.No. 2606, Bangalore - 560 026., India an amount of _____ (in words _____) subject to as may be determined below :**

**Electronics Division, Bangalore**

## PROFORMA OF PERFORMANCE BANK GUARANTEE
## (FOR FOREIGN PURCHASE ORDERS)

---

**1) Notwithstanding any right M/s. _____ may have directly against you or any disputes raised by M/s_____ _____ _____, Your written demand shall be conclusive evidence to us that repayment is due under the terms of the said contract and shall be binding on us.**

**2) We shall not be discharged or released from this undertaking and Guarantee by any arrangements, variations made between you and M/s. _____ with or without our consent and Knowledge or by any alteration in the obligations of M/s. _____ by any forbearance whether as to payment, time, performance or otherwise.**

**3) This guarantee shall remain valid until the end of six months after the close of the warranty period or until the same is reported by BHEL to us whichever is earlier.**

**4) We agree and undertake not to revoke this guarantee during its validity unless discharged in writing by you subject to the provision of clause (7) below :**

**5) This guarantee shall be a continuing guarantee subject to the foregoing and shall not be discharged by any change in the constitution of the Bank or M/s. _____.**

**6) This guarantee shall be governed by and constructed in accordance with the Laws of India.**

**7) At any time _____ Bank may render this guarantee null and void by paying to Bharat Heavy Electricals Ltd. the full amount being _____ ( in words _____ _____)**

**For and on behalf of Bank**
**by its Authorised Signatory**

**ANNEXURE - III(b)**

**INSTRUCTIONS FOR PBG SUBMISSION**

**SUB : POINTS TO BE COMPILED FOR THE SUBMISSION OF BANK GUARANTEES / PERFOMANCE BANK GURANTEES**

**Pursuant to the guidelines issued by BHEL corporate office and CVC the following points are to be taken care of during submission of BGs/PBGs. These conditions will incorporated in the purchase orders :**

* **BGs/PBGs of PSU banks in addition to BHEL consortium banks are only acceptable. List of BHEL Consortium Banks Enclosed.**

* **In case of BGs/PBGs issued by non consortium PSU banks the same are to be enforceable in Bangalore.**

* **In case of BGs/PBGs issued by Foreign banks the same to be confirmed by BHEL consortium bank in India.**

* **It is insisted upon that BGs/PBGs issued by issuing bank on behalf of your company should be sent to BHEL EDN directly by the issuing bank under Registered Post (AD) with a covering letter of bank indicating contact no., fax no., E-mail ID, issuing officer name, address of the issuing bank etc.**

* **Please ask the banker to post original PBG directly to : (Exective refered in PO)**

  **DGM/Purchase, Purchase Dept., NEB IInd (second) Floor, BHEL, Electronics Division, Mysore Road, Bangalore - 560 026, Ph : 080 26989191**

* **We will not accept any BGs/PBGs from your office directly. In case you collect BGs/ PBGs from issuing bank and send to us, the same will be returned back to your office.**

* **Expired BGs/PBGs will be returned after the expiry of the guarantee period including claim period or upon fulfillment of the relevant contract whichever is earlier.**

* **Please give Purchase dealing Executive name, postal address, P.O. No., tel ph no. to bank and insist bank to write these details on the envelope.**

**Electronics Division, Bangalore**

## Annexure-III (c)

## BHEL MEMBER BANKS (LIST OF CONSORTIUM BANKS)

## PBG SHALL BE ISSUED FROM THE FOLLOWING 22 BANKS ONLY:

| | |
|---|---|
| 1 | State Bank of India |
| 2 | Deutsche Bank AG |
| 3 | Canara Bank |
| 4 | HDFC Bank Ltd., |
| 5 | Punjab National Bank |
| 6 | CITI Bank NA, |
| 7 | Bank of Baroda |
| 8 | Standard Chartered Bank, |
| 9 | State Bank of Hyderabad |
| 10 | ICICI Bank Ltd. |
| 11 | The Hongkong and Shanghai Banking Corporation Ltd. |
| 12 | IDBI Bank Ltd. |
| 13 | State Bank of Tranvancore |
| 14 | Corporation Bank |
| 15 | Kotak Mahindra Bank Ltd. |
| 16 | ABN AMRO Bank N.V. |
| 17 | Syndicate Bank |
| 18 | Indian Bank |
| 19 | Oriental Bank Of Commerce |
| 20 | UCO Bank |
| 21 | Central Bank of India |
| 22 | The Federal Bank Ltd. |

**Please Note :** It is preferable if PBG is obtained from BHEL consortium Banks listed above. BHEL may accept PBG from other Nationalised Banks also which are not listed above. PBG will not be accepted from scheduled Banks and Co-operarive Banks.

**Electronics Division, Bangalore**

# ANNEXURE - IV

## GUIDELINES FOR REVERSE AUCTION PROCEDURE

Against this enquiry for the subject item/system with detailed scope of supply as per enquiry specifications, BHEL-EDN proposes to resort to "REVERSE AUCTION PROCEDURE" i.e., ON LINE BIDDING ON NETWORK, before finalizing the purchase order on technically competent bidders as per the guidelines given below:

1. Reverse Auction procedure shall be applicable for 2 Part bid tenders only.
2. For the proposed reverse auction, technically and commercially acceptable bidders only shall be eligible to participate, BHEL will engage the services of a service provider, having network all over the world. The online bidding can be done from the vendor's respective offices on their computers with Internet facility or at any of the cyber cafe, for which service provider's representative will provide all necessary training and assistance before commencement of on line bidding. Training is free of cost .
3. Vendors have to fax the Compliance form in the prescribed format (provided by Service provider) before start of Reverse auction. Without this, Reverse auction will not be started. Delay in faxing the above will lead to disqualification.
4. BHEL will send the Auto formulated EXCEL sheet which will help to arrive at "Total Cost to BHEL" like Basic Material cost, Packing & forwarding charges, Excise duty, Sales Tax/VAT, Freight charges, Insurance (by BHEL), Service Tax for Services,(-) ED disclaimer if any, and loading factors (for non-compliance to BHEL standard Commercial terms & conditions) for each of the vendor to enable them to fill-in the price and keep it ready for keying in during the Auction.
5. Reverse auction will be conducted on a mutually agreed schedule and time.
6. After Reverse auction is conducted , successful bidder has to Fax the Filled-in Excel sheet showing the final value accepted in Reverse Auction with breakup of each element as indicated in Sl No. 4 above to the service provider within 48 hours of Auction without fail.

   **Note: No changes are allowed in Rate of Excise Duty, Sales Tax, Freight, Insurance, Service Tax and Loading factors after auction is completed.**
7. After the reverse auction is conducted, the bidder whose price is lowest ( total cost to BHEL, after considering all factors as per enquiry including Loading factors for deviations to BHEL standard Commercial Terms & conditions), BHEL will process the tender as per BHEL purchase norms. Purchase order will be issued without loading factors for deviations.

   **Note: BHEL will also reserve the right to open the sealed price offer submitted by the vendors for comparison purpose, if deemed necessary, without any intimation to the technically and commercially accepted bidders.**
8. In case BHEL decides not to go for Reverse Auction procedure for this tender enquiry, the Price bids and price impacts (if any) already submitted and available with BHEL shall only be opened as per BHEL's standard practice without seeking anymore price Impacts on account of BHEL not going for Reverse Auction. Hence please quote your best lowest price in first instant itself.
9. Training by service provider will be given only once for the subsequent reverse auction. Training will not be given for a company which has already taken training for the FIRST REVERSE AUCTION conducted by BHEL-EDN, Bangalore.

**Electronics Division, Bangalore**

## GUIDELINES FOR REVERSE AUCTION PROCEDURE

10. **Activities involved in Reverse Auction :**

a) BHEL will inform the vendor in writing, the Service provider's information to enable them to contact & get trained. Alongwith the above information Business rules/policy also will be sent.

b) Vendors have to contact Service provider and send Compliance form for having understood Reverse Auction procedure and ready for Auction.

c) BHEL will send the Auto formulated Excel sheet (blank format without prices) as mentioned in Sl No.4 above to the respective vendors.

d) Vendors have to fill-in the Excel sheet (provided by BHEL) including Loading factors and get ready for Reverse Auction.

e) Date & Time of Reverse Auction and Website address will be intimated by Service Provider.

f) Bid decrement will be indicated in the Website after the Sealed bid is over and before start of Reverse Auction.

g) Vendors will have to key-in the "Total cost to BHEL" (as worked out in the Excel sheet mentioned in Sl No.4 above) in the "Sealed Bid" of the Reverse Auction within specified time duration of 20 to 30 minutes. After "Sealed Bid " auction, the lowest bidder's value or BHEL's start bid price will be the starting bid value for the commencement of Reverse Auction (English Reverse).

h) At the end of Reverse Auction time (English Reverse), the lowest bidder value will be known on the network.

i) Successful bidder has to fax the filled-in EXCEL sheet showing the final value accepted in the Reverse Auction with breakup of each component within 48 hours of completion of the Reverse Auction without altering any of the terms to the service Provider. Any alterations will be taken as sabotaging the tender process and will invite disqualification of vendor to conduct business with BHEL for the period of 2 years.

j) The loading factors for non-conformance to BHEL standard commercial terms are only for arriving at lowest Bidder. In the event of Purchase order, same will be issued without loading factor values indicated in EXCEL Sheet. We repeat PO, will be issued for scope of supply+ Packing & Forwarding charges if any, Excise duty, Sales Tax, Service Tax for services and Freight & Insurance. Insurance will be to BHEL Account.

**-X--X-X--X-X--X-**

**Electronics Division, Bangalore**

# ANNEXURE- V

## LIST OF INTERNATIONAL AIRPORTS.

| SNo | Country | Air Ports |
|---|---|---|
| 1 | Austria | Vienna, Linz, Graz. |
| 2 | Australia | Sydney,Melbourne, Perth |
| 3 | Belgium | Antwerp, Brussels |
| 4 | Canada | Toronto, Montreal |
| 5 | China | Shangai. |
| 6 | Cyprus | Larnaca. |
| 7 | Czech Republic | Prague (Via Frankfurt) |
| 8 | Denmark | Copenhagen |
| 9 | Egypt | Cairo |
| 10 | Finland | Helsinki |
| 11 | France | Paris (Roissy), Lyon |
| 12 | Germany | Darmstadt,Manihiem,Nurnberg,Hamburg, Stutttgart, Munich, Koln, Dusseldorf & Hannover, Frankfurt, Berlin. |
| 13 | Hongkong | Hongkong |
| 14 | Italy | Rome, Milan, Turin, Bologna, Florence |
| 15 | Ireland | Dublin |
| 16 | Isrel | Telaviv. |
| 17 | Japan | Tokyo, Osaka |
| 18 | Malaysia | Kaulalampur, Penang |
| 19 | Netherlands | Amsterdam, Rotterdam |
| 20 | Newzealand | Auckland |
| 21 | Norway | Oslo |
| 22 | Oman | Muscat |
| 23 | Philiphines | Manila |
| 24 | Romania | Bucharest |
| 25 | Russia | Moscow |
| 26 | Saudi Arabia | Riyad. |
| 27 | Singapore | Singapore |
| 28 | Slovakia | Bartislowa. |

**Electronics Division, Bangalore**

## LIST OF INTERNATIONAL AIRPORTS.

| SNo | Country | Air Ports |
|---|---|---|
| 29 | South Africa | Johannesburg, Durban. |
| 30 | South Korea | Kimpo |
| 31 | Spain | Barcelona |
| 32 | Sweden | Stockholm, Gothenburg, Milano |
| 33 | Switzerland | Basle, Zurich, Geneva |
| 34 | Taiwan | Taipei |
| 35 | U.A.E | Dubai |
| 36 | U.K | London (Heathrow), Newcastle, Oxford, Cheltham, Bristol, Wellingborough, Birmingham, East Midland, Manchester, Leeds, Glasgow. |
| 37 | U.S.A | Newyork, Chicago, Sanfrancisco, Los Angeles, Atlanta |
| 38 | Ukraine | Kiev |

# ANNEXURE - VI

## PRESENT PROCEDURE FOR SALE IN TRANSIT (HIGH SEA SALES)

1. DATE OF THE STAMP PAPER SHOULD BE PRIOR TO THE AIR WAY BILL / BILL OF LADING DATE. STAMP PAPER VALUE SHALL BE IN RS.200/- NON JUDICIAL PAPER.

2. SALE AGREEMENT IN RS. 200/- STAMP PAPER AND NOTARISED WITH 2 WITNESSES HAS TO BE SIGNED BETWEEN BHEL AND THE PARTY IMPORTING MATERIAL AND THE DATE OF THE SALE DOCUMENTS SHOULD BE IN BEWEEN THE DATE OF HOUSE AIR WAY BILL / BILL OF LADING AND BEFORE LANDING OF THE GOODS IN INDIAN ORIGIN.

3. THE SALE AGENTS SHOULD DULY ENDORSE HOUSE AIR WAY BILL (HAWB) FOR AIR SHIPMENTS OR ORIGINAL BILL OF LADING (O.B.L.) FOR SEA SHIPMENTS, DELIVERY ORDER AND FOREIGN CURRENCY INVOICE IN FAVOUR OF BHEL-EDN.

4. SELLER SHOULD GIVE FOREIGN CURRENCY INVOICE FROM THE ORIGINAL CONSIGNOR. THE FOREIGN CURRENCY INVOICE VALUE SHOULD BE AT LEAST 2% (TWO PER CENT) LESS THAN THE INDIGENOUS RUPEE INVOICE VALUE IN EQUIVALENT FOREIGN CURENCY.

5. SELLER SHOULD ALSO GIVE LETTER OF AUTHORISATION TO AIR CONSOL AGENTS FOR RELEASING DELIVEY ORDERS TO BHEL-EDN.

6. SELLER PARTY SHOULD ALSO GIVE A LETTER TO THE COMMISSIONER OF CUSTOMS FOR EFFECTING ABOVE SALE.

7. SELLING PARTY SHOULD ALSO GIVE A LETTER TO THE DEPUTY ASSESSOR (OCTROI) FOR EFFECTING ABOVE SALE IN FAVOUR OF BHEL.

8. DESCRIPTION OF ITEM (NOMENCLATURE), UNIT & QUANTITY IN BOTH FOREIGN CURRENCY & THE RUPEE INVOICE IN RUPEE SHALL BE EXACTLY AS PER PO DESCRIPTION OF ITEM, QUANTITY AND UNIT. THE INDIGENOUS INVOICE VALUE SHALL BE EXACTLY AS PER PO VALUE.

9. PRICES SHOULD BE C.I.F., MUMBAI BASIS.

10. I.E.C., C.S.T., K.S.T. NOS. TO BE MENTIONED.

11. NOTE: THE FOLLOWING SHALL BE INCLUDED IN THE HIGH SEA SALES AGREEMENT:

    **"THE BUYER ALSO UNDERTAKE DISCHARGES, THE OBLIGATION AND FULFILLMENT OF CONDITIONS, IF ANY, ATTACHED TO THE IMPORTATION, ASSESSMENT AND CLEARANCE OF THE GOODS IN TERMS CUSTOMS TARIFF ACT 1975, THE CUSTOMS ACT 1962 & RULES & REGULATIONS MADE THEREUNDER AND OTHER RELEVANT ACTS, ORDERS, NOTIFICATIONS".**

**REMARKS: IN CASE VENDOR NEEDS ANY CALRIFICATIONS ON THE ABOVE, THE SAME MAY BE SOUGHT IN WRITING.**

**-X-X-**

# ANNEXURE - VII

## Guidelines for Indian Agents of Foreign Suppliers

1.0 There shall be compulsory registration of agents for all Global (Open) Tender and Limited Tender. An agent who is not registered with BHEL shall apply for registration in the registration form in line with SEARP.

1.1 Registered agents will file an authenticated Photostat copy duly attested by a Notary Public/Original certificate of the Principal confirming the agency agreement and giving the status being enjoyed by the agent and the commission/ remuneration/ salary/ retainership being paid by the principal to the agent before the placement of order by BHEL.

1.2 Wherever the Indian representatives have communicated on behalf of their principals and the foreign parties have stated that they are not paying any commission to the Indian agents, and the Indian representative is working on the basis of salary or as retainer, a written declaration to this effect should be submitted by the party (i.e. Principal) before finalizing the order.

**2.0 Disclosure of particulars of agents/ representatives in India, if any.**

2.1 Tenderers of Foreign nationality shall furnish the following details in their offers:

2.1.1 The Bidder(s)/ Contractor(s) of foreign origin shall disclose the name and address of the agents/ representatives in India if any and the extent of authorization and authority given to commit the Principals. In case the agent/ representative be a foreign Company, it shall be confirmed whether it is existing Company and details of the same shall be furnished.

2.1.2 The amount of commission/ remuneration included in the quoted price(s) for such agents/ representatives in India.

2.1.3 Confirmation of the Tenderer that the commission/ remuneration, if any, payable to his agents/ representatives in India, may be paid by BHEL in Indian Rupees only.

2.2 Tenderers of Indian Nationality shall furnish the following details in their offers:

2.2.1 The Bidder(s)/ Contractor(s) of Indian Nationality shall furnish the name and address of the foreign principals, if any, indicating their nationality as well as their status, i.e. whether manufacturer or agents of manufacturer holding the Letter of Authority of the Principal specifically authorizing the agent to make an offer in India in response to tender either directly or through the agents/ representatives.

2.2.2 The amount of commission/ remuneration included in the price (s) quoted by the Tenderer for himself.

2.2.3 Confirmation of the foreign principals of the Tenderer that the commission/ remuneration, if any, reserved for the Tenderer in the quoted price(s), may be paid by BHEL in India in equivalent Indian Rupees on satisfactory completion of the Project or supplies of Stores and Spares in case of operation items.

2.3 In either case, in the event of contract materializing, the terms of payment will provide for payment of the commission/ remuneration, if any payable to the agents/ representatives in India in Indian Rupees on expiry of 90 days after the discharge of the obligations under the contract.

2.4 Failure to furnish correct and detailed information as called for in paragraph 2.0 above will render the concerned tender liable to rejection or in the event of a contract materializing, the same liable to termination by BHEL. Besides this there would be a penalty of banning business dealings with BHEL or damage or payment of a named sum.

---x---

This format is applicable only to Indian Suppliers/ Agents supplying indigenous portion of Foreign Purchases.

* In all other cases, extant guidelines of SEARP, 2010 are to be followed.

| SEARP (SRF) Clause No | Detail |
|---|---|
| | **Name & address of the firm** |
| **1.0** | **Products/ Systems / Services being considered for** |
| **2.0** | **General Information** |
| 2.2 | Name of Chief Executive |
| 2.3 | Details of authorized signatory |
| **3.0** | **Ownership Information** |
| 3.1 | Type of firm |
| 3.2 | Nature of Business<br>• *Attach **authorization letter** and **agency agreement** from Principal ( from whom capital equipment is procured)*<br>• *Attach copy of declaration from Foreign Principal for **total guarantee/ warranty of indigenous supplies*** |
| 3.3 | Year of establishment |
| 3.4 | Year of commencement of business |
| **4.0** | **Registration particulars** |
| 4.1 | Permanent Account No. |
| 4.2 / 4.3 | Sales Tax / TIN no |
| 4.6 | Service tax no. (in case of E&C) |
| **5.0** | **Organisational strength** |
| **6.0** | **Other particulars** |
| 6.1 | If the company is already registered with other units |
| 6.2 | Directors/ Partners, if related to any BHEL Employee |
| 6.9 | If any Ex BHEL Personnel employed by the Company |
| 6.12 | Details of pending legal issues with BHEL |
| 6.13 | Bank Account information |
| **9.0** | **Financial information** |
| 9.6 | Sales/ Turnover details of last 3 years (or from the date of incorporation whichever is less ) |

---x---

PROJECT : SHIRPUR POWER PROJECT (2x150 MW)

CUSTOMER : M/s SINTEX INFRA PROJECT LIMITED

# SPECIFICATION

# FOR

# UPS BATTERY



REVISION:00

APPROVED

M GURURAJ

| PREPARED | ISSUED | DATE |
|---|---|---|
| SATHISH | 416 | 16/10/2013 |

# CONTENTS

PROJECT : SHIRPUR POWER PROJECT (2x150 MW)

CUSTOMER : M/s SINTEX INFRA PROJECT LIMITED

# SECTION-A

# GENERAL INSTRUCTION TO BIDDERS

1.0 ALL REQUIRED DOCUMENTS AGAINST THIS TENDER/SPECIFICATION SHALL BE SUBMITTED IN ENGLISH ONLY.

2.0 **Introduction:** Bidders are required to offer Lead Acid Plante type Batteries for 750 AH and above, along with accessories, Discharge Resistor Bank and Mild Steel/Teak Wood Battery Stand (Both options to be provided).

3.0 In order to accept the Technical offers/ proposals from Bidders for three projects mentioned in this Specification (ref. Sections C, D & E), certain Pre-qualification criteria are required to be met by Bidder.

4.0 Pre – qualification requirements (PQR) are clearly mentioned in Section-B of this Specification. Bidder to read the same carefully and submit the details required for BHEL"s acceptance.

5.0 In case Bidder does not include the details or meet the requirements of Pre-qualification requirements, their offer will be summarily rejected and Bidder"s Technical offers will not be evaluated.

6.0 **Evaluation methodology:** BHEL shall initially open Bidder"s PQR documents only as per Section B of this specification for review acceptance. Only after acceptance of PQR evaluation, BHEL shall open Bidder"s Technical offer as per Cl 2.0 of above for evaluation. In the event of acceptance of Bidder"s technical offers, the names of such Bidders along with details provided by them for PQR and details of technical offers shall be submitted to End-users/Customers for their acceptance/approval. Commercial bids of only accepted /approved Bidders by End-users/Customers shall be considered by BHEL for further processing.

**7.0 Bidders are required to submit offers as detailed below:**

**aa**. Documents pertaining to Pre-Qualification requirement (CI AA of section B of this Specification) shall be in a separate cover with reference no. "CE/416/BATTERY/PQR/CI AA of section B" marked on it.

**bb**. Documents pertaining to Pre- Qualification requirement (CI BB of Section B of this Specification) shall be in a separate cover with reference no. "CE/416/BATTERY/PQR/CI BB of section B" marked on it.

**cc**. Technical offers/proposals for requirements mentioned in Sections C, D & E shall be submitted with Project Name & reference marked on it.

8.0 Whenever required during evaluation of PQR and Technical offers/bids, vendor is required to be present at BHEL Electronic Division, Bangalore, for discussions. Further in the event of order, during approval of the Vendor documents by End-users/Customers, Vendor shall accompany BHEL representative for discussions.

PROJECT : SHIRPUR POWER PROJECT (2x150 MW)

CUSTOMER : M/s SINTEX INFRA PROJECT LIMITED

# SECTION-B

# PRE-QUALIFICATION REQUIREMENTS

**AA. Pre-Qualification Requirements (PQR) of Bidders for Lead -Acid Battery, as a part of offer:**

**1.0** Submit Reference List of Projects where in offered Battery is supplied & commissioned along with details of performance and Year of Commissioning of the Batteries specified in Section C, D & E.

**2.0** Bidder should have manufactured and supplied atleast two (2) numbers of minimum 220V, 750 AH rating Lead Acid Plante type Battery in atleast two(2) different industrial installations, which should be in successful operation for atleast two(2) years as on date of bid opening.

**3.0** Submit List of Projects for which Erection & Commissioning has been carried out by subsidiary / Authorized Indian representative for last two years.

**4.0** Submit duly- filled Source Request form (SRF), which shall be downloaded by Bidder from our website "www.bhel.com".

**BB. Along with the documents related to PQR above, following details shall also be included in the Offer:**

1.0 Technical literature/Manuals, Catalogs & Charging/Discharging Characteristics of offered Battery Sets.

2.0 Un priced Purchase Order copies

3.0 Reports of successful erection & commissioning Protocols & Minutes of the meetings.

4.0 Name & registered address of the Indian branch office or Indian representative for support of Erection & Commissioning and after sales service with Organization chart.

5.0 Details of Manufacturing, testing & inspection facility.

6.0 Bidder shall have facility in India for Engineering activities, preparation of Documents, servicing of offered Batteries, Stocking of Spares, etc. submit these details.

7.0 Bidders shall submit following Type test reports for offered Batteries as per IS 1652:1991/equivalent standard.

8.0 Routine & Acceptance Tests shall be conducted as per IS 1652:1991/equivalent standard considering sample of cells pertaining to a lot.

9.0 If Bidder is not Original Equipment Manufacturer (OEM), then Bidder to include Authorization letter from OEM for Design, Engineering, Manufacture, Testing, Supply, Erection, Commissioning and Servicing of the offered Batteries. This Authorization letter provided by OEM to Bidder shall indicate the Type and Duration of the agreement.

**Importantly note: -** In case Bidder does not submit details mentioned in above clauses or meet the requirements of Pre-qualification requirements, Offers will be summarily Rejected and Bidder"s Technical offers/proposals will not be Evaluated. Please read carefully the General instructions in Section A of this specification.

PROJECT : SHIRPUR POWER PROJECT (2x150 MW)

CUSTOMER : M/s SINTEX INFRA PROJECT LIMITED

# SECTION-C

# TECHNICAL SPECIFICATION

**A.)** SCOPE:

Supply, Installation & Commissioning for 4 Sets of Lead Acid Plante Type Battery.

**B.)** SPECIFICATION:

The offer shall be corresponding to the parameters under the specifications below or better.

| **S.NO** | **BATTERY AND BACK-UP TIME** | | **COMPLIANCE (Value/Y/N-as applicable)** |
|---|---|---|---|
| **Offered Make/Model:** | | | |
| a.) | kVA Rating of UPS System. | 120 kVA, 3 Ph Input, 1 Ph Output.<br>kVA rating to be considered for Battery Sizing is 120 kVA. | |
| b.) | No. of Battery banks | Two Sets of Battery per UPS. Batteries are not to be paralleled under One Set of Battery. Total Four Sets are required for Two Sets of UPS System. | |
| c.) | Battery Type | Lead Acid Plante Type | |
| d.) | Minimum DC Bus Voltage | 320V DC | |
| e.) | Maximum DC Bus Voltage | 470V DC | |
| e.) | Back-up time or Duty Cycle | 60 minutes back-up each at 100% load. Battery sizing Calculation to be done as per Annexure-1 enclosed. | |
| f.) | Battery Mounting Rack | The batteries shall be housed in a separate battery rack made of teak wood/mild steel. The rack must facilitate easy physical examination/ maintenance/replacement of the individual cells. Drawing of battery mounting rack to be submitted as part of tender. | |
| g.) | Accessories | Accessories shall be provided as per Annexure-II attached. | |
| h.) | Documents | a.) Datasheets/Drawings for approval.<br>b.) O&M Manuals for site commissioning. | |

**C.1** The batteries shall be Lead Acid Plante type and shall be sized for an hour of full load operation. Lead Acid Plante batteries shall conform to IS: 1652:1991/equivalent standards.

**C.2** Bidder shall furnish battery sizing calculations, supporting curves/data etc. with the proposal to demonstrate to BHEL/Sintex Infra that the proposed battery capacity meets the above specification requirements at maximum temperature as well as minimum ambient temperature condition of 4°C.

**C.3** Cells shall be Lead Acid Plante, sealed type assembled in heat resistance; shock absorbent, explosion-proof, hard rubber type containers with cover fused or cemented in place to form a permanent leak-proof seal. Each cover shall be fitted with vent plugs.

**C.4** The plate structure shall be provided with adequate separators, suspensions and supports so that all plates are permanently aligned and protected from breakage.

**C.5** Sufficient sediment space shall be provided below the plates to eliminate the necessity of sediment removal during normal battery life.

**C.6** Each cell container shall be clearly marked for low and high electrolyte level limits on all four sides.

**C.7** Vent plug shall be of such a design to allow escape of gases but not of acid spray and shall be explosion proof.

**C.8** All cell terminals shall have adequate current carrying capacity and shall be lead alloy or approved equal material.

**C.9** Cell terminals posts shall be suitable for bolted connection and shall be equipped with complete connector bolts and nuts. Cell posts shall be sealed against creepage of electrolyte either by burned ring seals or by lead alloy seal nuts or equivalent.

**C.10** Racks shall be of teak wood/mild steel and construction in accordance with applicable codes and standards. AISC specification shall apply in the absence of another applicable design specification.

**C.11** Each cell shall be assigned an identification number. Identification numbers shall be clearly and permanently marked on the front of the rack structure so that individual cells are easily identifiable. In addition, the polarity markers shall be furnished for the end cells.

**C.12** The UPS Battery shall have sufficient amp-hour capacity to supply 100% full load current of UPS for 60 minutes. For this, the UPS capacity to be considered as the finally selected UPS rating, irrespective of the actual load on UPS. A drop of 4V from battery room to inverter input shall be considered for design.

## Typical Battery sizing calculation:

UPS full load considered = 120 kVA at 50 deg C.

***Options shall be provided for 90,100,105,130, 140 & 150 kVA also.***

Max. Output load on UPS in watts = 120 x 1000 x 0.8 (P.F)

= 96000 Watts

Inverter efficiency = „**A**“ say
Type of Battery and Back up Time required = Lead Acid Plante, 1 hour at full load.
End cell voltage (ECV) = 1.85 Volts/cell.
Number of cells = „**B**“ say
Ageing factor = 1.0 (Ageing Factor Not applicable for Lead Acid Plante Battery as per IEEE 485 standard)
Design Margin = 1.15

Temperature correction factor (at 4 deg. C. based on IEEE 485 standard) = „**C**“ say

Capacity Factor at ECV of 1.85V for 1 Hr. Back-up, K = „**D**“ say

Then Battery Discharge Current required $= \dfrac{96000}{1.85 \times \mathbf{A} \times \mathbf{B}}$ = „**E**“ say

AH required = „**E’** x „**D**“ = „**F’** say

Total Discharge Current considering the factors such as temperature correction factor, design margin & ageing factor is

= „**F**“ x „**C**“ 1.15 x 1.0 = „**Z**“ say

Battery AH to an End Cell Voltage of 1.85V/cell and suiting the above discharge current = „**Y’** say

Hence, Battery selected = **‘B’ cells of ‘Y’ AH which can deliver ‘Z’ for 1 Hr. back-up at ECV=1.85V**

**Note:** Inverter efficiency is to be taken as 90% and 91% with 180 cells in two separate options to be offered for Batteries.

# ANNEXURE-II

*Each battery shall be complete including the following equipment and material:*

**01** Hydrometer - 5 Nos.

02 Set of Hydrometer Syringes suitable for the vent holes in different cells - 5 Nos.

03 Thermometer for measuring electrolyte temperature - 5 Nos.

04 Specific Gravity Correction Chart - 5 Nos.

05 Wall mounting type holder made of teak wood for hydrometer & thermometer - 5 Nos.

**06** Cell Testing Voltmeter (3-0-3 V) - 5 Nos.

**07** Alkali Mixing Jar - 5 Nos.

**08** Rubber Apron - 5 Nos

**09** Pair of Rubber Gloves - 5 Nos

10 Set of Spanners - 5 Nos

11 No Smoking Notice for 2 Set of Batteries - 2 Nos.

12 Goggles (Industrial) - 5 Nos.

13 Instruction Card - 10 Nos.

14 Minimum and Maximum temperature indicator for 2 Set of Batteries - 1 Set

15 Cell lifting facility - 1 No.

16 Discharge Resistor Bank - 1 Set for 2 Sets of Batteries.

PROJECT : BELLARY U-3 STG-III (1x700 MW)

CUSTOMER : M/s KPCL

CONSULTANT : M/s TRACTEBEL ENGG PVT LTD.

# SPECIFICATION

# FOR

# UPS BATTERY



REVISION:00

APPROVED

M GURURAJ

| PREPARED | ISSUED | DATE |
|---|---|---|
|  SATHISH | 416 | 16/10/2013 |

# CONTENTS

PROJECT : BELLARY U-3 STG-III (1x700 MW)

CUSTOMER : M/s KPCL

CONSULTANT : M/s TRACTEBEL ENGG PVT LTD.

# SECTION-A

# GENERAL INSTRUCTION TO BIDDERS

1.0 ALL REQUIRED DOCUMENTS AGAINST THIS TENDER/SPECIFICATION SHALL BE SUBMITTED IN ENGLISH ONLY.

2.0 **Introduction:** Bidders are required to offer Lead Acid Plante type Batteries for 750 AH and above, along with accessories, Discharge Resistor Bank and Seismically Qualified Good Quality Battery Stand.

3.0 In order to accept the Technical offers/ proposals from Bidders for three projects mentioned in this Specification (ref. Sections C, D & E), certain Pre-qualification criteria are required to be met by Bidder.

4.0 Pre – qualification requirements (PQR) are clearly mentioned in Section-B of this Specification. Bidder to read the same carefully and submit the details required for BHEL"s acceptance.

5.0 In case Bidder does not include the details or meet the requirements of Pre-qualification requirements, their offer will be summarily rejected and Bidder"s Technical offers will not be evaluated.

6.0 **Evaluation methodology:** BHEL shall initially open Bidder"s PQR documents only as per Section B of this specification for review acceptance. Only after acceptance of PQR evaluation, BHEL shall open Bidder"s Technical offer as per Cl 2.0 of above for evaluation. In the event of acceptance of Bidder"s technical offers, the names of such Bidders along with details provided by them for PQR and details of technical offers shall be submitted to End-users/Customers for their acceptance/approval. Commercial bids of only accepted /approved Bidders by End-users/Customers shall be considered by BHEL for further processing.

**7.0 Bidders are required to submit offers as detailed below:**

**aa**. Documents pertaining to Pre-Qualification requirement (CI AA of section B of this Specification) shall be in a separate cover with reference no. "CE/416/BATTERY/PQR/CI AA of section B" marked on it.

**bb**. Documents pertaining to Pre- Qualification requirement (CI BB of Section B of this Specification) shall be in a separate cover with reference no. "CE/416/BATTERY/PQR/CI BB of section B" marked on it.

**cc**. Technical offers/proposals for requirements mentioned in Sections C, D & E shall be submitted with Project Name & reference marked on it.

8.0 Whenever required during evaluation of PQR and Technical offers/bids, vendor is required to be present at BHEL Electronic Division, Bangalore, for discussions. Further in the event of order, during approval of the Vendor documents by End-users/Customers, Vendor shall accompany BHEL representative for discussions.

PROJECT : BELLARY U-3 STG-III (1x700 MW)

CUSTOMER : M/s KPCL

CONSULTANT : M/s TRACTEBEL ENGG PVT LTD.

# SECTION-B

# PRE-QUALIFICATION REQUIREMENTS

**AA. Pre-Qualification Requirements (PQR) of Bidders for Lead- Acid Battery, as a part of offer:**

**1.0** Submit Reference List of Projects where in offered Battery is supplied & commissioned along with details of performance and Year of Commissioning of the Batteries specified in Section C, D & E.

**2.0** Bidder should have manufactured and supplied atleast two (2) numbers of minimum 220V, 750 AH rating Lead Acid Plante type Battery in atleast two(2) different industrial installations, which should be in successful operation for atleast two(2) years as on date of bid opening.

**3.0** Submit List of Projects for which Erection & Commissioning has been carried out by subsidiary / Authorized Indian representative for last two years.

**4.0** Submit duly- filled Source Request form (SRF), which shall be downloaded by Bidder from our website "www.bhel.com".

**BB. Along with the documents related to PQR above, following details shall also be included in the Offer:**

1.0 Technical literature/Manuals, Catalogs & Charging/Discharging Characteristics of offered Battery Sets.

2.0 Un priced Purchase Order copies

3.0 Reports of successful erection & commissioning Protocols & Minutes of the meetings.

4.0 Name & registered address of the Indian branch office or Indian representative for support of Erection & Commissioning and after sales service with Organization chart.

5.0 Details of Manufacturing, testing & inspection facility.

6.0 Bidder shall have facility in India for Engineering activities, preparation of Documents, servicing of offered Batteries, Stocking of Spares, etc. submit these details.

7.0 Bidders shall submit following Type test reports for offered Batteries as per IS 1652:1991/equivalent standard.

8.0 Routine & Acceptance Tests shall be conducted as per IS 1652:1991/equivalent standard considering sample of cells pertaining to a lot.

9.0 If Bidder is not Original Equipment Manufacturer (OEM), then Bidder to include Authorization letter from OEM for Design, Engineering, Manufacture, Testing, Supply, Erection, Commissioning and Servicing of the offered Batteries. This Authorization letter provided by OEM to Bidder shall indicate the Type and Duration of the agreement.

**Importantly note: -** In case Bidder does not submit details mentioned in above clauses or meet the requirements of Pre-qualification requirements, Offers will be summarily Rejected and Bidder"s Technical offers/proposals will not be Evaluated. Please read carefully the General instructions in Section A of this specification.

PROJECT : BELLARY U-3 STG-III (1x700 MW)

CUSTOMER : M/s KPCL

CONSULTANT : M/s TRACTEBEL ENGG PVT LTD.

# SECTION-C

# TECHNICAL SPECIFICATION

**A.)** SCOPE:

Supply, Installation & Commissioning for 2 Sets of Lead Acid Plante Type Battery.

**B.)** SPECIFICATION:

The offer shall be corresponding to the parameters under the specifications below or better.

| **S.NO** | **BATTERY AND BACK-UP TIME** | | **COMPLIANCE (Value/Y/N-as applicable)** |
|---|---|---|---|
| **Offered Make/Model:** | | | |
| a.) | kVA Rating of UPS System. | 150 kVA, 3 Ph Input, 1 Ph Output.<br>kVA rating to be considered for Battery Sizing is 150 kVA. | |
| b.) | No. of Battery banks | Two Sets of Battery per UPS. Batteries are not to be paralleled under One Set of Battery. Total Four Sets are required for Two Sets of UPS System. | |
| c.) | Battery Type | Lead Acid Plante Type | |
| d.) | Minimum DC Bus Voltage | 320V DC | |
| e.) | Maximum DC Bus Voltage | 470V DC | |
| e.) | Back-up time or Duty Cycle | 60 minutes back-up each at 100% load. Battery sizing Calculation to be done as per Annexure-1 enclosed. | |
| f.) | Battery Mounting Rack | The batteries shall be housed in a separate battery rack made of seismically qualified good battery stand. The rack must facilitate easy physical examination/maintenance/replacement of the individual cells. Drawing of battery mounting rack to be submitted as part of tender. | |
| g.) | Accessories | Accessories shall be provided as per Annexure-II attached. | |
| h.) | Documents | a.) Datasheets/Drawings for approval.<br>b.) O&M Manuals for site commissioning. | |

**C.1** The batteries shall be Lead Acid Plante type and shall be sized for an hour of full load operation. Lead Acid Plante batteries shall conform to IS: 1652:1991/equivalent standards.

**C.2** Bidder shall furnish battery sizing calculations, supporting curves/data etc. with the proposal to demonstrate to BHEL/KPCL/Tractebel that the proposed battery capacity meets the above specification requirements at maximum temperature as well as minimum ambient temperature condition of 4°C.

**C.3** Cells shall be Lead Acid Plante, sealed type assembled in heat resistance; shock absorbent, explosion-proof, hard rubber type containers with cover fused or cemented in place to form a permanent leak-proof seal. Each cover shall be fitted with vent plugs.

**C.4** The plate structure shall be provided with adequate separators, suspensions and supports so that all plates are permanently aligned and protected from breakage.

**C.5** Sufficient sediment space shall be provided below the plates to eliminate the necessity of sediment removal during normal battery life.

**C.6** Each cell container shall be clearly marked for low and high electrolyte level limits on all four sides.

**C.7** Vent plug shall be of such a design to allow escape of gases but not of acid spray and shall be explosion proof.

**C.8** All cell terminals shall have adequate current carrying capacity and shall be lead alloy or approved equal material.

**C.9** Cell terminals posts shall be suitable for bolted connection and shall be equipped with complete connector bolts and nuts. Cell posts shall be sealed against creepage of electrolyte either by burned ring seals or by lead alloy seal nuts or equivalent.

**C.10** Racks shall be of seismically qualified good quality battery stand and construction in accordance with applicable codes and standards. AISC specification shall apply in the absence of another applicable design specification.

**C.11** Each cell shall be assigned an identification number. Identification numbers shall be clearly and permanently marked on the front of the rack structure so that individual cells are easily identifiable. In addition, the polarity markers shall be furnished for the end cells.

**C.12** The UPS Battery shall have sufficient amp-hour capacity to supply 100% full load current of UPS for 60 minutes. For this, the UPS capacity to be considered as the finally selected UPS rating, irrespective of the actual load on UPS. A drop of 4V from battery room to inverter input shall be considered for design.

## Typical Battery sizing calculation:

UPS full load considered = 150 kVA at 50 deg C.

***Options shall be provided for 160 kVA also.***

Max. Output load on UPS in watts = 150 x 1000 x 0.8 (P.F)

= 120000 Watts

Inverter efficiency = „**A**“ say
Type of Battery and Back up Time required = Lead Acid Plante, 1 hour at full load.
End cell voltage (ECV) = 1.85 Volts/cell.
Number of cells = „**B**“ say
Ageing factor = 1.0 (Ageing Factor Not applicable for Lead Acid Plante Battery as per IEEE 485 standard)
Design Margin = 1.15

Temperature correction factor (at 4 deg. C. based on IEEE 485 standard) = „**C**“ say

Capacity Factor at ECV of 1.85V for 1 Hr. Back-up, K = „**D**“ say

Then Battery Discharge Current required $= \dfrac{120000}{1.85 \times \mathbf{A} \times \mathbf{B}}$ = „**E**“ say

AH required = „**E’** x „**D**“ = „**F’** say

Total Discharge Current considering the factors such as temperature correction factor, design margin & ageing factor is

= „**F**“ x „**C**“ 1.15 x 1.0 = „**Z**“ say

Battery AH to an End Cell Voltage of 1.85V/cell and suiting the above discharge current = „**Y’** say

Hence, Battery selected = **‘B’ cells of ‘Y’ AH which can deliver ‘Z’ for 1 Hr. back-up at ECV=1.85V**

**Note:** Inverter efficiency is to be taken as 90% and 91% with 180 cells in two separate options to be offered for Batteries.

# ANNEXURE-II

*Each battery shall be complete including the following equipment and material:*

**01** Hydrometer - 5 Nos.

02 Set of Hydrometer Syringes suitable for the vent holes in different cells - 5 Nos.

03 Thermometer for measuring electrolyte temperature - 5 Nos.

04 Specific Gravity Correction Chart - 5 Nos.

05 Wall mounting type holder made of teak wood for hydrometer & thermometer - 5 Nos.

**06** Cell Testing Voltmeter (3-0-3 V) - 5 Nos.

**07** Alkali Mixing Jar - 5 Nos.

**08** Rubber Apron - 5 Nos

**09** Pair of Rubber Gloves - 5 Nos

10 Set of Spanners - 5 Nos

11 No Smoking Notice for 2 Set of Batteries - 2 Nos.

12 Goggles (Industrial) - 5 Nos.

13 Instruction Card - 10 Nos.

14 Minimum and Maximum temperature indicator for 2 Set of Batteries - 1 Set

15 Cell lifting facility - 1 No.

16 Discharge Resistor Bank - 1 Set for 2 Sets of Batteries.

PROJECT : **YERAMARUS TPS** (**2**x**8**00 MW)

CUSTOMER : M/s **RPCL**

CONSULTANT :

# SPECIFICATION

# FOR

# UPS BATTERY



REVISION:00

APPROVED

M GURURAJ

| PREPARED | ISSUED | DATE |
|---|---|---|
|  SATHISH | 416 | 16/10/2013 |

# CONTENTS

PROJECT : **YERAMARUS** (**2**x**8**00 MW)

CUSTOMER : M/s **RPCL**

CONSULTANT :

# SECTION-A

# GENERAL INSTRUCTION TO BIDDERS

1.0 ALL REQUIRED DOCUMENTS AGAINST THIS TENDER/SPECIFICATION SHALL BE SUBMITTED IN ENGLISH ONLY.

2.0 **Introduction:** Bidders are required to offer Lead Acid Plante type Batteries for 750 AH and above, along with accessories, Discharge Resistor Bank and Seismically Qualified Good Quality Battery Stand.

3.0 In order to accept the Technical offers/ proposals from Bidders for three projects mentioned in this Specification (ref. Sections C, D & E), certain Pre-qualification criteria are required to be met by Bidder.

4.0 Pre – qualification requirements (PQR) are clearly mentioned in Section-B of this Specification. Bidder to read the same carefully and submit the details required for BHEL"s acceptance.

5.0 In case Bidder does not include the details or meet the requirements of Pre-qualification requirements, their offer will be summarily rejected and Bidder"s Technical offers will not be evaluated.

6.0 **Evaluation methodology:** BHEL shall initially open Bidder"s PQR documents only as per Section B of this specification for review acceptance. Only after acceptance of PQR evaluation, BHEL shall open Bidder"s Technical offer as per Cl 2.0 of above for evaluation. In the event of acceptance of Bidder"s technical offers, the names of such Bidders along with details provided by them for PQR and details of technical offers shall be submitted to End-users/Customers for their acceptance/approval. Commercial bids of only accepted /approved Bidders by End-users/Customers shall be considered by BHEL for further processing.

**7.0 Bidders are required to submit offers as detailed below:**

**aa**. Documents pertaining to Pre-Qualification requirement (CI AA of section B of this Specification) shall be in a separate cover with reference no. "CE/416/BATTERY/PQR/CI AA of section B" marked on it.

**bb**. Documents pertaining to Pre- Qualification requirement (CI BB of Section B of this Specification) shall be in a separate cover with reference no. "CE/416/BATTERY/PQR/CI BB of section B" marked on it.

**cc**. Technical offers/proposals for requirements mentioned in Sections C, D & E shall be submitted with Project Name & reference marked on it.

8.0 Whenever required during evaluation of PQR and Technical offers/bids, vendor is required to be present at BHEL Electronic Division, Bangalore, for discussions. Further in the event of order, during approval of the Vendor documents by End-users/Customers, Vendor shall accompany BHEL representative for discussions.

PROJECT : **YERAMARUS** (**2**x**8**00 MW)

CUSTOMER : M/s **R**PCL

CONSULTANT :

# SECTION-B

# PRE-QUALIFICATION REQUIREMENTS

**AA. Pre-Qualification Requirements (PQR) of Bidders for Lead-Acid Battery, as a part of offer:**

**1.0** Submit Reference List of Projects where in offered Battery is supplied & commissioned along with details of performance and Year of Commissioning of the Batteries specified in Section C, D & E.

**2.0** Bidder should have manufactured and supplied atleast two (2) numbers of minimum 220V, 750 AH rating Lead Acid Plante type Battery in atleast two(2) different industrial installations, which should be in successful operation for atleast two(2) years as on date of bid opening.

**3.0** Submit List of Projects for which Erection & Commissioning has been carried out by subsidiary / Authorized Indian representative for last two years.

**4.0** Submit duly- filled Source Request form (SRF), which shall be downloaded by Bidder from our website "www.bhel.com".

**BB. Along with the documents related to PQR above, following details shall also be included in the Offer:**

1.0 Technical literature/Manuals, Catalogs & Charging/Discharging Characteristics of offered Battery Sets.

2.0 Un priced Purchase Order copies

3.0 Reports of successful erection & commissioning Protocols & Minutes of the meetings.

4.0 Name & registered address of the Indian branch office or Indian representative for support of Erection & Commissioning and after sales service with Organization chart.

5.0 Details of Manufacturing, testing & inspection facility.

6.0 Bidder shall have facility in India for Engineering activities, preparation of Documents, servicing of offered Batteries, Stocking of Spares, etc. submit these details.

7.0 Bidders shall submit following Type test reports for offered Batteries as per IS 1652:1991/equivalent standard.

8.0 Routine & Acceptance Tests shall be conducted as per IS 1652:1991/equivalent standard considering sample of cells pertaining to a lot.

9.0 If Bidder is not Original Equipment Manufacturer (OEM), then Bidder to include Authorization letter from OEM for Design, Engineering, Manufacture, Testing, Supply, Erection, Commissioning and Servicing of the offered Batteries. This Authorization letter provided by OEM to Bidder shall indicate the Type and Duration of the agreement.

**Importantly note: -** In case Bidder does not submit details mentioned in above clauses or meet the requirements of Pre-qualification requirements, Offers will be summarily Rejected and Bidder"s Technical offers/proposals will not be Evaluated. Please read carefully the General instructions in Section A of this specification.

PROJECT : **YERAMARUS** (**2**x**8**0**0** MW)

CUSTOMER : M/s **R**PCL

CONSULTANT :

# SECTION-C

# TECHNICAL SPECIFICATION

**A.)** SCOPE:

Supply, Installation & Commissioning for 4 Sets of Lead Acid Plante Type Battery.

**B.)** SPECIFICATION:

The offer shall be corresponding to the parameters under the specifications below or better.

| S.NO | BATTERY AND BACK-UP TIME | | COMPLIANCE (Value/Y/N-as applicable) |
|---|---|---|---|
| **Offered Make/Model:** | | | |
| a.) | kVA Rating of UPS System. | 130 kVA, 3 Ph Input, 1 Ph Output.<br>kVA rating to be considered for Battery Sizing is 130 kVA. | |
| b.) | No. of Battery banks | Two Sets of Battery per UPS. Batteries are not to be paralleled under One Set of Battery. Total Four Sets are required for Two Sets of UPS System. | |
| c.) | Battery Type | Lead Acid Plante Type | |
| d.) | Minimum DC Bus Voltage | 320V DC | |
| e.) | Maximum DC Bus Voltage | 470V DC | |
| e.) | Back-up time or Duty Cycle | 60 minutes back-up each at 100% load. Battery sizing Calculation to be done as per Annexure-1 enclosed. | |
| f.) | Battery Mounting Rack | The batteries shall be housed in a separate battery rack made of seismically qualified good battery stand. The rack must facilitate easy physical examination/maintenance/replacement of the individual cells. Drawing of battery mounting rack to be submitted as part of tender. | |
| g.) | Accessories | Accessories shall be provided as per Annexure-II attached. | |
| h.) | Documents | a.) Datasheets/Drawings for approval.<br>b.) O&M Manuals for site commissioning. | |

**C.1** The batteries shall be Lead Acid Plante type and shall be sized for an hour of full load operation. Lead Acid Plante batteries shall conform to IS: 1652:1991/equivalent standards.

**C.2** Bidder shall furnish battery sizing calculations, supporting curves/data etc. with the proposal to demonstrate to BHEL/KPCL/Tractebel that the proposed battery capacity meets the above specification requirements at maximum temperature as well as minimum ambient temperature condition of 4°C.

**C.3** Cells shall be Lead Acid Plante, sealed type assembled in heat resistance; shock absorbent, explosion-proof, hard rubber type containers with cover fused or cemented in place to form a permanent leak-proof seal. Each cover shall be fitted with vent plugs.

**C.4** The plate structure shall be provided with adequate separators, suspensions and supports so that all plates are permanently aligned and protected from breakage.

**C.5** Sufficient sediment space shall be provided below the plates to eliminate the necessity of sediment removal during normal battery life.

**C.6** Each cell container shall be clearly marked for low and high electrolyte level limits on all four sides.

**C.7** Vent plug shall be of such a design to allow escape of gases but not of acid spray and shall be explosion proof.

**C.8** All cell terminals shall have adequate current carrying capacity and shall be lead alloy or approved equal material.

**C.9** Cell terminals posts shall be suitable for bolted connection and shall be equipped with complete connector bolts and nuts. Cell posts shall be sealed against creepage of electrolyte either by burned ring seals or by lead alloy seal nuts or equivalent.

**C.10** Racks shall be of seismically qualified good quality battery stand and construction in accordance with applicable codes and standards. AISC specification shall apply in the absence of another applicable design specification.

**C.11** Each cell shall be assigned an identification number. Identification numbers shall be clearly and permanently marked on the front of the rack structure so that individual cells are easily identifiable. In addition, the polarity markers shall be furnished for the end cells.

**C.12** The UPS Battery shall have sufficient amp-hour capacity to supply 100% full load current of UPS for 60 minutes. For this, the UPS capacity to be considered as the finally selected UPS rating, irrespective of the actual load on UPS. A drop of 4V from battery room to inverter input shall be considered for design.

## Typical Battery sizing calculation:

UPS full load considered = 130 kVA at 50 deg C.

***Options shall be provided for next higher rating also.***

Max. Output load on UPS in watts = 130 x 1000 x 0.8 (P.F)

= 104000 Watts

Inverter efficiency = „**A**“ say
Type of Battery and Back up Time required = Lead Acid Plante, 1 hour at full load.
End cell voltage (ECV) = 1.85 Volts/cell.
Number of cells = „**B**“ say
Ageing factor = 1.0 (Ageing Factor Not applicable for Lead Acid Plante Battery as per IEEE 485 standard)
Design Margin = 1.15

Temperature correction factor (at 4 deg. C. based on IEEE 485 standard) = „**C**“ say

Capacity Factor at ECV of 1.85V for 1 Hr. Back-up, K = „**D**“ say

Then Battery Discharge Current required $= \dfrac{104000}{1.85 \times \mathbf{A} \times \mathbf{B}}$ = „**E**“ say

AH required = „**E’** x „**D**“ = „**F’** say

Total Discharge Current considering the factors such as temperature correction factor, design margin & ageing factor is

= „**F**“ x „**C**“ 1.15 x 1.0 = „**Z**“ say

Battery AH to an End Cell Voltage of 1.85V/cell and suiting the above discharge current = „**Y’** say

Hence, Battery selected = **‘B’ cells of ‘Y’ AH which can deliver ‘Z’ for 1 Hr. back-up at ECV=1.85V**

**Note:** Inverter efficiency is to be taken as 90% and 91% with 180 cells in two separate options to be offered for Batteries.

# ANNEXURE-II

*Each battery shall be complete including the following equipment and material:*

**01** Hydrometer - 5 Nos.

02 Set of Hydrometer Syringes suitable for the vent holes in different cells - 5 Nos.

03 Thermometer for measuring electrolyte temperature - 5 Nos.

04 Specific Gravity Correction Chart - 5 Nos.

05 Wall mounting type holder made of teak wood for hydrometer & thermometer - 5 Nos.

**06** Cell Testing Voltmeter (3-0-3 V) - 5 Nos.

**07** Alkali Mixing Jar - 5 Nos.

**08** Rubber Apron - 5 Nos

**09** Pair of Rubber Gloves - 5 Nos

10 Set of Spanners - 5 Nos

11 No Smoking Notice for 2 Set of Batteries - 2 Nos.

12 Goggles (Industrial) - 5 Nos.

13 Instruction Card - 10 Nos.

14 Minimum and Maximum temperature indicator for 2 Set of Batteries - 1 Set

15 Cell lifting facility - 1 No.

16

PROJECT : SHIRPUR POWER PROJECT (2x150 MW)

CUSTOMER : M/s SINTEX INFRA PROJECT LIMITED

# SPECIFICATION

# FOR

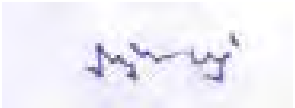
# UNINTERRUPTIBLE POWER SUPPLY SYSTEM(UPS)

## Including UPS BATTERY



REVISION:00

APPROVED



M GURURAJ

| PREPARED | ISSUED | DATE |
|---|---|---|
|  SATHISH | 416 | 30/09/13 |

# CONTENTS

PROJECT : SHIRPUR POWER PROJECT (2x150 MW)

CUSTOMER : M/s SINTEX INFRA PROJECT LIMITED

# SCOPE OF SUPPLY

## SCOPE OF SUPPLY

Following UPS shall be as per Technical Requirement Ref: CE/416/ SHIRPUR/UPS/TR and detailed Scope of Supply.

**A. SHIRPUR POWER PROJECT (2x150 MW)** ⟶ **2 SETS**

120 kVA, Single-phase 0.8 p.f lagging 230V AC, 50Hz parallel redundant UPS guaranteed at 50 deg. C. If any manufacturer doesn't have UPS guaranteed at 50 deg C, the vendor shall offer as per their manufacturing standards at 40/45 deg C with applicable temperature derating.

**B. Each UPS system comprises** ⟶

| | |
|---|---|
| 01. 100% Capacity Static Inverters | 2 Nos. |
| 02. 100% Capacity Static Switches | 2 Sets |
| 03. Manual Bypass Switch. | 1 Set |
| 04. Input Isolation Transformers | 2 Nos. |
| 05. 100% Capacity float cum boost chargers | 2 Nos. |
| 06. UPS Battery (Lead Acid Plante Battery with accessories for 1 hr. duty cycle at 100 % load) | 2 Sets * |
| 06. Step down transformer 415V, 3 Ph. to 230V, 1 Ph. | 1 No. |
| 07. Servo Controlled Voltage Stabilizer. | 1 No. |
| 08. AC power Distribution boards | 2 Nos. |
| 09. Battery isolation box(housed in UPS panel) | 1 Set |
| 10. Accessories of UPS system, in line with specification including suitable interconnection cables. | 1 Set |

**Note:** The interconnection cables shall be from Battery to UPS, between UPS, between UPS to ACDB (to be offered on per meter basis). The cable quantity from Battery to UPS shall be 50 meters per run and from UPS to ACDB shall be 25 metres per run.

MODBUS cable of 100 meters per run is to be provided per charger / inverter combination for DCS connection. Therefore since each UPS system has redundant charger/inverter, this cable shall be 200 mtrs under each UPS system.

** Battery being procured by BHEL separately.*

C. **Erection supervision, complete commissioning & handing over.** ⟶ 2 Sets

1.1.0 **COMMISSIONING SPARES: (Common for the complete project)**

| S.NO | ITEM | QUANTITY(Nos) |
|---|---|---|
| 01) | Transistor each type & rating | 2 |
| 02) | SCR Charger & Static Switch each type & rating | 2 |
| 03) | Fuses each type & rating as used in UPS (no fuses to be offered of ACDB) | 5 |
| 04) | PCB'S/electronics cards/modules catering to following:- | |
| a) | Controller each type | 1 |
| b) | Pulse + RC – Rectifier | 1 |
| c) | Pulse + RC – Static Switch | 1 |

1.2.0 **MANDATORY SPARES: (Common for the complete project)**

| S.NO | ITEM | QUANTITY(Nos) |
|---|---|---|
| 01) | Fuses of each type and rating | 5 Nos |
| 02) | MCB of each type and rating | 5 Nos |
| 03) | Terminals of each type | 50 Nos |
| 04) | 50 meters wire of each type used in wiring and Male /Female connectors of prefabricated cables | 6 Nos of each type |
| 05) | All the PCB/cards | 2 Nos |
| 06) | Push Buttons | 2 Nos |
| 07) | Lamps/LED's | 2 Nos |
| 08) | Meters/Indicators of each type | 1 No |
| 09) | Cooling Fan/Blower | 1 No |

1.3.0 In addition to above spare miscellaneous parts for inverters, chargers, distribution panels batteries, etc., shall be furnished in accordance with manufacturer's standards. Bidder shall indicate list of such spares in his offer under miscellaneous spares.

2.0 GENERAL TERMS & CONDITIONS

2.1 Since the projects, are bunched together based on commonality of some aspects such as specifications, vendors, customers, etc., will be technically evaluated as a package, the participating vendors should quote for all the items.

2.2 Considering possibilities of change in requirement i.e. increase/decrease of loads & feeder quantities for individual project feeder list after system design finalization at a later date, the vendor must clearly quote for the UPS model with the most suitable kVA rating, next three higher kVA rating ones and next three lower kVA rating ones in the same offer as per manufacturer catalog. If any vendor does not have the mentioned UPS rating, still the vendor is eligible for offering as the rating may get reduced during detailed engineering.

2.3 As battery is to be sized after the finalization of UPS kVA rating, the vendor shall quote for all the mentioned loads in the typical battery sizing calculation sheet.

2.4 Similarly, the vendor must clearly quote for unit price as well as lot price for all the selected UPS & UPS battery models including accessories, commissioning spares and cables (for UPS System only) for indisputable calculations of lot prices in case of revised quantities later.

2.5 The type tests are as listed as part of the specification & if the type tests are not specifically conducted, then same are to be offered with unit rates in offer. However, in either case, the type tests are to be submitted for BHEL/ Customer approval in case of order.

3.0 GENERAL TECHNICAL REQUIREMENTS

3.1 The output voltage, current and frequency transducers (4-20mA DC) are to be provided (total 6 numbers) per UPS system as a standard for remote monitoring. Apart from this, transducers related to input voltage and current at charger limbs and SCVS are to be provided (total 6 Nos. per UPS). All these transducers are remote monitoring wired to UPS. All above analog signals are apart from Binary potential free contacts provided as meaningful information to DCS.

3.2 Only the site-proven & type tested (in the last 4 years), electronic modules (in case of UPS System) & cell plates (in case of UPS Battery) will be acceptable unless otherwise decided by the purchaser in special circumstances.

3.3 For UPS, the type test shall be as per IEC-146, Degree of Protection test as per IS-2147 and the same are not to be specifically conducted for the projects if conducted on similar type/rating or similar type/ higher rating UPS.

3.4 Routine & Acceptance tests shall be done as per relevant standards. Temperature rise test is also to be done 100% for 10-12 hours duration each time (till temperature stabilizes).

3.5 Feeder List details will be provided during detailed engineering. Now, 130 feeders shall be considered per ACDB.

3.6 Considering the fact, separate quotations are being sent for UPS vendors and UPS battery vendors separately. Battery will be sized corresponding to the UPS manufacturer and accordingly UPS & Battery orders will be placed. Battery order will be placed after determining the UPS vendor and UPS rating. However, both UPS and battery vendors have to offer lumpsum unit rates for erection supervision & commissioning of UPS, erection supervision & commissioning of Battery with overall integration of complete system being responsibility of UPS vendor.

3.7 Protection class of all UPS, Voltage Stabilizer shall be IP42 and ACDB panels shall be IP54 as per IS2147 or equivalent standard.

3.8 The paint shade will be finalized during detailed engineering for the cubicle : -

a) Colour of cubicle enclosure exterior and interior.
b) Mounting plate colour.
c) Side plate exterior.
d) Plinth.

3.8 Material Thickness = All sides are 2mm CRCA, Mounting plate 3mm, Gland plate = 3mm. Also please note that panel construction shall be with base/bottom frame of approximate height as 100mm (3mm thick) and anti-vibration pad as 15mm thick-all details as per manufacturer standard.

3.9 Each ACDB shall be provided with Electrolytic grade tinned bus bars as 4 numbers each of suitable capacity. One busbar caters to ACDB body earthing (broughtout by suitable screws), two busbars for Phase and Neutral, One busbar catering to cable shields in ACDB-1 and other busbar for 24V DC zero potential bus bar in ACDB-II. All these busbars will be separately connected to Earth pit/ risers. (Earthing arrangement alongwith cables are not in vendor scope).

4.1. DOCUMENTS TO BE FURNISHED

4.1.0. Following documents shall be furnished to BHEL as a minimum, apart from any other documents required to be submitted as called for elsewhere or as deemed necessary.

4.1.1. Along with the Technical offer: For technical evaluation, vendor must send one (01) set of the following documents in hard copy, without which your offer is liable to be rejected.

01. Single line diagram
02. GA drawings
03. Circuit diagrams
04. Fault co-ordination details
05. Charger/Inverter rating calculation
06. Battery sizing calculation (as per IEEE or Equivalent Standard)
07. Battery curves
08. Technical write-up
09. Technical literature / Catalog of each component

10. Data sheet of complete system/subsystem
11. Wiring diagram/interconnecting arrangement details
12. Complete Bill of Material with make & Model
13. Commissioning spares list.
14. Clause-wise deviation list

NOTE: - Later no explanation on noncompliance or deviation, stated or observed, may be acceptable.

Incomplete offers (without documents / not relevant documents as mentioned above) will be technically rejected without any notice.

4.1.2 After placement of Purchase Order within 1 week: For BHEL/CUSTOMER approval, vendor must send Eight (8) sets of the following documents in hard copy & one (01) CD in soft copy, for each project.

a) All documents Sl. No 01 ~ 13 as above.
b) Interfacing diagram & cable type details used or suggested.
c) Quality Plan format enclosed as part of the specification.

4.1.3. After Type Test but before Inspection : For BHEL/CUSTOMER approval, vendor must send eight (8) Sets of the following documents in hard copy.

01. Type test reports/Certificates as per specification/approved QP

4.1.4. After Inspection but 1 week before dispatch: For BHEL/CUSTOMER approval, vendor must send two (2) sets of the following documents one in hard copy & one in soft copy.

01. Preliminary Instruction /O&M Manual

4.1.5. Along with the materials being dispatched: Vendor must send five (5) sets of the following "As **Built & Approved"** status documents four (4) in hard copies & one (1) in soft copy.

(a) Instruction/O&M Manual
(b) Bill of Material
(c) Data Sheets
(d) Technical literatures/Catalogs
(e) Drawings GA/layout/wiring/interconnection/schematic, etc.)

4.1.6. After despatch of material within 1 week : Vendor must send two ( 2 ) set of the following **"As Built & Approved"** status documents one (1) in hard copy & one (1) in soft copy directly to the project site.

(a) Instruction/O&M Manual

NOTE: One (01) set soft copy of Final document shall also be provided to BHEL. The soft copy shall be in CD-ROM media and shall be compatible with Windows-95/98/NT/2000 with drawing/documents in AutoCad-14/MS-Word/MS-Excel/Acrobat formats. Soft copy to be supplied for datasheet/document/ drawings at approval stage also.

PROJECT : SHIRPUR POWER PROJECT (2x150 MW)

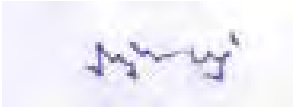
CUSTOMER : M/s SINTEX INFRA PROJECT LIMITED

# TECHNICAL REQUIREMENTS



REVISION:00

APPROVED



M GURURAJ

| PREPARED | ISSUED | DATE |
|---|---|---|
|  SATHISH | 416 | 30/09/13 |

# Uninterruptible Power Supply (UPS) system including UPS Battery



## 1.0 GENERAL REQUIREMENTS

This specification covers the requirement of an Uninterruptible Power Supply (UPS) System comprising of static inverters, static switch, manual bypass switch, chargers, battery banks and DC & AC distribution boards.

The equipment covered under this specification shall meet the requirements of latest edition of all applicable codes and standards like ANSI, NEMA, IEEE, and IEC. NEC & IS. The UPS equipment and the complete system shall have surge withstand capability (SWC) to meet the requirements of ANSI C37. 90a, IEEE Standard 472. The requirements of UPS System are specified herein on system basis. The bidder shall be responsible for engineering and furnishing a complete and operational system fully meeting the intent and requirements of this specification and BHEL/CUSTOMER approved drawings. All equipment and accessories required for completeness of this system shall be furnished by the Bidder within the quoted price whether these are specifically mentioned herein or not.

All non interrupting components of UPS system shall be capable of withstanding all available short circuit currents without damage. Additionally, all circuits interrupting components shall be capable of withstanding and interrupting all encountered short circuit currents without damage.

UPS provided with fuse free circuit breaker shall be preferred. However In case, it is the standard practice of manufacturer to use fast current limiting fuses at inverter output etc. to protect its power semiconductors devices, the same shall be acceptable. However, in AC distribution board either fuse-free circuit breakers shall be employed same shall be of HRC type only. In any case selective fuse( fuse free circuit breaker ) coordination shall be provided by Bidder to ensure that only the fuse (fuse free circuit breaker ) nearest to the fault will open and isolate the faulted circuit. Other branches of the distribution system will be unaffected and the fault will not cause more than one fuse to open . Further it will be the sole responsibility of the UPS supplier to Engineer/design this system keeping in view the basic guideline as indicated elsewhere in specification like selectivity ratios etc.

The selection and selective coordination of all the protecting devices including fuse free circuit breakers / fuses shall conform to the requirements of National Electric Code (NEC) 1984 and other applicable standards. The selectivity ratios of the fuses (fuse free breakers) shall be such that there is a sufficient margin between the total electric energy of the downstream fuse and the total melting energy of the upstream fuse. The selective ratio shall be as finalized during detailed engineering stage but the same shall be not less than 2:1 in any case.

Following general requirements shall be met for ensuring proper branch and circuit protection.

**I.** The feeder fuse ampere rating and feeder conductor capacity must be at least 100% of the non continuous load plus 125% of the continuous load as calculated per Article 220 (220-10G) of NEC code - 1984. The feeder conductor must be protected by a fuse not greater than the conductor capacity.

**II**. For circuit with transformers requirements for conductor protection articles 230 and 310 of NEC must be observed. If secondary fuse protection is not provided then the primary fuses must not be sized larger than 125% of the transformer primary full-load amperes.

If secondary fuses are sized not greater than 125% of transformer secondary current, individual transformer fuses are not required in the primary provided the primary feeder fuses are not larger than 250% of the transformer rated primary current.

The UPS system shall have 2x100% parallel redundant chargers and inverters. 2x100% battery bank, bypass line transformers and voltage stabilizer, static switch, manual bypass switch, AC/DC distribution boards, other necessary protective devices and accessories and shall meet the following requirements as a minimum.

**1.1** The KVA rating of UPS arrived at shall be guaranteed at 50°c ambient. If UPS KVA rating is applicable at a lower ambient temperature than specified 50°C the bidder shall consider a derating factor of at least 1.5% / °C for arriving at the specified UPS capacity at applicable ambient temperature. The UPS shall have an over load capacity of 125% rated capacity for 10 minutes and 150% rating capacity for 10 seconds. The inverter shall have sufficient $I^2t$ capability to clear fault in the maximum rated branch circuit limited to 12 percent of finally selected UPS capacity. The sizing of UPS shall be based on the power factor of loads being led subject to maximum of 0.8.

In case the calculated UPS rating above is not same as one of the standard KVA ratings of the UPS manufacturer (indicated in printed catalogue), the next higher standard KVA rating of the manufacturer shall be selected and provided. Bidder may specifically note that UPS of manufacturer's non-standard rating shall not be acceptable.

**2.0** Each of the redundant chargers & batteries shall meet the specification requirements are as follows :

**2.1** Float cum boost chargers

**2.1.1** Each of the two sets of 2X100% redundant chargers shall be sized to meet the 100 % load requirements of the control system plus recharge the fully discharged battery within 8 Hours.

The chargers shall be self regulating, solid state silicon controlled, full - wave rectifier type designed for single and parallel operation with battery and shall have automatic voltage regulators for a close voltage stability even when AC supply voltage and DC load fluctuates, effective current limiting features and filters on both input and output to minimize harmonics. The charger output regulation shall be ±1% from no load to full load with an input power supply variation of ±10 % in voltage and ±5 % in frequency. In addition to alarms on charger panel, potential free contacts for alarms like charger O/P voltage high etc. shall also be provided for use in DDCMIS. Further isolated 4-20mA signals shall be provided for important parameters like charger voltage etc.

**2.1.2** The Bidder shall furnish the charger rating calculations to the BHEL/ SHIRPUR to satisfy that this requirement is met. The charger shall be furnished as per rating approved by the BHEL/ SHIRPUR during engineering stage without any price repercussions whatsoever. Typical calculation for sizing the capacity of the chargers to be followed by the Bidder is enclosed as part of the specification and the Bidder must adhere to the same strictly while sizing the capacity of the chargers to be offered by him.

**2.1.3** The chargers shall be served from a 415V, 50 Hz, 3 phase 3 wire system. The chargers shall maintain the output voltage within ± 1.0 % from no load to full load with an input power supply deviation in voltage level of ±10% and input power supply deviation in frequency of ±5% and with both deviations present in any combination.

**2.1.4** In addition to supply DC power for inverters, the chargers shall be designed to charge a fully discharged battery without causing interrupting operation of AC or DC circuit breakers for the entire range of intended operating regimes. Suitable solid state electronic circuits shall be provided to ensure that the charging current is voltage regulated and current limited. After the battery is recharged the charger shall maintain the battery at full charge until the next emergency operation when the UPS battery is again required to provide DC power.

**2.1.5** Float and equalizing controls shall have an adjustment range of 5% continuous (without steps).

**2.1.6** The charger shall be current limited at 125% of full load to reduce output stage for charger circuit protection and for protection of battery from overcharge. The current limit shall be continuously adjustable from 80% to 125%.

**2.1.7** Suitable devices/hardware shall be provided to alarm charger output voltage higher than adjustable present limit. Further, charger shall be tripped automatically on charger output voltage high-high (adjustable). This aspect shall be further discussed during detailed engineering.

**2.1.8** All necessary equipment and devices shall be provided to protect the charger from short circuits, transient voltage surges and load and supply fluctuations including sudden loss of input or load.

**2.1.9** The charger shall have a slow walk-in circuit which shall prevent application of full load DC current in less than 10 seconds after AC power is energized.

2.1.10 The minimum full load efficiency at nominal input and float output shall be 90%. The output regulation, ripple content and power factor shall meet the requirements of UPS system as well as the inverter furnished by the Bidder as specified above.

**2.2.0** BATTERY CHARGER AUXILIARY EQUIPMENT

In addition to the battery charger specified herein, auxiliary equipment shall be furnished with each charger as follows :

**2.2.1** Equipment and materials furnished, mounted and wired on the front panel of the charger enclosures:-

| ITEM | QUANTITY |
|---|---|
| a) AC voltmeter, indicating at input with required scale range and 2%accuracy | 1 No. |
| b) DC voltmeter, indicating output with required scale range and 2%accuracy | 1 No. |
| c) DC Ammeter, indicating output Amperes with required scale range and 2% accuracy | 1 No. |
| d) Charger ON-OFF push buttons | 2 Nos. |
| e) Potentiometers, one "Float voltage adjust" and" one Equalizing voltage adjust " both with manual adjustment knobs. The settings of these knobs shall be independent of each other. | 2 Nos. |
| f) Selector switch of selecting " float charge " or "Equalizing charge " | 1 No. |
| g) Charging rate setter | 1 No. |
| h) Selector switch & lights for ground fault detector | 1 Set |
| i) Equalizing charge timer(0-72 hrs.) with manual reset | 1 No. |

**2.2.2** Indicating light listed below with proper actuating devices, circuitry and legend shall be furnished on the front of UPS panels. One set of electrically independent potential free contacts shall be wired to the "Integrated Distributed Digital Control Monitoring and Information System". The following indications shall be furnished as minimum :-

a) Failure of input AC supply to the charger.
b) Charger failure.
c) Charger fuse blown.
d) System on battery operation.
e) Battery equalize timer “ON ".
f) Low battery voltage.
g) Low DC bus voltage.
h) DC ground fault.
i) Charger output voltage high and high-high.
j) Redundant fan failure and temperature high (as provided).

**3.0** BATTERIES

**3.1.0** The batteries shall be heavy duty lead acid Plante type and shall be sized for an hour of full load operation. Lead Acid Plante batteries sizng shall conform to IEEE 485 including Temperature correction factor. For further details, refer Typical Battery sizing calculation format attached.

**3.1.1** Bidder shall furnish battery sizing calculations, supporting curves/data etc. with the proposal to demonstrate to BHEL/ SHIRPUR that the proposed battery capacity meets the above specification requirements at maximum temperature as well as minimum ambient temperature condition of 4°C.

**3.1.2** The plate structure shall be provided with adequate separators, suspensions and supports so that all plates are permanently aligned and protected from breakage.

**3.1.3** Sufficient sediment space shall be provided below the plates to eliminate the necessity of sediment removal during normal battery life.

**3.1.4** Each cell container shall be clearly marked for low and high electrolyte level limits on all four sides.

**3.1.5** All cell terminals shall have adequate current carrying capacity and shall be lead alloy or approved equal material.

**3.1.6** Cell terminals posts shall be suitable for bolted connection and shall be equipped with complete connector bolts and nuts. Cell posts shall be sealed against creepage of electrolyte either by burned ring seals or by lead alloy seal nuts or equivalent.

**3.1.7** Cells shall be arranged on two step battery rack so that the edges of the plate are conveniently visible.

**3.1.8** Battery racks shall be Mild Steel Stand/Teak Wood (Both options has to be offered) and painted with 3 coats of anti-acid paint in accordance with applicable codes and standards shall be provided.

**3.1.9** Each cell shall be assigned an identification number. Identification numbers shall be clearly and permanently marked on the front of the rack structure so that individual cells are easily identifiable. In addition, the polarity markers shall be furnished for the end cells.

3.1.10 The UPS Battery shall have sufficient amp-hour capacity to supply 100% full load current of UPS for 60 minutes. For this, the UPS capacity to be considered as the finally selected UPS rating, irrespective of the actual load on UPS. A drop of 4V from battery room to inverter input shall be considered for design.

3.2.0 BATTERY ACCESSORIES

Each battery shall be complete including the following equipment and material:

**01** Hydrometer - 5 Nos.

02 Set of Hydrometer Syringes suitable for the vent holes in different cells - 5 Nos.

03 Thermometer for measuring electrolyte temperature - 5 Nos.

04 Specific Gravity Correction Chart - 5 Nos.

05 Wall mounting type holder made of teak wood for hydrometer & thermometer - 5 Nos.

**06** Cell Testing Voltmeter (3-0-3 V) - 5 Nos.

**07** Alkali Mixing Jar - 5 Nos.

**08** Rubber Apron - 5 Nos

**09** Pair of Rubber Gloves - 5 Nos

10 Set of Spanners - 5 Nos

11 No Smoking Notice for 2 Set of Batteries - 2 Nos.

12 Goggles (Industrial) - 5 Nos.

13 Instruction Card - 10 Nos.

14 Minimum and Maximum temperature indicator for 2 Set of Batteries - 1 Set

15 Cell lifting facility - 1 No.

NOTE:

1.) Accessories for Lead Acid Plante battery shall be offered as per above which are subject to BHEL/Customer approval.

2.) Suitable termination with isolation/ACDB shall be provided at battery set output for proper isolation of battery set at battery end. This Battery isolating switch shall be wall-mounting type in IP55 enclosure.

**4.0** The UPS system shall be capable of operating without DC battery in circuit under all conditions of load and the performance of various components of UPS like inverter, charger, static switch etc. shall be guaranteed without the battery in circuit.

**4.1** The UPS system design shall ensure that in case of failure of line input power supply to one of the chargers, the other charger whose mains input power supply is healthy, shall feed to one or both the inverters as the case may be as per manufacturer's standard practice & continue to charge the DC battery at all load conditions. The bidder should note that this situation should not in any way lead to the discharge of the DC Battery.

**4.2** Both the inverters/chargers shall not be housed in single cubicle. One inverter one charger can be housed in one common cubicle i.e. there will be two such cubicles per UPS system if the same is standard and proven practice of the bidder.

5.0 STATIC INVERTER

**i**. The static inverter shall be solid state type using proven pulse width modulation (PWM) / Quasi square wave /step wave technique. Ferro resonant type inverters are not acceptable. The static inverter equipment shall include all necessary circuitry and devices to confirm to requirements like voltage regulation, current limiting, wave shaping, transient recovery, automatic synchronization, etc. The steady state voltage regulation shall be ± 2 % and transient voltage regulation (on application / Removal of 100 % load ) shall be ± 20% Time to recover from transient to normal voltage shall not be more than 50 msec. Frequency regulation for all conditions of input supplies, loads and temperature occurring simultaneously or in any combination shall be better than 0.5% (automatically controlled ). The total harmonic content shall be 5% maximum and content of any single harmonic shall be 3% maximum. The inverter efficiency shall be atleast 85 % on full load and 80 % on 50% load. The synchronization limit for maintenance of synchronization between the inverter and stand by AC source shall be 47.5-51.5 Hz, field adjustable in steps of 0.5 Hz. Each inverter shall have an overload capacity of 125% rated capacity for 10 minutes and 150% rated capacity for 60 seconds and 300% for 4 msecs.

**ii** OVER LOAD, SHORT CIRCUIT AND LOAD LOSS

The inverter shall be provided with suitable HRC fuses at the input and output which will permit proper coordination with other protective devices and at the same time protect the inverter against damage due to internal faults. However, if the bidder's system design does not use fuses then the fuse free circuit breaker may also be permitted provided it meets the specification requirements. All necessary equipment shall be provided to protect the inverter against overload, short circuit & 100 % loss of load. The inverter shall be self protecting against damage if energized with full load connected.

**iii** Inverter equipment shall include all solid state circuitry and devices including stable oscillator etc to enable inverters to operate satisfactorily in parallel sharing mode each inverter taking 50 % load during normal operation.

In case of failure of either inverter, 100% load shall automatically be transferred to healthy inverter without any break and degradation in the quality of UPS output and disconnecting the faulty inverter automatically.

**iv** The inverter failure shall be alarmed and the healthy inverter shall get synchronizing signal from the standby AC source and remain synchronized within the set limits. The limits for the synchronization between healthy inverter and standby AC source shall be field adjustable.

**v** On failure of both inverters, the loads shall be transferred to standby AC power without a break if within synchronization limits. Provision of asynchronous transfer with a break in case of inverter being out of synchronization limits shall also be there with standby source.

**6.**0 Static Switch and Manual bypass switch: The static switch shall be provided to perform the function of transferring UPS loads automatically without any break from

(i) faulty inverter to healthy inverter in case of failure of one of the inverter and
(ii) from faulty inverter to stand by AC source in case of failure of both inverter.

Manual bypass switch shall be employed for isolating the UPS during maintenance

Continuous and overload capacity of the switches shall be equal to 100% of the continuous and overload rating of each inverter. Peak capacity shall be 1000% of continuous rating for 5 cycles.

7.0 STEP DOWN TRANSFORMER & VOLTAGE STABILIZER

**7.1** The transformer shall be of low impedance type and the rating shall be such that extremely fast fault clearance is achieved even in the largest rated branch circuit. The overload capacity of the transformer / stabilizer shall not be less than 300% for 200 ms. The voltage stabilizer shall employ state of art control circuitry and shall maintain the specified output voltage for 0-100% load with maximum input voltage variations as indicated above. The efficiency of the stabilizer shall be 95% or better. The stabilizer shall be servo controlled voltage stabilizer.

**7.2** AUXILIARY EQUIPMENT

All required auxiliary equipment / materials as finalized during detailed engineering shall be furnished with each charger / inverter / battery bank and shall include as a minimum various meters (AC / DC voltage / current, KVA, power factor, frequency meters etc., circuit breakers, selector switches, push buttons, indicating lights/ Lamps ground detector system) battery accessories like ( inter cell connectors, inter step connectors battery racks etc ) further, isolated 4 -20mA signals for important parameters and potential free contacts for important alarms shall be provided for use in DDCMIS.

**7.3 Each** inverter 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 each inverter on the input as well as the output side by means of DC and AC MCCBs.

**7.4** Indicating lights listed below with proper actuating devices, circuitry and legend shall be furnished on front of UPS panels. For these abnormal conditions which could be of a momentary nature, the indicating lights shall remain energized and the Contact remain closed until cleared by a reset push button furnished on the panel. The indicating lights shall be of make subject to BHEL/ SHIRPUR approval. The following indications shall be provided as a minimum.

a) DC voltage to the inverter : Low
b) DC voltage to the inverter : High
c) DC input loss to the inverter : High
d) Inverter A output voltage : High
e) Inverter B output voltage : High
Avoid unnecessary alarm due to low voltage on load in rush etc).
f) Inverter A output voltage low. - With a time delay.
g) Inverter B output voltage low. - With a time delay.
h) Inverter A failure.
i) Inverter B failure.
j) Inverter fuse failure.
k) Redundant fan failure and temperature high (if provided)
l) Standby AC source failure
m) Inverter A/Inverter B not synchronized with stand-by AC source in case of failure of inverter B/inverter A respectively.
n) Automatic transfer to stand by AC source & Inverter A/Inverter B feeding 100% UPS load.
o) Stand by source feeding 100% UPS loads.
p) Inverter A overload Trip.
q) Inverter B overload Trip.

**7.5** In addition to the above lamps one potential free change over contact shall be made available (wired up to the terminal block) for each of the above conditions to be connected to other systems.

**7.6** The following meters shall be provided as minimum, mounted on front of inverter panels for each inverter :-

i) DC input voltmeter.
ii) DC input Ammeter.
iii) AC output voltmeter.
iv) AC output Ammeter.
v) Frequency meter.
vi) Output KVA meter.
vii) Power factor meter.

**7.7** The above listed instruments shall be of ± 1% accuracy class. Inverter ON/OFF switch & Alarm reset Push Button shall also be provided for each inverter.

**7.**8 Bidder shall furnish the power supply distribution scheme, single line diagram, all calculation such as charger/inverter rating calculations, battery sizing calculation etc. during offer stage itself and during detailed engineering stage for owner's review and approval.

**7.9** ACDB

**7.9.1** AC distribution panel of CRCA sheet steel construction shall be supplied for 2 wire AC single phase distribution with a solid neutral bar.

**7.9.2** The phase and neutral bars shall be of copper.

**7.9.3** Rating of the main lugs shall be equal to the rated continuous full load current of each inverter.

**7.9.4** The panel boards shall be rated for 600V AC. All outgoing switches shall be load breaker, air break type provided with quick make breaker manual operating mechanism.

**7.9.5** Each UPS load shall be fed from redundant feeder from AC distribution board “A” and other AC distribution board “B " ie all the UPS loads shall be fed from both the distribution boards A & B. Each AC distribution panel board shall have all the required HRC slow acting fuses, switches and other devices. The exact nos and rating etc. of HRC slow acting fuses, switches shall be as finalized during detailed engineering without any price repercussions. BHEL/ SHIRPUR decision shall be final in case there is any disagreement in Bidder's opinion and BHEL/ SHIRPUR view.

**7.9.6** Each ACDB shall be provided with electrolytic grade tinned busbars as 3 numbers each of suitable capacity. One busbar caters to ACDB body earthing (broughtout by suitable screws), another to cable shields and third one is for zero potential busbar. All these busbars will be separately connected to Earth pit/risers (Earthing arrangement alongwith cables are not in vendor scope). Neutral of both ACDBs shall also be terminated to Earthpit.

**7.10** TESTS ON UPS SYSTEM

**7.10.1** Burning test on PCBs – Assembled PCBs shall be tested at 70 deg C for 72 hours in loaded condition.

.

**7.10.2** Rapid Temperature cycling test at 70 deg C and 0 deg C for 30 minutes at each temperature - 5 such cycles.

**7.10.3** Functional tests to demonstrate compliance with all specified requirements & published. Specifications such as frequency regulation, voltage regulation, current limiting, fuse clearing capability of inverters, demonstration of phase and frequency control of inverter for synchronization with range of adjustments transfer and retransfer of static switches under influence of under voltage and over current, tests on chargers, batteries and other system component to confirm compliance with specification.

**8.0** Factory Tests:

**8.1** The complete UPS system, including all instruments and devices shall be subjected to standard factory tests (i.e. Type Tests and Routine Tests) as per IS, NEMA, IEEE, IEC-146 standards wherever applicable.

**8.2** The following Factory Acceptance tests shall be conducted as a minimum requirement as per IEC-146 Standard.

i) Output Voltage & Frequency Tolerance (IEC 146-2)
ii) Input Voltage variation test (Approved Procedure)
iii) Current limiting test.
iv) Transfer time test.
v) Short circuit current capability test. (IEC 146-4-Clause 5.10)
vi) Power Efficiency test. (IEC 146-2, IEC 146) at 100% load, 50% load
vii) Transient response test.
viii) Meter accuracy test.
ix) Relative Harmonic content measuring test.(IEC -146.2)
x) Temp. Rise Test without redundant fans (IEC-146.2).
xi) Restart Test (IEC 146-2)
xii) Voltage Current Division (IEC 146-2).
xiii) Load Test (Approved Procedure)- Load Regulation Test
xiv) Audible Noise Test. (IEC 146-2)
xv) Synchronous Transfer & Synchronization Test. (IEC 146-4)
xvi) Radio Frequency Interference.
xvi) Parallel Redundancy Test (Simulation of Parallel Redundant Fault (IEC-146.4)).
xvii) Checklist of Auxiliary Devices.
xix) Insulation Test (IEC 146)
xx) Fuse Clearing Capability (Approved Procedure)
xxi) Overload Test on Inverter & Charger (Approved Procedure)
Also refer scope of supply.

8.3 BATTERY CHARGER

a) Short circuit current capability test. (IEC 146-2)
b) Temp. Rise Test without redundant fans (IEC-146.2)
c) SWC Test ( Approved Procedure)
d) Efficiency/PF Test (IEC 146-2, IEC 146)
e) Audible Noise Test (IEC 146-2)
f) Fuse Clearing Capability (Approved Procedure)
g) Relative Harmonic content (Approved Procedure)
h) Overload Test on charger (Approved Procedure)
i) Restart Test (IEC 146-2)
j) Output Voltage Tolerance (Approved Procedure)
k) Output Voltage Harmonic Content (Approved Procedure)

The above tests covered under Clause No. 8.2, 8.3 will be witnessed by Customer/Customer Representative

8.4 TYPE TEST

The following type tests shall be conducted at National/International Laboratories only.

a) IP degree
b) Surge Withstand Capability (SWC)
c) Dry Heat Test (IEC-68.2.2)
d) Dump Heat Test (IEC-68.2.3)
e) Vibration Test (IEC 68.2.8)
f) EMC Test (IEC-61000.4.2)

8.5 SITE TESTS

The Contractor shall also carry out the site tests on equipments/systems as specified below. However, these shall not be limited to this specification only and in case any other site test is required to be conducted as a standard practice of BHEL or deemed necessary by the Employer and mutually agreed between BHEL and SHIRPUR, the same shall also be carried out. Full load Test shall be demonstrated after commissioning of UPS and Charger with batteries at site for 72 hours.

Uninterruptible Power Supply System

Functional Test

On completion of installation and commissioning of the equipment the following tests/checks shall be carried out with the maximum available load, which does not exceed the rated continuous load. These tests/checks shall include but not limited to the tests as indicated below. The details of the tests are as indicated below:

1. Light Load Test

This test is carried out to verify that the UPS is correctly connected and all functions operate properly. The load applied is limited to some percent of rated value. The following points should be checked:

(a)Output voltage, frequency and the correct operation of meters;
(b)Operation of all control switches and other means to put units into operation.
(c)Functioning of protective and warning devices.
(d)Operation of remote signaling and remote control devices.

2. Checking of Auxiliary Devices

The functioning of auxiliary devices, such as lighting, cooling, pumps, fans annunciation, etc., should be checked, if convenient, in conjunction with the preliminary light load test.

3. Synchronization Test

If possible, frequency variation limits should be tested by use of a variable frequency generator, otherwise, by simulation of control circuit conditions. Applicable rate of change of frequency during synchronization shall be measured.

4. A. C_ Input Failure Test

The test is performed with a fully charged battery and is carried out by tripping input circuit breakers or may be simulated by switching off all UPS rectifiers and bypass feeder as at the same time. Output voltage variations are to be checked for specified limits with an oscilloscope or equivalent. Frequency variation is defined as the steady state frequency of the UPS with and without AC input. The rate of change of frequency is measured by the time it takes to reach steady-state values.

5. A. C Input Return Test

AC input return test is performed by closing AC input circuit breakers, or is simulated by energizing rectifiers and bypass feeders.

Proper operation of rectifier starting and voltage and frequency variations are to be observed.

Note: This test is normally performed with a fully of partially charged battery.

6. Simulation of Parallel Redundant UPS Fault

This test is applicable for UPS with parallel redundant connections. Faults of rectifier or inverter units may be carried out by simulation. Output transients are to be observed.

7. Transfer Test

This test is applicable for UPS with bypass, particularly in the case of an electronic bypass switch. Transients shall be measured during load transfer to bypass caused by a simulated fault and load retransfer after clearing of the fault.

8. Full load test

Load tests are performed by connecting the actual load to the UPS output. Large UPS in parallel connection may be load tested by testing the individual UPS units separately. Load tests are necessary for testing output voltage and frequency, rated stored energy, recharge time, ventilation, temperature rise and determination of efficiency. Load tests are performed to prove, transient voltage deviations specified under step load conditions.

9. Efficiency

Efficiency should be determined by the measurement of the active power at input and output.

10. Actual Load Test

Conditions under actual load may differ from those with a dummy load Steady-state generation of current and voltage harmonics and transients a load switching conditions should be observed.

11. Current Division in Parallel -

Load sharing between the Modular DC power supply rectifier banks & UPE units shall be measured with actual load under conditions of parallel operation.

12. Rated Stored Energy Time (Battery Test)

This test is a load test to prove the actual possible time of battery operation.

If rated load is not available in the case of large UPS, it is possible to, apply a partial load to check the actual battery discharge characteristics and compare these with characteristics specified by the battery manufacturer Discharge time with rated load- shall then be calculated. The test shall be performed with a fully charged battery and also may be done under other battery conditions to be specified, if so agreed. Active power output of the UPS and the battery voltage shall be recorded during the test.

Since new batteries often do not provide full capacity during a starting up period, the discharge test may be repeated after a reasonable recharge time if the original test has failed.

13. Rated Restored Energy Time

Restored energy depends on the charging capacity of the rectifiers and the battery characteristics. If a certain recharging rate is specified, it shall be provided by repeating the discharge test after the specified charging period.

14. Battery Ripple Current

If battery ripple currents are specified, then the ripple current which depends on UPS operation shall be checked under normal operating conditions. Rough measuring methods are sufficient.

**15.** On Site Ventilation Test

The test is performed with the actual load. Temperatures conditions of all UPS cubicles are to be observed.

16. Overload Capability Test

Overload capability test is a load test. Specified values of short time overload or starting up sequences of actual load are to be applied for the time interval specified. Specifed values of voltage and current are to be recorded.

17. Short Circuit Current Capability

If short-circuit current capability is specified, it may be tested by applicable of a short circuit to UPS output if necessary, via suitable fuse, short circuit is to be recorded.

18. Short Circuit Fuse Test

Fuse tripping capability of a UPS shall be tested, by short-circuiting the UPS output via a fuse of specified type.

The test shall be repeated to ensure against fuse non-uniformity and switching time during the cycle. The test is carried out at an appropriate UPS load, under normal operation, if not otherwise specified by Owner.

19. Restart

Automatic or other restart means are to be tested after a completed shut-down of UPS as specified.

20. Output over voltage

Output over voltage protection is to be checked.

21. Periodic Output Voltage Modulation

When this test is specified, it may be checked by voltage recording at different loads and operating conditions.

22. Harmonic Conditions

Harmonic components of output voltage shall be checked with the actual load. Methods of specification and checking shall be subject to Owner's approval.

23. Earth Fault Test

If the UPS output is isolated from earth, then an earth fault can be applied to any output terminal. UPS output transients (if any) shall be measured.

If the battery is isolated from earth, then an earth fault can be applied to any output terminals. UPS output transient (if any) shall be measured.

## 9.0 RELIABILITY & AVAILABILITY:-

Each component and system offered by the Bidder shall be of established reliability. The minimum target reliability of each piece of equipment like each electronic module/card, Power supply, peripherals, etc. shall be established by the Bidder, considering its failure rate / mean time between failures (MTBF), meantime to repair (MTTR), such that the availability of the complete C&I system is assured for 99.7%.

Further the Bidder shall ensure that all equipment/Part of its system shall have normal life expectancy exceeding the expected life of the plant i.e. thirty years.

**9.1** In order to ensure the target reliability the Bidder shall ensure selection of proper materials, control manufacturing process, use quality controlled components and parts, take adequate design margins & derating of electronic components and parts and carry out necessary tests, etc.

**9.2** The equipment shall employ latest state of the art technology to guard against obsolescence. In any case, Bidder shall be required to ensure supply of spare parts for life time of the plant. In case, it is felt by the Bidder that certain equipment/component is likely to become obsolete the bidder shall clearly bring out the same in his offer and indicate steps proposed to deal with such obsolescence.

## **10.0** THERMAL DESIGN OF UPS SYSTEM PANELS

The UPS panels shall be preferably designed for natural cooling and shall be fabricated from not less than 3mm thick sheet steel. When the inverter is in operation the temperature rise in the panel shall not be more than 15 Deg. C above ambient for all operating conditions. All components like transistors, SCRs, ICs, capacitors, resistors etc. Shall be properly chosen and derated such that failure rate is reduced to absolute minimum.

### **10.1** Cooling System

If the equipment supplied requires forced air cooling, the cooling system furnished shall meet the following requirements:

(a) Reserve cooling equipment shall be furnished for each switch board assembly. Reserve fan capacity shall be equal to 100 percent of cooling fan requirements for full load operation at the specified maximum ambient temperature failure of air flow.

(b) Completely independent duplicate wiring and control system shall be provided for the normal cooling fan system the reserve cooling fan system.

(c) Each cooling fan shall normally run continuously and shall be powered from the output of the inverter whose enclosure if serves. Each cooling fan supply circuit shall be separately fused.

(d) Each cooling fan shall be equipped with an air low switch having an alarm contact that closes upon failure of air flow.

*****

PROJECT : SHIRPUR POWER PROJECT (2x150 MW)

CUSTOMER : M/s SINTEX INFRA PROJECT LIMITED

# TYPICAL BATTERY SIZING CALCULATION FOR UPS



REVISION:00

APPROVED

M GURURAJ

| PREPARED | ISSUED | DATE |
|---|---|---|
| SATHISH | 416 | 30/09/13 |

## Typical Battery sizing calculation:

UPS full load considered = 120 kVA at 50 deg C.

***Options shall be provided for 90, 100, 105, 130 & 150 kVA also.***

Max. Output load on UPS in watts = 120 x 1000 x 0.8 (P.F)

= 96000 Watts

Inverter efficiency = '**A**' say
Type of Battery and Back up Time required = Lead Acid Plante, 1 hour at full load.
End cell voltage (ECV) = 1.85 Volts/cell.
Number of cells = '**B**' say
Ageing factor = 1.0 (Ageing Factor Not applicable for Lead Acid Plante Battery as per IEEE standard)
Design Margin = 1.15

Temperature correction factor (at 4 deg. C. based on IEEE 485 standard) = '**C**' say

Capacity Factor at ECV of 1.85V for 1 Hr. Back-up, K = '**D**' say

Then Battery Discharge Current required $= \dfrac{96000}{1.85 \times \mathbf{A} \times \mathbf{B}}$ = '**E**' say

AH required = '**E**' x '**D**' = '**F**' say

Total Discharge Current considering the factors such as temperature correction factor, design margin & ageing factor is

= '**F**' x '**C**' 1.15 x 1.0 = 'Z' say

Battery AH to an End Cell Voltage of 1.85V/cell and suiting the above discharge current = '**Y**' say

Hence, Battery selected = **„B" cells of „Y" "H type Battery" which can deliver „Z" for 1 Hr. back-up at ECV=1.85V**

**Note:** Inverter efficiency is to be taken as 90% and 91% with 180 cells in two separate options to be offered for Batteries.

PROJECT : SHIRPUR POWER PROJECT (2x150 MW)

CUSTOMER : M/s SINTEX INFRA PROJECT LIMITED

# TYPE & ROUTINE ACCEPTANCE TEST



REVISION:00

APPROVED

M GURURAJ

| PREPARED | ISSUED | DATE |
|---|---|---|
| SATHISH | 416 | 30/09/13 |

## TYPE TEST REQUIREMENTS

| | |
|---|---|
| 1.00.00 | **TYPE TEST REQUIREMENTS** |
| 1.01.00 | General Requirements |
| 1.01.01 | The Contractor shall furnish the type test reports of all type tests as per relevant standards and codes as well as other specific tests indicated in this specification. A list of such tests are given for various equipment in table titled 'TYPE TEST REQUIREMENT FOR C&I SYSTEMS' at the end of this chapter and under the item Special Requirement for Solid State Equipments/Systems. For the balance equipment instrument, type tests may be conducted as per manufactures standard or if required by relevant standard.<br><br>(a) Out of the tests listed, the Bidder/ sub-vendor/ manufacturer is required to conduct certain type tests specifically for this contract (and witnessed by Employer or his authorized representative) even if the same had been conducted earlier, as clearly indicated subsequently against such tests.<br><br>(b) For the rest, submission of type test results and certificate shall be acceptable provided.<br><br>i. The same has been carried out by the Bidder/ sub-vendor on exactly the same model /rating of equipment.<br><br>ii. There has been no change in the components from the offered equipment & tested equipment.<br><br>iii. The test has been carried out as per the latest standards alongwith amendments as on the date of Bid opening.<br><br>(c) In case the approved equipment is different from the one on which the type test had been conducted earlier or any of the above grounds, then the tests have to be repeated and the cost of such tests shall be borne by the Bidder/ sub-vendor within the quoted price and no extra cost will be payable by the Employer on this account. |
| 1.01.02 | As mentioned against certain items, the test certificates for some of the items shall be reviewed and approved by the main Bidder or his authorized representative and the balance have to be approved by the Employer. |
| 1.01.03 | The schedule of conduction of type tests/ submission of reports shall be submitted and finalized during pre-award discussion. |
| 1.01.04 | For the type tests to be conducted, Contractor shall submit detailed test procedure for approval by Employer. This shall clearly specify test setup, instruments to be used, procedure, acceptance norms (wherever applicable), recording of different parameters, interval of recording precautions to be taken etc. for the tests to be carried out. |
| 1.01.05 | The Bidder shall indicate in the relevant BPS schedule, the cost of the type test for each item only for which type tests are to be conducted specifically for this project. |

The cost shall only be payable after conduction of the respective type test in presence of authorize representative of Employer. If a test is waived off, then the cost shall not be payable.

**2.00.00 SPECIAL REQUIREMENT FOR SOLID STATE EQUIPMENTS/ SYSTEMS**

2.01.00 The minimum type test reports, over and above the requirements of above clause, which are to be submitted for each of the major C&I systems shall be as indicated below:

i) Surge Withstand Capability ( SWC) for Solid State Equipments/ Systems

All solid state systems/ equipments shall be able to withstand the electrical noise and surges as encountered in actual service conditions and inherent in a power plant. All the solid state systems/ equipments shall be provided with all required protections that needs the surge withstand capability as defined in ANSI 37.90.1/ IEEE-472. Hence, all front end cards which receive external signals like Analog input & output modules, Binary input & output modules etc. including power supply, data highway, data links shall be provided with protections that meets the surge withstand capability as defined in ANSI 37.90.1/ IEEE-472. Complete details of the features incorporated in electronics systems to meet this requirement, the relevant tests carried out, the test certificates etc. shall be submitted along with the proposal. As an alternative to above, suitable class of EN 61000-4-12 which is equivalent to ANSI 37.90.1/ IEEE-472 may also be adopted for SWC test.

ii) Dry Heat test as per IEC-68-2-2 or equivalent.

iii) Damp Heat test as per IEC-68-2-3 or equivalent.

iv) Vibration test as per IEC-68-2-6 or equivalent.

v) Electrostatic discharge tests as per EN 61000-4-2 or equivalent.

vi) Radio frequency immunity test as per EN 61000-4-6 or equivalent.

vii) Electromagnetic Field immunity as per EN 61000-4-3 or equivalent.

Test listed at item no. v, vi, vii, above are applicable for electronic cards only as defined under item (i) above.

| TECHNICAL REQUIREMENTS | | | | | |
|---|---|---|---|---|---|
| *S. NO.* | *ITEM* | *TYPE TEST REQUIREMENT* | *STANDARD* | *TEST TO BE SPECIFICALLY CONDUCTED* | *NTPC'S APPROVAL REQD. ON TEST CERTIFICATE* |
| 1 | Battery | As per Standard | IS-10918 | NO | YES |
| 2 | UPS(Applicable for each model and rating) | Degree of Protection Test | IS-2147 | NO | YES |
| | | Power Efficiency | IEC 146-2, IEC 146 | NO | YES |
| | | Load test | Approved Procedure | YES | YES |
| | | Audible Noise Test | IEC 146- 2 | NO | YES |
| | | Fuse Cleaning Capability | Approved Procedure | YES | YES |
| | | Relative harmonic content | Approved Procedure | NO | YES |
| | | Radio interference | IEC 146 - 4 | NO | YES |
| | | Synchronous transfer test | IEC 146 - 4 | NO | YES |
| | | Temperature rise test without redundant fans | Approved Procedure | NO | YES |
| | | Input voltage variation test | Approved Procedure | NO | YES |
| | | Over load Test | Approved Procedure | NO | YES |
| | | Insulation test | IEC 146 | NO | YES |
| | | Restart Test | IEC 146 - 2 | NO | YES |
| | | Short circuit current capability | IEC 146 - 2 | NO | YES |
| | | Output voltage & frequency Tolerance | IEC 146 - 2 | NO | YES |
| | | Voltage/current Division | IEC 146 - 2 | NO | YES |
| | | Relative Harmonic Content | IEC 146 - 2 | NO | YES |

## QUALITY ASSURANCE

**POWER SUPPLY SYSTEM**

| ITEMS \ TESTS | Visual/dimension/rating/ Paint Adhesion/ Thickness (R) | General arrangement/BOM/make of components /Mimic® | Efficiency ,regulation(R) | Input voltage variation (A) | Out put voltage and frequency adj.range(A) | Premilinary light load test(R) | Load transfer retransfer test (R) * | AC input failure and return test (R) | Parralel operation and current divison(R) | Relative harmonic content(R) | Restart with PRI A.C and battery (separately)(R) | System transfer and retransfer (R)* | Asynchronous transfer(R) | Ripple content(R) | Load limiter operation (R) | IR/HV(R) | Tests as per standard &specification (R)&(A) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **UPS/CONVERTER (IEC-146 PT-4)** | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| **VOLTAGE STABILISER** | Y | Y | Y | Y | Y | | | | | Y | | Y | | | | Y | |
| **LEAD ACID BATTERY(TUBLAR )-IS-1651** | | | | | | | | | | | | | | | | | Y |
| **LEAD ACID BATTERY (PLANTE)-IS-1652** | | | | | | | | | | | | | | | | | Y |
| **NICKEL CADMIUM BATTERY(IS-10918/IEC-623)** | | | | | | | | | | | | | | | | | Y |

R-Routine Test A- Acceptance Test Y – Test applicable

* Transfer time and Over shoot /under shoot during load & system transfer shall be recorded .

Note: 1) **Detailed procedure of Burn-in and Elevated Temperature test shall be as per Quality Assurance Programme in General Technical Conditions**

2) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted alongwith relevant supporting documents.

PROJECT : SHIRPUR POWER PROJECT (2x150 MW)

CUSTOMER : M/s SINTEX INFRA PROJECT LIMITED

# QUALITY PLAN FORMAT



REVISION:00

APPROVED

M GURURAJ

| PREPARED | ISSUED | DATE |
|---|---|---|
| SATHISH | 416 | 30/09/13 |

| Customer<br><br>**NTPC** | Manufacturer's Name & address | MANUFACTURER'S QUALITY PLAN<br>ITEM: | QP no.<br>Rev:<br>Date:<br>Page of | Project:<br>Package:<br>Contract no:<br>Contractor: BHEL, EDN |
|---|---|---|---|---|

| SL No. | Components & Operation | Characteristics | Class | Type Of Check | Quantum Of Check | Reference Document | Acceptance norms | Format of record | Agency | | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | M | | C | N | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D* | ** | 10 | | 11 |
| | | | | | | | | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | |

| | | | |
|---|---|---|---|
| | | LEGEND:<br>* Records identified with v/ shall be essentially included by the contractor in QA documentation.<br>** M: Manufacturer / Sub contractor<br>C: contractor nominated inspection agency<br>N: Customer<br>Indicate " P " – Perform<br>" W " – Witness<br>" V " - Verification | For Customer use / Doc.No. |
| Manufacturer/ Subcontractor | Contractor | | |
| Signature | | | Reviewed By<br>Name & SIGN. Of approving Authority & Seal. |

PROJECT : BELLARY U-3 STG-III (1x700 MW)

CUSTOMER : M/s KPCL

CONSULTANT : M/s TRACTEBEL ENGG PVT LTD.

# SPECIFICATION

# FOR

# UNINTERRUPTIBLE POWER SUPPLY SYSTEM(UPS)

## Including UPS BATTERY



REVISION:00

APPROVED

M GURURAJ

| PREPARED | ISSUED | DATE |
|---|---|---|
| SATHISH | 416 | 31/07/13 |

# CONTENTS

PROJECT : BELLARY U-3 STG-III (1x700 MW)

CUSTOMER : M/s KPCL

CONSULTANT : M/s TRACTEBEL ENGG PVT LTD.

# SCOPE OF SUPPLY

## SCOPE OF SUPPLY

Following UPS shall be as per Technical Requirement Ref: CE/416/BELLARY/UPS/TR and detailed Scope of Supply.

**A. BELLARY (1x500 MW)** ⟶ **1 SET**

130 kVA, Single-phase 0.8 p.f lagging 240V AC, 50Hz parallel redundant UPS guaranteed at 50 deg. C. If any manufacturer doesn't have UPS guaranteed at 50 deg C, the vendor shall offer as per their manufacturing standards at 40/45 deg C with applicable temperature derating.

**B. Each UPS system comprises** ⟶

| | |
|---|---|
| 01. 100% Capacity Static Inverters | 2 Nos. |
| 02. 100% Capacity Static Switches | 2 Sets |
| 03. Manual Bypass Switch. | 1 Set |
| 04. Input Isolation Transformers | 2 Nos. |
| 05. 100% Capacity float cum boost chargers | 2 Nos. |
| 06. UPS Battery (Lead Acid Plante Battery with accessories for 1 hr. duty cycle at 100 % load) | 2 Sets * |
| 06. Step down transformer 415V, 3 Ph. to 240V, 1 Ph. | 1 No. |
| 07. Static Voltage Stabilizer. | 1 No. |
| 08. AC power Distribution boards | 2 Nos. |
| 09. Battery isolation box(housed in UPS panel) | 1 Set |
| 10. Accessories of UPS system, in line with specification including suitable interconnection cables. | 1 Set |

**Note:** The interconnection cables shall be from Battery to UPS, between UPS, between UPS to ACDB (to be offered on per meter basis). The cable quantity from Battery to UPS shall be 100 metres per run and from UPS to ACDB shall be 25 metres per run.

MODBUS cable of 100 meters per run is to be provided per charger / inverter combination for DCS connection. Therefore since each UPS system has redundant charger/inverter, this cable shall be 200 mtrs under each UPS system.

** Battery being procured by BHEL separately.*

C. **Erection supervision, complete commissioning & handing over.** ⟶ 1 Set

1.1.0 **COMMISSIONING SPARES: (Common for the complete project)**

| S.NO | ITEM | QUANTITY(Nos) |
|---|---|---|
| 01) | Transistor each type & rating | 2 |
| 02) | SCR Charger & Static Switch each type & rating | 2 |
| 03) | Fuses each type & rating as used in UPS (no fuses to be offered of ACDB) | 5 |
| 04) | PCB'S/electronics cards/modules catering to following:- | |
| a) | Controller each type | 1 |
| b) | Pulse + RC – Rectifier | 1 |
| c) | Pulse + RC – Static Switch | 1 |

1.3.0 In addition to above spare miscellaneous parts for inverters, chargers, distribution panels batteries, etc., shall be furnished in accordance with manufacturer's standards. Bidder shall indicate list of such spares in his offer under miscellaneous spares.

2.0 GENERAL TERMS & CONDITIONS

2.1 Since the projects, are bunched together based on commonality of some aspects such as specifications, vendors, customers, etc., will be technically evaluated as a package, the participating vendors should quote for all the items.

2.2 Considering possibilities of change in requirement i.e. increase/decrease of loads & feeder quantities for individual project feeder list after system design finalization at a later date, the vendor must clearly quote for the UPS model with the most suitable kVA rating, next three higher kVA rating one in the same offer as per manufacturer catalog. If any vendor does not have the mentioned UPS rating, still the vendor is eligible for offering as the rating may get reduced during detailed engineering.

2.3 As battery is to be sized after the finalization of UPS kVA rating, the vendor shall quote for all the mentioned loads in the typical battery sizing calculation sheet.

2.4 Similarly, the vendor must clearly quote for unit price as well as lot price for all the selected UPS & UPS battery models including accessories, commissioning spares and cables (for UPS System only) for indisputable calculations of lot prices in case of revised quantities later.

2.5 The type tests are as listed as part of the specification & if the type tests are not specifically conducted, then same are to be offered with unit rates in offer. However, in either case, the type tests are to be submitted for BHEL/ Customer approval in case of order.

3.0 GENERAL TECHNICAL REQUIREMENTS

3.1 The output voltage, current and frequency transducers (4-20mA DC) are to be provided (total 6 numbers) per UPS system as a standard for remote monitoring. Apart from this, transducers related to input voltage and current at charger limbs and SCVS are to be provided (total 6 Nos. per UPS). All these transducers are remote monitoring wired to UPS. All above analog signals are apart from Binary potential free contacts provided as meaningful information to DCS.

3.2 Only the site-proven & type tested (in the last 4 years), electronic modules (in case of UPS System) & cell plates (in case of UPS Battery) will be acceptable unless otherwise decided by the purchaser in special circumstances.

3.3 For UPS, the type test shall be as per IEC-146, Degree of Protection test as per IS-2147 and the same are not to be specifically conducted for the projects if conducted on similar type/rating or similar type/ higher rating UPS.

3.4 Routine & Acceptance tests shall be done as per relevant standards. Temperature rise test is also to be done 100% for 10-12 hours duration each time (till temperature stabilizes).

3.5 Feeder List details will be provided during detailed engineering. Now, 130 feeders shall be considered per ACDB.

3.6 Considering the fact, separate quotations are being sent for UPS vendors and UPS battery vendors separately. Battery will be sized corresponding to the UPS manufacturer and accordingly UPS & Battery orders will be placed. Battery order will be placed after determining the UPS vendor and UPS rating. However, both UPS and battery vendors have to offer lumpsum unit rates for erection supervision & commissioning of UPS, erection supervision & commissioning of Battery with overall integration of complete system being responsibility of UPS vendor.

3.7 Protection class of all UPS, Voltage Stabilizer shall be IP42 and ACDB panels shall be IP54 as per IS2147 or equivalent standard.

3.8 The paint shade will be finalized during detailed engineering for the cubicle : -

a) Colour of cubicle enclosure exterior and interior.
b) Mounting plate colour.
c) Side plate exterior.
d) Plinth.

3.8 Material Thickness = All sides are 2mm CRCA, Mounting plate 3mm, Gland plate = 3mm. Also please note that panel construction shall be with base/bottom frame of approximate height as 100mm (3mm thick) and anti-vibration pad as 15mm thick-all details as per manufacturer standard.

3.9 Each ACDB shall be provided with Electrolytic grade tinned bus bars as 4 numbers each of suitable capacity. One busbar caters to ACDB body earthing (broughtout by suitable screws), two busbars for Phase and Neutral, One busbar catering to cable shields in ACDB-1 and other busbar for 24V DC zero potential bus bar in ACDB-II. All these busbars will be separately connected to Earth pit/ risers. (Earthing arrangement alongwith cables are not in vendor scope).

4.1. DOCUMENTS TO BE FURNISHED

4.1.0. Following documents shall be furnished to BHEL as a minimum, apart from any other documents required to be submitted as called for elsewhere or as deemed necessary.

4.1.1. Along with the Technical offer: For technical evaluation, vendor must send one (01) set of the following documents in hard copy, without which your offer is liable to be rejected.

01. Single line diagram
02. GA drawings
03. Circuit diagrams
04. Fault co-ordination details
05. Charger/Inverter rating calculation
06. Battery sizing calculation (as per IEEE or Equivalent Standard)
07. Battery curves
08. Technical write-up
09. Technical literature / Catalog of each component

10. Data sheet of complete system/subsystem
11. Wiring diagram/interconnecting arrangement details
12. Complete Bill of Material with make & Model
13. Commissioning spares list.
14. Clause-wise deviation list

NOTE: - Later no explanation on noncompliance or deviation, stated or observed, may be acceptable.

Incomplete offers (without documents / not relevant documents as mentioned above) will be technically rejected without any notice.

4.1.2 After placement of Purchase Order within 1 week: For BHEL/CUSTOMER approval, vendor must send Eight (8) sets of the following documents in hard copy & one (01) CD in soft copy, for each project.

a) All documents Sl. No 01 ~ 13 as above.
b) Interfacing diagram & cable type details used or suggested.
c) Quality Plan format enclosed as part of the specification.

4.1.3. After Type Test but before Inspection : For BHEL/CUSTOMER approval, vendor must send eight (8) Sets of the following documents in hard copy.

01. Type test reports/Certificates as per specification/approved QP

4.1.4. After Inspection but 1 week before dispatch: For BHEL/CUSTOMER approval, vendor must send two (2) sets of the following documents one in hard copy & one in soft copy.

01. Preliminary Instruction /O&M Manual

4.1.5. Along with the materials being dispatched: Vendor must send five (5) sets of the following "As **Built & Approved"** status documents four (4) in hard copies & one (1) in soft copy.

(a) Instruction/O&M Manual
(b) Bill of Material
(c) Data Sheets
(d) Technical literatures/Catalogs
(e) Drawings GA/layout/wiring/interconnection/schematic, etc.)

4.1.6. After despatch of material within 1 week : Vendor must send two ( 2 ) set of the following **"As Built & Approved"** status documents one (1) in hard copy & one (1) in soft copy directly to the project site.

(a) Instruction/O&M Manual

NOTE: One (01) set soft copy of Final document shall also be provided to BHEL. The soft copy shall be in CD-ROM media and shall be compatible with Windows-95/98/NT/2000 with drawing/documents in AutoCad-14/MS-Word/MS-Excel/Acrobat formats. Soft copy to be supplied for datasheet/document/ drawings at approval stage also.

PROJECT : BELLARY U-3 STG-III (1x700 MW)

CUSTOMER : M/s KPCL

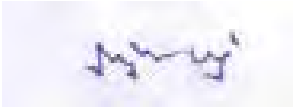
CONSULTANT : M/s TRACTEBEL ENGG PVT LTD.

# TECHNICAL REQUIREMENTS



REVISION:00

APPROVED



M GURURAJ

| PREPARED | ISSUED | DATE |
|---|---|---|
|  SATHISH | 416 | 31/07/13 |

# Uninterruptible Power Supply (UPS) system including UPS Battery

## 1.0 GENERAL REQUIREMENTS

This specification covers the requirement of an Uninterruptible Power Supply (UPS) System comprising of static inverters, static switch, manual bypass switch, chargers, battery banks and DC & AC distribution boards.

The equipment covered under this specification shall meet the requirements of latest edition of all applicable codes and standards like ANSI, NEMA, IEEE, and IEC. NEC & IS. The UPS equipment and the complete system shall have surge withstand capability (SWC) to meet the requirements of ANSI C37. 90a, IEEE Standard 472. The requirements of UPS System are specified herein on system basis. The bidder shall be responsible for engineering and furnishing a complete and operational system fully meeting the intent and requirements of this specification and BHEL/CUSTOMER approved drawings. All equipment and accessories required for completeness of this system shall be furnished by the Bidder within the quoted price whether these are specifically mentioned herein or not.

All non interrupting components of UPS system shall be capable of withstanding all available short circuit currents without damage. Additionally, all circuits interrupting components shall be capable of withstanding and interrupting all encountered short circuit currents without damage.

UPS provided with fuse free circuit breaker shall be preferred. However In case, it is the standard practice of manufacturer to use fast current limiting fuses at inverter output etc. to protect its power semiconductors devices, the same shall be acceptable. However, in AC distribution board either fuse-free circuit breakers shall be employed same shall be of HRC type only. In any case selective fuse( fuse free circuit breaker ) coordination shall be provided by Bidder to ensure that only the fuse (fuse free circuit breaker ) nearest to the fault will open and isolate the faulted circuit. Other branches of the distribution system will be unaffected and the fault will not cause more than one fuse to open . Further it will be the sole responsibility of the UPS supplier to Engineer/design this system keeping in view the basic guideline as indicated elsewhere in specification like selectivity ratios etc.

The selection and selective coordination of all the protecting devices including fuse free circuit breakers / fuses shall conform to the requirements of National Electric Code (NEC) 1984 and other applicable standards. The selectivity ratios of the fuses (fuse free breakers) shall be such that there is a sufficient margin between the total electric energy of the downstream fuse and the total melting energy of the upstream fuse. The selective ratio shall be as finalized during detailed engineering stage but the same shall be not less than 2:1 in any case.

Following general requirements shall be met for ensuring proper branch and circuit protection.

**I.** The feeder fuse ampere rating and feeder conductor capacity must be at least 100% of the non continuous load plus 125% of the continuous load as calculated per Article 220 (220-10G) of NEC code - 1984. The feeder conductor must be protected by a fuse not greater than the conductor capacity.

**II**. For circuit with transformers requirements for conductor protection articles 230 and 310 of NEC must be observed. If secondary fuse protection is not provided then the primary fuses must not be sized larger than 125% of the transformer primary full-load amperes.

If secondary fuses are sized not greater than 125% of transformer secondary current, individual transformer fuses are not required in the primary provided the primary feeder fuses are not larger than 250% of the transformer rated primary current.

The UPS system shall have 2x100% parallel redundant chargers and inverters. 2x100% battery bank, bypass line transformers and voltage stabilizer, static switch, manual bypass switch, AC/DC distribution boards, other necessary protective devices and accessories and shall meet the following requirements as a minimum.

**1.1** The KVA rating of UPS arrived at shall be guaranteed at 50°c ambient. If UPS KVA rating is applicable at a lower ambient temperature than specified 50°C the bidder shall consider a derating factor of at least 1.5% / °C for arriving at the specified UPS capacity at applicable ambient temperature. The UPS shall have an over load capacity of 125% rated capacity for 10 minutes and 150% rating capacity for 10 seconds. The inverter shall have sufficient $I^2t$ capability to clear fault in the maximum rated branch circuit limited to 12 percent of finally selected UPS capacity. The sizing of UPS shall be based on the power factor of loads being led subject to maximum of 0.8.

In case the calculated UPS rating above is not same as one of the standard KVA ratings of the UPS manufacturer (indicated in printed catalogue), the next higher standard KVA rating of the manufacturer shall be selected and provided. Bidder may specifically note that UPS of manufacturer's non-standard rating shall not be acceptable.

**2.0** Each of the redundant chargers & batteries shall meet the specification requirements are as follows :

**2.1** Float cum boost chargers

**2.1.1** Each of the two sets of 2X100% redundant chargers shall be sized to meet the 100 % load requirements of the control system plus recharge the fully discharged battery within 8 Hours.

The chargers shall be self regulating, solid state silicon controlled, full - wave rectifier type designed for single and parallel operation with battery and shall have automatic voltage regulators for a close voltage stability even when AC supply voltage and DC load fluctuates, effective current limiting features and filters on both input and output to minimize harmonics. The charger output regulation shall be ±1% from no load to full load with an input power supply variation of ±10 % in voltage and ±5 % in frequency. In addition to alarms on charger panel, potential free contacts for alarms like charger O/P voltage high etc. shall also be provided for use in DDCMIS. Further isolated 4-20mA signals shall be provided for important parameters like charger voltage etc.

**2.1.2** The Bidder shall furnish the charger rating calculations to the BHEL/BELLARY to satisfy that this requirement is met. The charger shall be furnished as per rating approved by the BHEL/BELLARY during engineering stage without any price repercussions whatsoever. Typical calculation for sizing the capacity of the chargers to be followed by the Bidder is enclosed as part of the specification and the Bidder must adhere to the same strictly while sizing the capacity of the chargers to be offered by him.

**2.1.3** The chargers shall be served from a 415V, 50 Hz, 3 phase 3 wire system. The chargers shall maintain the output voltage within ± 1.0 % from no load to full load with an input power supply deviation in voltage level of ±10% and input power supply deviation in frequency of ±5% and with both deviations present in any combination.

**2.1.4** In addition to supply DC power for inverters, the chargers shall be designed to charge a fully discharged battery without causing interrupting operation of AC or DC circuit breakers for the entire range of intended operating regimes. Suitable solid state electronic circuits shall be provided to ensure that the charging current is voltage regulated and current limited. After the battery is recharged the charger shall maintain the battery at full charge until the next emergency operation when the UPS battery is again required to provide DC power.

**2.1.5** Float and equalizing controls shall have an adjustment range of 5% continuous (without steps).

**2.1.6** The charger shall be current limited at 125% of full load to reduce output stage for charger circuit protection and for protection of battery from overcharge. The current limit shall be continuously adjustable from 80% to 125%.

**2.1.7** Suitable devices/hardware shall be provided to alarm charger output voltage higher than adjustable present limit. Further, charger shall be tripped automatically on charger output voltage high-high (adjustable). This aspect shall be further discussed during detailed engineering.

**2.1.8** All necessary equipment and devices shall be provided to protect the charger from short circuits, transient voltage surges and load and supply fluctuations including sudden loss of input or load.

**2.1.9** The charger shall have a slow walk-in circuit which shall prevent application of full load DC current in less than 10 seconds after AC power is energized.

2.1.10 The minimum full load efficiency at nominal input and float output shall be 90%. The output regulation, ripple content and power factor shall meet the requirements of UPS system as well as the inverter furnished by the Bidder as specified above.

**2.2.0** BATTERY CHARGER AUXILIARY EQUIPMENT

In addition to the battery charger specified herein, auxiliary equipment shall be furnished with each charger as follows :

**2.2.1** Equipment and materials furnished, mounted and wired on the front panel of the charger enclosures:-

| ITEM | QUANTITY |
|---|---|
| a) AC voltmeter, indicating at input with required scale range and 2%accuracy | 1 No. |
| b) DC voltmeter, indicating output with required scale range and 2%accuracy | 1 No. |
| c) DC Ammeter, indicating output Amperes with required scale range and 2% accuracy | 1 No. |
| d) Charger ON-OFF push buttons | 2 Nos. |
| e) Potentiometers, one "Float voltage adjust" and" one Equalizing voltage adjust " both with manual adjustment knobs. The settings of these knobs shall be independent of each other. | 2 Nos. |
| f) Selector switch of selecting " float charge " or "Equalizing charge " | 1 No. |
| g) Charging rate setter | 1 No. |
| h) Selector switch & lights for ground fault detector | 1 Set |
| i) Equalizing charge timer(0-72 hrs.) with manual reset | 1 No. |

**2.2.2** Indicating light listed below with proper actuating devices, circuitry and legend shall be furnished on the front of UPS panels. One set of electrically independent potential free contacts shall be wired to the "Integrated Distributed Digital Control Monitoring and Information System". The following indications shall be furnished as minimum :-

a) Failure of input AC supply to the charger.
b) Charger failure.
c) Charger fuse blown.
d) System on battery operation.
e) Battery equalize timer “ON ".
f) Low battery voltage.
g) Low DC bus voltage.
h) DC ground fault.
i) Charger output voltage high and high-high.
j) Redundant fan failure and temperature high (as provided).

**3.0** BATTERIES

**3.1.0** The batteries shall be heavy duty lead acid Plante type and shall be sized for an hour of full load operation. Lead Acid Plante batteries sizng shall conform to IEEE 485 including Temperature correction factor. For further details, refer Typical Battery sizing calculation format attached.

**3.1.1** Bidder shall furnish battery sizing calculations, supporting curves/data etc. with the proposal to demonstrate to BHEL/BELLARY that the proposed battery capacity meets the above specification requirements at maximum temperature as well as minimum ambient temperature condition of 4°C.

**3.1.2** The plate structure shall be provided with adequate separators, suspensions and supports so that all plates are permanently aligned and protected from breakage.

**3.1.3** Sufficient sediment space shall be provided below the plates to eliminate the necessity of sediment removal during normal battery life.

**3.1.4** Each cell container shall be clearly marked for low and high electrolyte level limits on all four sides.

**3.1.5** All cell terminals shall have adequate current carrying capacity and shall be lead alloy or approved equal material.

**3.1.6** Cell terminals posts shall be suitable for bolted connection and shall be equipped with complete connector bolts and nuts. Cell posts shall be sealed against creepage of electrolyte either by burned ring seals or by lead alloy seal nuts or equivalent.

**3.1.7** Cells shall be arranged on two step battery rack so that the edges of the plate are conveniently visible.

**3.1.8** Battery racks shall be seismically qualified suitable good quality stand and painted with 3 coats of anti-acid paint in accordance with applicable codes and standards shall be provided.

**3.1.9** Each cell shall be assigned an identification number. Identification numbers shall be clearly and permanently marked on the front of the rack structure so that individual cells are easily identifiable. In addition, the polarity markers shall be furnished for the end cells.

3.1.10 The UPS Battery shall have sufficient amp-hour capacity to supply 100% full load current of UPS for 60 minutes. For this, the UPS capacity to be considered as the finally selected UPS rating, irrespective of the actual load on UPS. A drop of 4V from battery room to inverter input shall be considered for design.

3.2.0 BATTERY ACCESSORIES

Each battery shall be complete including the following equipment and material:

**01** Hydrometer - 5 Nos.

02 Set of Hydrometer Syringes suitable for the vent holes in different cells - 5 Nos.

03 Thermometer for measuring electrolyte temperature - 5 Nos.

04 Specific Gravity Correction Chart - 5 Nos.

05 Wall mounting type holder made of teak wood for hydrometer & thermometer - 5 Nos.

**06** Cell Testing Voltmeter (3-0-3 V) - 5 Nos.

**07** Alkali Mixing Jar - 5 Nos.

**08** Rubber Apron - 5 Nos

**09** Pair of Rubber Gloves - 5 Nos

10 Set of Spanners - 5 Nos

11 No Smoking Notice for 2 Set of Batteries - 2 Nos.

12 Goggles (Industrial) - 5 Nos.

13 Instruction Card - 10 Nos.

14 Minimum and Maximum temperature indicator for 2 Set of Batteries - 1 Set

15 Cell lifting facility - 1 No.

NOTE:

1.) Accessories for Lead Acid Plante battery shall be offered as per above which are subject to BHEL/Customer approval.

2.) Suitable termination with isolation/ACDB shall be provided at battery set output for proper isolation of battery set at battery end. This Battery isolating switch shall be wall-mounting type in IP55 enclosure.

**4.0** The UPS system shall be capable of operating without DC battery in circuit under all conditions of load and the performance of various components of UPS like inverter, charger, static switch etc. shall be guaranteed without the battery in circuit.

**4.1** The UPS system design shall ensure that in case of failure of line input power supply to one of the chargers, the other charger whose mains input power supply is healthy, shall feed to one or both the inverters as the case may be as per manufacturer's standard practice & continue to charge the DC battery at all load conditions. The bidder should note that this situation should not in any way lead to the discharge of the DC Battery.

**4.2** Both the inverters/chargers shall not be housed in single cubicle. One inverter one charger can be housed in one common cubicle i.e. there will be two such cubicles per UPS system if the same is standard and proven practice of the bidder.

5.0 STATIC INVERTER

**i**. The static inverter shall be solid state type using proven pulse width modulation (PWM) / Quasi square wave /step wave technique. Ferro resonant type inverters are not acceptable. The static inverter equipment shall include all necessary circuitry and devices to confirm to requirements like voltage regulation, current limiting, wave shaping, transient recovery, automatic synchronization, etc. The steady state voltage regulation shall be ± 2 % and transient voltage regulation (on application / Removal of 100 % load ) shall be ± 20% Time to recover from transient to normal voltage shall not be more than 50 msec. Frequency regulation for all conditions of input supplies, loads and temperature occurring simultaneously or in any combination shall be better than 0.5% (automatically controlled ). The total harmonic content shall be 5% maximum and content of any single harmonic shall be 3% maximum. The inverter efficiency shall be atleast 85 % on full load and 80 % on 50% load. The synchronization limit for maintenance of synchronization between the inverter and stand by AC source shall be 47.5-51.5 Hz, field adjustable in steps of 0.5 Hz. Each inverter shall have an overload capacity of 125% rated capacity for 10 minutes and 150% rated capacity for 60 seconds and 300% for 4 msecs.

**ii** OVER LOAD, SHORT CIRCUIT AND LOAD LOSS

The inverter shall be provided with suitable HRC fuses at the input and output which will permit proper coordination with other protective devices and at the same time protect the inverter against damage due to internal faults. However, if the bidder's system design does not use fuses then the fuse free circuit breaker may also be permitted provided it meets the specification requirements. All necessary equipment shall be provided to protect the inverter against overload, short circuit & 100 % loss of load. The inverter shall be self protecting against damage if energized with full load connected.

**iii** Inverter equipment shall include all solid state circuitry and devices including stable oscillator etc to enable inverters to operate satisfactorily in parallel sharing mode each inverter taking 50 % load during normal operation.

In case of failure of either inverter, 100% load shall automatically be transferred to healthy inverter without any break and degradation in the quality of UPS output and disconnecting the faulty inverter automatically.

**iv** The inverter failure shall be alarmed and the healthy inverter shall get synchronizing signal from the standby AC source and remain synchronized within the set limits. The limits for the synchronization between healthy inverter and standby AC source shall be field adjustable.

**v** On failure of both inverters, the loads shall be transferred to standby AC power without a break if within synchronization limits. Provision of asynchronous transfer with a break in case of inverter being out of synchronization limits shall also be there with standby source.

**6.**0 Static Switch and Manual bypass switch: The static switch shall be provided to perform the function of transferring UPS loads automatically without any break from

(i) faulty inverter to healthy inverter in case of failure of one of the inverter and
(ii) from faulty inverter to stand by AC source in case of failure of both inverter.

Manual bypass switch shall be employed for isolating the UPS during maintenance

Continuous and overload capacity of the switches shall be equal to 100% of the continuous and overload rating of each inverter. Peak capacity shall be 1000% of continuous rating for 5 cycles.

7.0 STEP DOWN TRANSFORMER & VOLTAGE STABILIZER

**7.1** The transformer shall be of low impedance type and the rating shall be such that extremely fast fault clearance is achieved even in the largest rated branch circuit. The overload capacity of the transformer / stabilizer shall not be less than 300% for 200 ms. The voltage stabilizer shall employ state of art control circuitry and shall maintain the specified output voltage for 0-100% load with maximum input voltage variations as indicated above. The efficiency of the stabilizer shall be 95% or better. The stabilizer shall be servo controlled voltage stabilizer.

**7.2** AUXILIARY EQUIPMENT

All required auxiliary equipment / materials as finalized during detailed engineering shall be furnished with each charger / inverter / battery bank and shall include as a minimum various meters (AC / DC voltage / current, KVA, power factor, frequency meters etc., circuit breakers, selector switches, push buttons, indicating lights/ Lamps ground detector system) battery accessories like ( inter cell connectors, inter step connectors battery racks etc ) further, isolated 4 -20mA signals for important parameters and potential free contacts for important alarms shall be provided for use in DDCMIS.

**7.3 Each** inverter 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 each inverter on the input as well as the output side by means of DC and AC MCCBs.

**7.4** Indicating lights listed below with proper actuating devices, circuitry and legend shall be furnished on front of UPS panels. For these abnormal conditions which could be of a momentary nature, the indicating lights shall remain energized and the Contact remain closed until cleared by a reset push button furnished on the panel. The indicating lights shall be of make subject to BHEL/BELLARY approval. The following indications shall be provided as a minimum.

a) DC voltage to the inverter : Low
b) DC voltage to the inverter : High
c) DC input loss to the inverter : High
d) Inverter A output voltage : High
e) Inverter B output voltage : High
Avoid unnecessary alarm due to low voltage on load in rush etc).
f) Inverter A output voltage low. - With a time delay.
g) Inverter B output voltage low. - With a time delay.
h) Inverter A failure.
i) Inverter B failure.
j) Inverter fuse failure.
k) Redundant fan failure and temperature high (if provided)
l) Standby AC source failure
m) Inverter A/Inverter B not synchronized with stand-by AC source in case of failure of inverter B/inverter A respectively.
n) Automatic transfer to stand by AC source & Inverter A/Inverter B feeding 100% UPS load.
o) Stand by source feeding 100% UPS loads.
p) Inverter A overload Trip.
q) Inverter B overload Trip.

**7.5** In addition to the above lamps one potential free change over contact shall be made available (wired up to the terminal block) for each of the above conditions to be connected to other systems.

**7.6** The following meters shall be provided as minimum, mounted on front of inverter panels for each inverter :-

i) DC input voltmeter.
ii) DC input Ammeter.
iii) AC output voltmeter.
iv) AC output Ammeter.
v) Frequency meter.
vi) Output KVA meter.
vii) Power factor meter.

**7.7** The above listed instruments shall be of ± 1% accuracy class. Inverter ON/OFF switch & Alarm reset Push Button shall also be provided for each inverter.

**7.**8 Bidder shall furnish the power supply distribution scheme, single line diagram, all calculation such as charger/inverter rating calculations, battery sizing calculation etc. during offer stage itself and during detailed engineering stage for owner's review and approval.

**7.9** ACDB

**7.9.1** AC distribution panel of CRCA sheet steel construction shall be supplied for 2 wire AC single phase distribution with a solid neutral bar.

**7.9.2** The phase and neutral bars shall be of copper.

**7.9.3** Rating of the main lugs shall be equal to the rated continuous full load current of each inverter.

**7.9.4** The panel boards shall be rated for 600V AC. All outgoing switches shall be load breaker, air break type provided with quick make breaker manual operating mechanism.

**7.9.5** Each UPS load shall be fed from redundant feeder from AC distribution board “A” and other AC distribution board “B " ie all the UPS loads shall be fed from both the distribution boards A & B. Each AC distribution panel board shall have all the required HRC slow acting fuses, switches and other devices. The exact nos and rating etc. of HRC slow acting fuses, switches shall be as finalized during detailed engineering without any price repercussions. BHEL/BELLARY decision shall be final in case there is any disagreement in Bidder's opinion and BHEL/BELLARY view.

**7.9.6** Each ACDB shall be provided with electrolytic grade tinned busbars as 3 numbers each of suitable capacity. One busbar caters to ACDB body earthing (broughtout by suitable screws), another to cable shields and third one is for zero potential busbar. All these busbars will be separately connected to Earth pit/risers (Earthing arrangement alongwith cables are not in vendor scope). Neutral of both ACDBs shall also be terminated to Earthpit.

**7.10** TESTS ON UPS SYSTEM

**7.10.1** Burning test on PCBs – Assembled PCBs shall be tested at 70 deg C for 72 hours in loaded condition.

.

**7.10.2** Rapid Temperature cycling test at 70 deg C and 0 deg C for 30 minutes at each temperature - 5 such cycles.

**7.10.3** Functional tests to demonstrate compliance with all specified requirements & published. Specifications such as frequency regulation, voltage regulation, current limiting, fuse clearing capability of inverters, demonstration of phase and frequency control of inverter for synchronization with range of adjustments transfer and retransfer of static switches under influence of under voltage and over current, tests on chargers, batteries and other system component to confirm compliance with specification.

**8.0** Factory Tests:

**8.1** The complete UPS system, including all instruments and devices shall be subjected to standard factory tests (i.e. Type Tests and Routine Tests) as per IS, NEMA, IEEE, IEC-146 standards wherever applicable.

**8.2** The following Factory Acceptance tests shall be conducted as a minimum requirement as per IEC-146 Standard.

i) Output Voltage & Frequency Tolerance (IEC 146-2)
ii) Input Voltage variation test (Approved Procedure)
iii) Current limiting test.
iv) Transfer time test.
v) Short circuit current capability test. (IEC 146-4-Clause 5.10)
vi) Power Efficiency test. (IEC 146-2, IEC 146) at 100% load, 50% load
vii) Transient response test.
viii) Meter accuracy test.
ix) Relative Harmonic content measuring test.(IEC -146.2)
x) Temp. Rise Test without redundant fans (IEC-146.2).
xi) Restart Test (IEC 146-2)
xii) Voltage Current Division (IEC 146-2).
xiii) Load Test (Approved Procedure)- Load Regulation Test
xiv) Audible Noise Test. (IEC 146-2)
xv) Synchronous Transfer & Synchronization Test. (IEC 146-4)
xvi) Radio Frequency Interference.
xvi) Parallel Redundancy Test (Simulation of Parallel Redundant Fault (IEC-146.4)).
xvii) Checklist of Auxiliary Devices.
xix) Insulation Test (IEC 146)
xx) Fuse Clearing Capability (Approved Procedure)
xxi) Overload Test on Inverter & Charger (Approved Procedure)
Also refer scope of supply.

8.3 BATTERY CHARGER

a) Short circuit current capability test. (IEC 146-2)
b) Temp. Rise Test without redundant fans (IEC-146.2)
c) SWC Test ( Approved Procedure)
d) Efficiency/PF Test (IEC 146-2, IEC 146)
e) Audible Noise Test (IEC 146-2)
f) Fuse Clearing Capability (Approved Procedure)
g) Relative Harmonic content (Approved Procedure)
h) Overload Test on charger (Approved Procedure)
i) Restart Test (IEC 146-2)
j) Output Voltage Tolerance (Approved Procedure)
k) Output Voltage Harmonic Content (Approved Procedure)

The above tests covered under Clause No. 8.2, 8.3 will be witnessed by Customer/Customer Representative

8.4 TYPE TEST

The following type tests shall be conducted at National/International Laboratories only.

a) IP degree
b) Surge Withstand Capability (SWC)
c) Dry Heat Test (IEC-68.2.2)
d) Dump Heat Test (IEC-68.2.3)
e) Vibration Test (IEC 68.2.8)
f) EMC Test (IEC-61000.4.2)

8.5 SITE TESTS

The Contractor shall also carry out the site tests on equipments/systems as specified below. However, these shall not be limited to this specification only and in case any other site test is required to be conducted as a standard practice of BHEL or deemed necessary by the Employer and mutually agreed between BHEL and BELLARY, the same shall also be carried out. Full load Test shall be demonstrated after commissioning of UPS and Charger with batteries at site for 72 hours.

Uninterruptible Power Supply System

Functional Test

On completion of installation and commissioning of the equipment the following tests/checks shall be carried out with the maximum available load, which does not exceed the rated continuous load. These tests/checks shall include but not limited to the tests as indicated below. The details of the tests are as indicated below:

1. Light Load Test

This test is carried out to verify that the UPS is correctly connected and all functions operate properly. The load applied is limited to some percent of rated value. The following points should be checked:

(a)Output voltage, frequency and the correct operation of meters;
(b)Operation of all control switches and other means to put units into operation.
(c)Functioning of protective and warning devices.
(d)Operation of remote signaling and remote control devices.

2. Checking of Auxiliary Devices

The functioning of auxiliary devices, such as lighting, cooling, pumps, fans annunciation, etc., should be checked, if convenient, in conjunction with the preliminary light load test.

3. Synchronization Test

If possible, frequency variation limits should be tested by use of a variable frequency generator, otherwise, by simulation of control circuit conditions. Applicable rate of change of frequency during synchronization shall be measured.

4. A. C_ Input Failure Test

The test is performed with a fully charged battery and is carried out by tripping input circuit breakers or may be simulated by switching off all UPS rectifiers and bypass feeder as at the same time. Output voltage variations are to be checked for specified limits with an oscilloscope or equivalent. Frequency variation is defined as the steady state frequency of the UPS with and without AC input. The rate of change of frequency is measured by the time it takes to reach steady-state values.

5. A. C Input Return Test

AC input return test is performed by closing AC input circuit breakers, or is simulated by energizing rectifiers and bypass feeders.

Proper operation of rectifier starting and voltage and frequency variations are to be observed.

Note: This test is normally performed with a fully of partially charged battery.

6. Simulation of Parallel Redundant UPS Fault

This test is applicable for UPS with parallel redundant connections. Faults of rectifier or inverter units may be carried out by simulation. Output transients are to be observed.

7. Transfer Test

This test is applicable for UPS with bypass, particularly in the case of an electronic bypass switch. Transients shall be measured during load transfer to bypass caused by a simulated fault and load retransfer after clearing of the fault.

8. Full load test

Load tests are performed by connecting the actual load to the UPS output. Large UPS in parallel connection may be load tested by testing the individual UPS units separately. Load tests are necessary for testing output voltage and frequency, rated stored energy, recharge time, ventilation, temperature rise and determination of efficiency. Load tests are performed to prove, transient voltage deviations specified under step load conditions.

9. Efficiency

Efficiency should be determined by the measurement of the active power at input and output.

10. Actual Load Test

Conditions under actual load may differ from those with a dummy load Steady-state generation of current and voltage harmonics and transients a load switching conditions should be observed.

11. Current Division in Parallel -

Load sharing between the Modular DC power supply rectifier banks & UPE units shall be measured with actual load under conditions of parallel operation.

12. Rated Stored Energy Time (Battery Test)

This test is a load test to prove the actual possible time of battery operation.

If rated load is not available in the case of large UPS, it is possible to, apply a partial load to check the actual battery discharge characteristics and compare these with characteristics specified by the battery manufacturer Discharge time with rated load- shall then be calculated. The test shall be performed with a fully charged battery and also may be done under other battery conditions to be specified, if so agreed. Active power output of the UPS and the battery voltage shall be recorded during the test.

Since new batteries often do not provide full capacity during a starting up period, the discharge test may be repeated after a reasonable recharge time if the original test has failed.

13. Rated Restored Energy Time

Restored energy depends on the charging capacity of the rectifiers and the battery characteristics. If a certain recharging rate is specified, it shall be provided by repeating the discharge test after the specified charging period.

14. Battery Ripple Current

If battery ripple currents are specified, then the ripple current which depends on UPS operation shall be checked under normal operating conditions. Rough measuring methods are sufficient.

**15.** On Site Ventilation Test

The test is performed with the actual load. Temperatures conditions of all UPS cubicles are to be observed.

16. Overload Capability Test

Overload capability test is a load test. Specified values of short time overload or starting up sequences of actual load are to be applied for the time interval specified. Specifed values of voltage and current are to be recorded.

17. Short Circuit Current Capability

If short-circuit current capability is specified, it may be tested by applicable of a short circuit to UPS output if necessary, via suitable fuse, short circuit is to be recorded.

18. Short Circuit Fuse Test

Fuse tripping capability of a UPS shall be tested, by short-circuiting the UPS output via a fuse of specified type.

The test shall be repeated to ensure against fuse non-uniformity and switching time during the cycle. The test is carried out at an appropriate UPS load, under normal operation, if not otherwise specified by Owner.

19. Restart

Automatic or other restart means are to be tested after a completed shut-down of UPS as specified.

20. Output over voltage

Output over voltage protection is to be checked.

21. Periodic Output Voltage Modulation

When this test is specified, it may be checked by voltage recording at different loads and operating conditions.

22. Harmonic Conditions

Harmonic components of output voltage shall be checked with the actual load. Methods of specification and checking shall be subject to Owner's approval.

23. Earth Fault Test

If the UPS output is isolated from earth, then an earth fault can be applied to any output terminal. UPS output transients (if any) shall be measured.

If the battery is isolated from earth, then an earth fault can be applied to any output terminals. UPS output transient (if any) shall be measured.

## 9.0 RELIABILITY & AVAILABILITY:-

Each component and system offered by the Bidder shall be of established reliability. The minimum target reliability of each piece of equipment like each electronic module/card, Power supply, peripherals, etc. shall be established by the Bidder, considering its failure rate / mean time between failures (MTBF), meantime to repair (MTTR), such that the availability of the complete C&I system is assured for 99.7%.

Further the Bidder shall ensure that all equipment/Part of its system shall have normal life expectancy exceeding the expected life of the plant i.e. thirty years.

**9.1** In order to ensure the target reliability the Bidder shall ensure selection of proper materials, control manufacturing process, use quality controlled components and parts, take adequate design margins & derating of electronic components and parts and carry out necessary tests, etc.

**9.2** The equipment shall employ latest state of the art technology to guard against obsolescence. In any case, Bidder shall be required to ensure supply of spare parts for life time of the plant. In case, it is felt by the Bidder that certain equipment/component is likely to become obsolete the bidder shall clearly bring out the same in his offer and indicate steps proposed to deal with such obsolescence.

## **10.0** THERMAL DESIGN OF UPS SYSTEM PANELS

The UPS panels shall be preferably designed for natural cooling and shall be fabricated from not less than 3mm thick sheet steel. When the inverter is in operation the temperature rise in the panel shall not be more than 15 Deg. C above ambient for all operating conditions. All components like transistors, SCRs, ICs, capacitors, resistors etc. Shall be properly chosen and derated such that failure rate is reduced to absolute minimum.

### **10.1** Cooling System

If the equipment supplied requires forced air cooling, the cooling system furnished shall meet the following requirements:

(a) Reserve cooling equipment shall be furnished for each switch board assembly. Reserve fan capacity shall be equal to 100 percent of cooling fan requirements for full load operation at the specified maximum ambient temperature failure of air flow.

(b) Completely independent duplicate wiring and control system shall be provided for the normal cooling fan system the reserve cooling fan system.

(c) Each cooling fan shall normally run continuously and shall be powered from the output of the inverter whose enclosure if serves. Each cooling fan supply circuit shall be separately fused.

(d) Each cooling fan shall be equipped with an air low switch having an alarm contact that closes upon failure of air flow.

*****

PROJECT : BELLARY U-3 STG-III (1x700 MW)

CUSTOMER : M/s KPCL

CONSULTANT : M/s TRACTEBEL ENGG PVT LTD.

# TYPICAL BATTERY SIZING CALCULATION FOR UPS



REVISION:00

APPROVED

M GURURAJ

| PREPARED | ISSUED | DATE |
|---|---|---|
| SATHISH | 416 | 31/07/13 |

## Typical Battery sizing calculation:

UPS full load considered = 130 kVA at 50 deg C.

***Options shall be provided for 140 kVA, 150 kVA & 160 kVA also.***

Max. Output load on UPS in watts = 130 x 1000 x 0.8 (P.F)

= 104000 Watts

Inverter efficiency = '**A**' say
Type of Battery and Back up Time required = Lead Acid Plante, 1 hour at full load.
End cell voltage (ECV) = 1.85 Volts/cell.
Number of cells = '**B**' say
Ageing factor = 1.0 (Ageing Factor Not applicable for Lead Acid Plante Battery as per IEEE standard)
Design Margin = 1.15

Temperature correction factor (at 4 deg. C. based on IEEE 485 standard) = '**C**' say

Capacity Factor at ECV of 1.85V for 1 Hr. Back-up, K = '**D**' say

Then Battery Discharge Current required $= \dfrac{104000}{1.85 \times \mathbf{A} \times \mathbf{B}}$ = '**E**' say

AH required = '**E**' x '**D**' = '**F**' say

Total Discharge Current considering the factors such as temperature correction factor, design margin & ageing factor is

= '**F**' x '**C**' 1.15 x 1.0 = 'Z' say

Battery AH to an End Cell Voltage of 1.85V/cell and suiting the above discharge current = '**Y**' say

Hence, Battery selected = **„B" cells of „Y" "H type Battery" which can deliver „Z" for 1 Hr. back-up at ECV=1.85V**

**Note:** Inverter efficiency is to be taken as 90% and 91% with 180 cells in two separate options to be offered for Batteries.

PROJECT : BELLARY U-3 STG-III (1x700 MW)

CUSTOMER : M/s KPCL

CONSULTANT : M/s TRACTEBEL ENGG PVT LTD.

# TYPE & ROUTINE ACCEPTANCE TEST



REVISION:00

APPROVED

M GURURAJ

| PREPARED | ISSUED | DATE |
|---|---|---|
| SATHISH | 416 | 31/07/13 |

## TYPE TEST REQUIREMENTS

| | |
|---|---|
| 1.00.00 | **TYPE TEST REQUIREMENTS** |
| 1.01.00 | General Requirements |
| 1.01.01 | The Contractor shall furnish the type test reports of all type tests as per relevant standards and codes as well as other specific tests indicated in this specification. A list of such tests are given for various equipment in table titled 'TYPE TEST REQUIREMENT FOR C&I SYSTEMS' at the end of this chapter and under the item Special Requirement for Solid State Equipments/Systems. For the balance equipment instrument, type tests may be conducted as per manufactures standard or if required by relevant standard.<br><br>(a) Out of the tests listed, the Bidder/ sub-vendor/ manufacturer is required to conduct certain type tests specifically for this contract (and witnessed by Employer or his authorized representative) even if the same had been conducted earlier, as clearly indicated subsequently against such tests.<br><br>(b) For the rest, submission of type test results and certificate shall be acceptable provided.<br><br>i. The same has been carried out by the Bidder/ sub-vendor on exactly the same model /rating of equipment.<br><br>ii. There has been no change in the components from the offered equipment & tested equipment.<br><br>iii. The test has been carried out as per the latest standards alongwith amendments as on the date of Bid opening.<br><br>(c) In case the approved equipment is different from the one on which the type test had been conducted earlier or any of the above grounds, then the tests have to be repeated and the cost of such tests shall be borne by the Bidder/ sub-vendor within the quoted price and no extra cost will be payable by the Employer on this account. |
| 1.01.02 | As mentioned against certain items, the test certificates for some of the items shall be reviewed and approved by the main Bidder or his authorized representative and the balance have to be approved by the Employer. |
| 1.01.03 | The schedule of conduction of type tests/ submission of reports shall be submitted and finalized during pre-award discussion. |
| 1.01.04 | For the type tests to be conducted, Contractor shall submit detailed test procedure for approval by Employer. This shall clearly specify test setup, instruments to be used, procedure, acceptance norms (wherever applicable), recording of different parameters, interval of recording precautions to be taken etc. for the tests to be carried out. |
| 1.01.05 | The Bidder shall indicate in the relevant BPS schedule, the cost of the type test for each item only for which type tests are to be conducted specifically for this project. |

The cost shall only be payable after conduction of the respective type test in presence of authorize representative of Employer. If a test is waived off, then the cost shall not be payable.

**2.00.00 SPECIAL REQUIREMENT FOR SOLID STATE EQUIPMENTS/ SYSTEMS**

2.01.00 The minimum type test reports, over and above the requirements of above clause, which are to be submitted for each of the major C&I systems shall be as indicated below:

i) Surge Withstand Capability ( SWC) for Solid State Equipments/ Systems

All solid state systems/ equipments shall be able to withstand the electrical noise and surges as encountered in actual service conditions and inherent in a power plant. All the solid state systems/ equipments shall be provided with all required protections that needs the surge withstand capability as defined in ANSI 37.90.1/ IEEE-472. Hence, all front end cards which receive external signals like Analog input & output modules, Binary input & output modules etc. including power supply, data highway, data links shall be provided with protections that meets the surge withstand capability as defined in ANSI 37.90.1/ IEEE-472. Complete details of the features incorporated in electronics systems to meet this requirement, the relevant tests carried out, the test certificates etc. shall be submitted along with the proposal. As an alternative to above, suitable class of EN 61000-4-12 which is equivalent to ANSI 37.90.1/ IEEE-472 may also be adopted for SWC test.

ii) Dry Heat test as per IEC-68-2-2 or equivalent.

iii) Damp Heat test as per IEC-68-2-3 or equivalent.

iv) Vibration test as per IEC-68-2-6 or equivalent.

v) Electrostatic discharge tests as per EN 61000-4-2 or equivalent.

vi) Radio frequency immunity test as per EN 61000-4-6 or equivalent.

vii) Electromagnetic Field immunity as per EN 61000-4-3 or equivalent.

Test listed at item no. v, vi, vii, above are applicable for electronic cards only as defined under item (i) above.

| TECHNICAL REQUIREMENTS | | | | | |
|---|---|---|---|---|---|
| *S. NO.* | *ITEM* | *TYPE TEST REQUIREMENT* | *STANDARD* | *TEST TO BE SPECIFICALLY CONDUCTED* | *NTPC'S APPROVAL REQD. ON TEST CERTIFICATE* |
| 1 | Battery | As per Standard | IS-10918 | NO | YES |
| 2 | UPS(Applicable for each model and rating) | Degree of Protection Test | IS-2147 | NO | YES |
| | | Power Efficiency | IEC 146-2, IEC 146 | NO | YES |
| | | Load test | Approved Procedure | YES | YES |
| | | Audible Noise Test | IEC 146- 2 | NO | YES |
| | | Fuse Cleaning Capability | Approved Procedure | YES | YES |
| | | Relative harmonic content | Approved Procedure | NO | YES |
| | | Radio interference | IEC 146 - 4 | NO | YES |
| | | Synchronous transfer test | IEC 146 - 4 | NO | YES |
| | | Temperature rise test without redundant fans | Approved Procedure | NO | YES |
| | | Input voltage variation test | Approved Procedure | NO | YES |
| | | Over load Test | Approved Procedure | NO | YES |
| | | Insulation test | IEC 146 | NO | YES |
| | | Restart Test | IEC 146 - 2 | NO | YES |
| | | Short circuit current capability | IEC 146 - 2 | NO | YES |
| | | Output voltage & frequency Tolerance | IEC 146 - 2 | NO | YES |
| | | Voltage/current Division | IEC 146 - 2 | NO | YES |
| | | Relative Harmonic Content | IEC 146 - 2 | NO | YES |

## QUALITY ASSURANCE

**POWER SUPPLY SYSTEM**

| ITEMS \ TESTS | Visual/dimension/rating/ Paint Adhesion/ Thickness (R) | General arrangement/BOM/make of components /Mimic® | Efficiency ,regulation(R) | Input voltage variation (A) | Out put voltage and frequency adj.range(A) | Premilinary light load test(R) | Load transfer retransfer test (R) * | AC input failure and return test (R) | Parralel operation and current divison(R) | Relative harmonic content(R) | Restart with PRI A.C and battery (separately)(R) | System transfer and retransfer (R)* | Asynchronous transfer(R) | Ripple content(R) | Load limiter operation (R) | IR/HV(R) | Tests as per standard &specification (R)&(A) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **UPS/CONVERTER (IEC-146 PT-4)** | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| **VOLTAGE STABILISER** | Y | Y | Y | Y | Y | | | | | Y | | Y | | | | Y | |
| **LEAD ACID BATTERY(TUBLAR )-IS-1651** | | | | | | | | | | | | | | | | | Y |
| **LEAD ACID BATTERY (PLANTE)-IS-1652** | | | | | | | | | | | | | | | | | Y |
| **NICKEL CADMIUM BATTERY(IS-10918/IEC-623)** | | | | | | | | | | | | | | | | | Y |

R-Routine Test A- Acceptance Test Y – Test applicable

* Transfer time and Over shoot /under shoot during load & system transfer shall be recorded .

Note: 1) **Detailed procedure of Burn-in and Elevated Temperature test shall be as per Quality Assurance Programme in General Technical Conditions**

2) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted alongwith relevant supporting documents.

PROJECT : BELLARY U-3 STG-III (1x700 MW)

CUSTOMER : M/s KPCL

CONSULTANT : M/s TRACTEBEL ENGG PVT LTD.

# QUALITY PLAN FORMAT



REVISION:00

APPROVED

M GURURAJ

| PREPARED | ISSUED | DATE |
|---|---|---|
|  SATHISH | 416 | 31/07/13 |

| Customer<br><br>**NTPC** | Manufacturer's Name & address | MANUFACTURER'S QUALITY PLAN<br>ITEM: | QP no.<br>Rev:<br>Date:<br>Page of | Project:<br>Package:<br>Contract no:<br>Contractor: BHEL, EDN |
|---|---|---|---|---|

| SL No. | Components & Operation | Characteristics | Class | Type Of Check | Quantum Of Check | Reference Document | Acceptance norms | Format of record | Agency | | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | M | | C | N | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D* | ** | 10 | | 11 |
| | | | | | | | | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | |

| | | | |
|---|---|---|---|
| | | LEGEND:<br>* Records identified with v/ shall be essentially included by the contractor in QA documentation.<br>** M: Manufacturer / Sub contractor<br>C: contractor nominated inspection agency<br>N: Customer<br>Indicate " P " – Perform<br>" W " – Witness<br>" V " - Verification | For Customer use / Doc.No. |
| Manufacturer/ Subcontractor | Contractor | | |
| Signature | | | Reviewed By<br>Name & SIGN. Of approving Authority & Seal. |

PROJECT : YERAMARUS TPS (2x800 MW)

CUSTOMER : M/s RPCL

# SPECIFICATION

# FOR

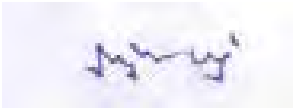
# UNINTERRUPTIBLE POWER SUPPLY SYSTEM(UPS)

## Including UPS BATTERY



REVISION:00

APPROVED



M GURURAJ

| PREPARED | ISSUED | DATE |
|---|---|---|
|  SATHISH | 416 | 15/11/13 |

# CONTENTS

PROJECT : YERAMARUS TPS (2x800 MW)

CUSTOMER : M/s RPCL

# SCOPE OF SUPPLY

## SCOPE OF SUPPLY

Following UPS shall be as per Technical Requirement Ref: CE/416/ YERAMARUS/UPS/TR and detailed Scope of Supply.

**A. YERAMARUS (1x500 MW)** ⟶ **2 SETS**

130 kVA, Single-phase 0.8 p.f lagging 240V AC, 50Hz parallel redundant UPS guaranteed at 50 deg. C. If any manufacturer doesn't have UPS guaranteed at 50 deg C, the vendor shall offer as per their manufacturing standards at 40/45 deg C with applicable temperature derating.

**B. Each UPS system comprises** ⟶

| | |
|---|---|
| 01. 100% Capacity Static Inverters | 2 Nos. |
| 02. 100% Capacity Static Switches | 2 Sets |
| 03. Manual Bypass Switch. | 1 Set |
| 04. Input Isolation Transformers | 2 Nos. |
| 05. 100% Capacity float cum boost chargers | 2 Nos. |
| 06. UPS Battery (Lead Acid Plante Battery with accessories for 1 hr. duty cycle at 100 % load) | 2 Sets * |
| 06. Step down transformer 415V, 3 Ph. to 240V, 1 Ph. | 1 No. |
| 07. Static Voltage Stabilizer. | 1 No. |
| 08. AC power Distribution boards | 2 Nos. |
| 09. Battery isolation box(housed in UPS panel) | 1 Set |
| 10. Accessories of UPS system, in line with specification including suitable interconnection cables. | 1 Set |

**Note:** The interconnection cables shall be from Battery to UPS, between UPS, between UPS to ACDB (to be offered on per meter basis). The cable quantity from Battery to UPS shall be 100 metres per run and from UPS to ACDB shall be 25 metres per run.

MODBUS cable of 100 meters per run is to be provided per charger / inverter combination for DCS connection. Therefore since each UPS system has redundant charger/inverter, this cable shall be 200 mtrs under each UPS system.

** Battery being procured by BHEL separately.*

C. **Erection supervision, complete commissioning & handing over.** ⟶ 2 Sets

1.1.0 **COMMISSIONING SPARES: (Common for the complete project)**

| S.NO | ITEM | QUANTITY(Nos) |
|---|---|---|
| 01) | Transistor each type & rating | 2 |
| 02) | SCR Charger & Static Switch each type & rating | 2 |
| 03) | Fuses each type & rating as used in UPS (no fuses to be offered of ACDB) | 5 |
| 04) | PCB'S/electronics cards/modules catering to following:- | |
| a) | Controller each type | 1 |
| b) | Pulse + RC – Rectifier | 1 |
| c) | Pulse + RC – Static Switch | 1 |

1.3.0 In addition to above spare miscellaneous parts for inverters, chargers, distribution panels batteries, etc., shall be furnished in accordance with manufacturer's standards. Bidder shall indicate list of such spares in his offer under miscellaneous spares.

2.0 GENERAL TERMS & CONDITIONS

2.1 Since the projects, are bunched together based on commonality of some aspects such as specifications, vendors, customers, etc., will be technically evaluated as a package, the participating vendors should quote for all the items.

2.2 Considering possibilities of change in requirement i.e. increase/decrease of loads & feeder quantities for individual project feeder list after system design finalization at a later date, the vendor must clearly quote for the UPS model with the most suitable kVA rating, next three higher kVA rating one in the same offer as per manufacturer catalog. If any vendor does not have the mentioned UPS rating, still the vendor is eligible for offering as the rating may get reduced during detailed engineering.

2.3 As battery is to be sized after the finalization of UPS kVA rating, the vendor shall quote for all the mentioned loads in the typical battery sizing calculation sheet.

2.4 Similarly, the vendor must clearly quote for unit price as well as lot price for all the selected UPS & UPS battery models including accessories, commissioning spares and cables (for UPS System only) for indisputable calculations of lot prices in case of revised quantities later.

2.5 The type tests are as listed as part of the specification & if the type tests are not specifically conducted, then same are to be offered with unit rates in offer. However, in either case, the type tests are to be submitted for BHEL/ Customer approval in case of order.

3.0 GENERAL TECHNICAL REQUIREMENTS

3.1 The output voltage, current and frequency transducers (4-20mA DC) are to be provided (total 6 numbers) per UPS system as a standard for remote monitoring. Apart from this, transducers related to input voltage and current at charger limbs and SCVS are to be provided (total 6 Nos. per UPS). All these transducers are remote monitoring wired to UPS. All above analog signals are apart from Binary potential free contacts provided as meaningful information to DCS.

3.2 Only the site-proven & type tested (in the last 4 years), electronic modules (in case of UPS System) & cell plates (in case of UPS Battery) will be acceptable unless otherwise decided by the purchaser in special circumstances.

3.3 For UPS, the type test shall be as per IEC-146, Degree of Protection test as per IS-2147 and the same are not to be specifically conducted for the projects if conducted on similar type/rating or similar type/ higher rating UPS.

3.4 Routine & Acceptance tests shall be done as per relevant standards. Temperature rise test is also to be done 100% for 10-12 hours duration each time (till temperature stabilizes).

3.5 Feeder List details will be provided during detailed engineering. Now, 130 feeders shall be considered per ACDB.

3.6 Considering the fact, separate quotations are being sent for UPS vendors and UPS battery vendors separately. Battery will be sized corresponding to the UPS manufacturer and accordingly UPS & Battery orders will be placed. Battery order will be placed after determining the UPS vendor and UPS rating. However, both UPS and battery vendors have to offer lumpsum unit rates for erection supervision & commissioning of UPS, erection supervision & commissioning of Battery with overall integration of complete system being responsibility of UPS vendor.

3.7 Protection class of all UPS, Voltage Stabilizer shall be IP42 and ACDB panels shall be IP54 as per IS2147 or equivalent standard.

3.8 The paint shade will be finalized during detailed engineering for the cubicle : -

a) Colour of cubicle enclosure exterior and interior.
b) Mounting plate colour.
c) Side plate exterior.
d) Plinth.

3.8 Material Thickness = All sides are 2mm CRCA, Mounting plate 3mm, Gland plate = 3mm. Also please note that panel construction shall be with base/bottom frame of approximate height as 100mm (3mm thick) and anti-vibration pad as 15mm thick-all details as per manufacturer standard.

3.9 Each ACDB shall be provided with Electrolytic grade tinned bus bars as 4 numbers each of suitable capacity. One busbar caters to ACDB body earthing (broughtout by suitable screws), two busbars for Phase and Neutral, One busbar catering to cable shields in ACDB-1 and other busbar for 24V DC zero potential bus bar in ACDB-II. All these busbars will be separately connected to Earth pit/ risers. (Earthing arrangement alongwith cables are not in vendor scope).

4.1. DOCUMENTS TO BE FURNISHED

4.1.0. Following documents shall be furnished to BHEL as a minimum, apart from any other documents required to be submitted as called for elsewhere or as deemed necessary.

4.1.1. Along with the Technical offer: For technical evaluation, vendor must send one (01) set of the following documents in hard copy, without which your offer is liable to be rejected.

01. Single line diagram
02. GA drawings
03. Circuit diagrams
04. Fault co-ordination details
05. Charger/Inverter rating calculation
06. Battery sizing calculation (as per IEEE or Equivalent Standard)
07. Battery curves
08. Technical write-up
09. Technical literature / Catalog of each component

10. Data sheet of complete system/subsystem
11. Wiring diagram/interconnecting arrangement details
12. Complete Bill of Material with make & Model
13. Commissioning spares list.
14. Clause-wise deviation list

NOTE: - Later no explanation on noncompliance or deviation, stated or observed, may be acceptable.

Incomplete offers (without documents / not relevant documents as mentioned above) will be technically rejected without any notice.

4.1.2 After placement of Purchase Order within 1 week: For BHEL/CUSTOMER approval, vendor must send Eight (8) sets of the following documents in hard copy & one (01) CD in soft copy, for each project.

a) All documents Sl. No 01 ~ 13 as above.
b) Interfacing diagram & cable type details used or suggested.
c) Quality Plan format enclosed as part of the specification.

4.1.3. After Type Test but before Inspection : For BHEL/CUSTOMER approval, vendor must send eight (8) Sets of the following documents in hard copy.

01. Type test reports/Certificates as per specification/approved QP

4.1.4. After Inspection but 1 week before dispatch: For BHEL/CUSTOMER approval, vendor must send two (2) sets of the following documents one in hard copy & one in soft copy.

01. Preliminary Instruction /O&M Manual

4.1.5. Along with the materials being dispatched: Vendor must send five (5) sets of the following "As **Built & Approved"** status documents four (4) in hard copies & one (1) in soft copy.

(a) Instruction/O&M Manual
(b) Bill of Material
(c) Data Sheets
(d) Technical literatures/Catalogs
(e) Drawings GA/layout/wiring/interconnection/schematic, etc.)

4.1.6. After despatch of material within 1 week : Vendor must send two ( 2 ) set of the following **"As Built & Approved"** status documents one (1) in hard copy & one (1) in soft copy directly to the project site.

(a) Instruction/O&M Manual

NOTE: One (01) set soft copy of Final document shall also be provided to BHEL. The soft copy shall be in CD-ROM media and shall be compatible with Windows-95/98/NT/2000 with drawing/documents in AutoCad-14/MS-Word/MS-Excel/Acrobat formats. Soft copy to be supplied for datasheet/document/ drawings at approval stage also.

PROJECT : YERAMARUS TPS (2x800 MW)

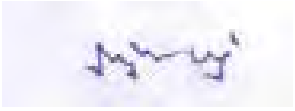
CUSTOMER : M/s RPCL

# TECHNICAL REQUIREMENTS



REVISION:00

APPROVED



M GURURAJ

| PREPARED | ISSUED | DATE |
|---|---|---|
|  SATHISH | 416 | 15/11/13 |

# Uninterruptible Power Supply (UPS) system including UPS Battery



## 1.0 GENERAL REQUIREMENTS

This specification covers the requirement of an Uninterruptible Power Supply (UPS) System comprising of static inverters, static switch, manual bypass switch, chargers, battery banks and DC & AC distribution boards.

The equipment covered under this specification shall meet the requirements of latest edition of all applicable codes and standards like ANSI, NEMA, IEEE, and IEC. NEC & IS. The UPS equipment and the complete system shall have surge withstand capability (SWC) to meet the requirements of ANSI C37. 90a, IEEE Standard 472. The requirements of UPS System are specified herein on system basis. The bidder shall be responsible for engineering and furnishing a complete and operational system fully meeting the intent and requirements of this specification and BHEL/CUSTOMER approved drawings. All equipment and accessories required for completeness of this system shall be furnished by the Bidder within the quoted price whether these are specifically mentioned herein or not.

All non interrupting components of UPS system shall be capable of withstanding all available short circuit currents without damage. Additionally, all circuits interrupting components shall be capable of withstanding and interrupting all encountered short circuit currents without damage.

UPS provided with fuse free circuit breaker shall be preferred. However In case, it is the standard practice of manufacturer to use fast current limiting fuses at inverter output etc. to protect its power semiconductors devices, the same shall be acceptable. However, in AC distribution board either fuse-free circuit breakers shall be employed same shall be of HRC type only. In any case selective fuse( fuse free circuit breaker ) coordination shall be provided by Bidder to ensure that only the fuse (fuse free circuit breaker ) nearest to the fault will open and isolate the faulted circuit. Other branches of the distribution system will be unaffected and the fault will not cause more than one fuse to open . Further it will be the sole responsibility of the UPS supplier to Engineer/design this system keeping in view the basic guideline as indicated elsewhere in specification like selectivity ratios etc.

The selection and selective coordination of all the protecting devices including fuse free circuit breakers / fuses shall conform to the requirements of National Electric Code (NEC) 1984 and other applicable standards. The selectivity ratios of the fuses (fuse free breakers) shall be such that there is a sufficient margin between the total electric energy of the downstream fuse and the total melting energy of the upstream fuse. The selective ratio shall be as finalized during detailed engineering stage but the same shall be not less than 2:1 in any case.

Following general requirements shall be met for ensuring proper branch and circuit protection.

**I.** The feeder fuse ampere rating and feeder conductor capacity must be at least 100% of the non continuous load plus 125% of the continuous load as calculated per Article 220 (220-10G) of NEC code - 1984. The feeder conductor must be protected by a fuse not greater than the conductor capacity.

**II**. For circuit with transformers requirements for conductor protection articles 230 and 310 of NEC must be observed. If secondary fuse protection is not provided then the primary fuses must not be sized larger than 125% of the transformer primary full-load amperes.

If secondary fuses are sized not greater than 125% of transformer secondary current, individual transformer fuses are not required in the primary provided the primary feeder fuses are not larger than 250% of the transformer rated primary current.

The UPS system shall have 2x100% parallel redundant chargers and inverters. 2x100% battery bank, bypass line transformers and voltage stabilizer, static switch, manual bypass switch, AC/DC distribution boards, other necessary protective devices and accessories and shall meet the following requirements as a minimum.

**1.1** The KVA rating of UPS arrived at shall be guaranteed at 50°c ambient. If UPS KVA rating is applicable at a lower ambient temperature than specified 50°C the bidder shall consider a derating factor of at least 1.5% / °C for arriving at the specified UPS capacity at applicable ambient temperature. The UPS shall have an over load capacity of 125% rated capacity for 10 minutes and 150% rating capacity for 10 seconds. The inverter shall have sufficient $I^2t$ capability to clear fault in the maximum rated branch circuit limited to 12 percent of finally selected UPS capacity. The sizing of UPS shall be based on the power factor of loads being led subject to maximum of 0.8.

In case the calculated UPS rating above is not same as one of the standard KVA ratings of the UPS manufacturer (indicated in printed catalogue), the next higher standard KVA rating of the manufacturer shall be selected and provided. Bidder may specifically note that UPS of manufacturer's non-standard rating shall not be acceptable.

**2.0** Each of the redundant chargers & batteries shall meet the specification requirements are as follows :

**2.1** Float cum boost chargers

**2.1.1** Each of the two sets of 2X100% redundant chargers shall be sized to meet the 100 % load requirements of the control system plus recharge the fully discharged battery within 8 Hours.

The chargers shall be self regulating, solid state silicon controlled, full - wave rectifier type designed for single and parallel operation with battery and shall have automatic voltage regulators for a close voltage stability even when AC supply voltage and DC load fluctuates, effective current limiting features and filters on both input and output to minimize harmonics. The charger output regulation shall be ±1% from no load to full load with an input power supply variation of ±10 % in voltage and ±5 % in frequency. In addition to alarms on charger panel, potential free contacts for alarms like charger O/P voltage high etc. shall also be provided for use in DDCMIS. Further isolated 4-20mA signals shall be provided for important parameters like charger voltage etc.

**2.1.2** The Bidder shall furnish the charger rating calculations to the BHEL/ YERAMARUS to satisfy that this requirement is met. The charger shall be furnished as per rating approved by the BHEL/ YERAMARUS during engineering stage without any price repercussions whatsoever. Typical calculation for sizing the capacity of the chargers to be followed by the Bidder is enclosed as part of the specification and the Bidder must adhere to the same strictly while sizing the capacity of the chargers to be offered by him.

**2.1.3** The chargers shall be served from a 415V, 50 Hz, 3 phase 3 wire system. The chargers shall maintain the output voltage within ± 1.0 % from no load to full load with an input power supply deviation in voltage level of ±10% and input power supply deviation in frequency of ±5% and with both deviations present in any combination.

**2.1.4** In addition to supply DC power for inverters, the chargers shall be designed to charge a fully discharged battery without causing interrupting operation of AC or DC circuit breakers for the entire range of intended operating regimes. Suitable solid state electronic circuits shall be provided to ensure that the charging current is voltage regulated and current limited. After the battery is recharged the charger shall maintain the battery at full charge until the next emergency operation when the UPS battery is again required to provide DC power.

**2.1.5** Float and equalizing controls shall have an adjustment range of 5% continuous (without steps).

**2.1.6** The charger shall be current limited at 125% of full load to reduce output stage for charger circuit protection and for protection of battery from overcharge. The current limit shall be continuously adjustable from 80% to 125%.

**2.1.7** Suitable devices/hardware shall be provided to alarm charger output voltage higher than adjustable present limit. Further, charger shall be tripped automatically on charger output voltage high-high (adjustable). This aspect shall be further discussed during detailed engineering.

**2.1.8** All necessary equipment and devices shall be provided to protect the charger from short circuits, transient voltage surges and load and supply fluctuations including sudden loss of input or load.

**2.1.9** The charger shall have a slow walk-in circuit which shall prevent application of full load DC current in less than 10 seconds after AC power is energized.

2.1.10 The minimum full load efficiency at nominal input and float output shall be 90%. The output regulation, ripple content and power factor shall meet the requirements of UPS system as well as the inverter furnished by the Bidder as specified above.

**2.2.0** BATTERY CHARGER AUXILIARY EQUIPMENT

In addition to the battery charger specified herein, auxiliary equipment shall be furnished with each charger as follows :

**2.2.1** Equipment and materials furnished, mounted and wired on the front panel of the charger enclosures:-

| ITEM | QUANTITY |
|---|---|
| a) AC voltmeter, indicating at input with required scale range and 2%accuracy | 1 No. |
| b) DC voltmeter, indicating output with required scale range and 2%accuracy | 1 No. |
| c) DC Ammeter, indicating output Amperes with required scale range and 2% accuracy | 1 No. |
| d) Charger ON-OFF push buttons | 2 Nos. |
| e) Potentiometers, one "Float voltage adjust" and" one Equalizing voltage adjust " both with manual adjustment knobs. The settings of these knobs shall be independent of each other. | 2 Nos. |
| f) Selector switch of selecting " float charge " or "Equalizing charge " | 1 No. |
| g) Charging rate setter | 1 No. |
| h) Selector switch & lights for ground fault detector | 1 Set |
| i) Equalizing charge timer(0-72 hrs.) with manual reset | 1 No. |

**2.2.2** Indicating light listed below with proper actuating devices, circuitry and legend shall be furnished on the front of UPS panels. One set of electrically independent potential free contacts shall be wired to the "Integrated Distributed Digital Control Monitoring and Information System". The following indications shall be furnished as minimum :-

a) Failure of input AC supply to the charger.
b) Charger failure.
c) Charger fuse blown.
d) System on battery operation.
e) Battery equalize timer “ON ".
f) Low battery voltage.
g) Low DC bus voltage.
h) DC ground fault.
i) Charger output voltage high and high-high.
j) Redundant fan failure and temperature high (as provided).

**3.0** BATTERIES

**3.1.0** The batteries shall be heavy duty lead acid Plante type and shall be sized for an hour of full load operation. Lead Acid Plante batteries sizng shall conform to IEEE 485 including Temperature correction factor. For further details, refer Typical Battery sizing calculation format attached.

**3.1.1** Bidder shall furnish battery sizing calculations, supporting curves/data etc. with the proposal to demonstrate to BHEL/ YERAMARUS that the proposed battery capacity meets the above specification requirements at maximum temperature as well as minimum ambient temperature condition of 4°C.

**3.1.2** The plate structure shall be provided with adequate separators, suspensions and supports so that all plates are permanently aligned and protected from breakage.

**3.1.3** Sufficient sediment space shall be provided below the plates to eliminate the necessity of sediment removal during normal battery life.

**3.1.4** Each cell container shall be clearly marked for low and high electrolyte level limits on all four sides.

**3.1.5** All cell terminals shall have adequate current carrying capacity and shall be lead alloy or approved equal material.

**3.1.6** Cell terminals posts shall be suitable for bolted connection and shall be equipped with complete connector bolts and nuts. Cell posts shall be sealed against creepage of electrolyte either by burned ring seals or by lead alloy seal nuts or equivalent.

**3.1.7** Cells shall be arranged on two step battery rack so that the edges of the plate are conveniently visible.

**3.1.8** Battery racks shall be seismically qualified suitable good quality stand and painted with 3 coats of anti-acid paint in accordance with applicable codes and standards shall be provided.

**3.1.9** Each cell shall be assigned an identification number. Identification numbers shall be clearly and permanently marked on the front of the rack structure so that individual cells are easily identifiable. In addition, the polarity markers shall be furnished for the end cells.

3.1.10 The UPS Battery shall have sufficient amp-hour capacity to supply 100% full load current of UPS for 60 minutes. For this, the UPS capacity to be considered as the finally selected UPS rating, irrespective of the actual load on UPS. A drop of 4V from battery room to inverter input shall be considered for design.

3.2.0 BATTERY ACCESSORIES

Each battery shall be complete including the following equipment and material:

**01** Hydrometer - 5 Nos.

02 Set of Hydrometer Syringes suitable for the vent holes in different cells - 5 Nos.

03 Thermometer for measuring electrolyte temperature - 5 Nos.

04 Specific Gravity Correction Chart - 5 Nos.

05 Wall mounting type holder made of teak wood for hydrometer & thermometer - 5 Nos.

**06** Cell Testing Voltmeter (3-0-3 V) - 5 Nos.

**07** Alkali Mixing Jar - 5 Nos.

**08** Rubber Apron - 5 Nos

**09** Pair of Rubber Gloves - 5 Nos

10 Set of Spanners - 5 Nos

11 No Smoking Notice for 2 Set of Batteries - 2 Nos.

12 Goggles (Industrial) - 5 Nos.

13 Instruction Card - 10 Nos.

14 Minimum and Maximum temperature indicator for 2 Set of Batteries - 1 Set

15 Cell lifting facility - 1 No.

NOTE:

1.) Accessories for Lead Acid Plante battery shall be offered as per above which are subject to BHEL/Customer approval.

2.) Suitable termination with isolation/ACDB shall be provided at battery set output for proper isolation of battery set at battery end. This Battery isolating switch shall be wall-mounting type in IP55 enclosure.

**4.0** The UPS system shall be capable of operating without DC battery in circuit under all conditions of load and the performance of various components of UPS like inverter, charger, static switch etc. shall be guaranteed without the battery in circuit.

**4.1** The UPS system design shall ensure that in case of failure of line input power supply to one of the chargers, the other charger whose mains input power supply is healthy, shall feed to one or both the inverters as the case may be as per manufacturer's standard practice & continue to charge the DC battery at all load conditions. The bidder should note that this situation should not in any way lead to the discharge of the DC Battery.

**4.2** Both the inverters/chargers shall not be housed in single cubicle. One inverter one charger can be housed in one common cubicle i.e. there will be two such cubicles per UPS system if the same is standard and proven practice of the bidder.

5.0 STATIC INVERTER

**i**. The static inverter shall be solid state type using proven pulse width modulation (PWM) / Quasi square wave /step wave technique. Ferro resonant type inverters are not acceptable. The static inverter equipment shall include all necessary circuitry and devices to confirm to requirements like voltage regulation, current limiting, wave shaping, transient recovery, automatic synchronization, etc. The steady state voltage regulation shall be ± 2 % and transient voltage regulation (on application / Removal of 100 % load ) shall be ± 20% Time to recover from transient to normal voltage shall not be more than 50 msec. Frequency regulation for all conditions of input supplies, loads and temperature occurring simultaneously or in any combination shall be better than 0.5% (automatically controlled ). The total harmonic content shall be 5% maximum and content of any single harmonic shall be 3% maximum. The inverter efficiency shall be atleast 85 % on full load and 80 % on 50% load. The synchronization limit for maintenance of synchronization between the inverter and stand by AC source shall be 47.5-51.5 Hz, field adjustable in steps of 0.5 Hz. Each inverter shall have an overload capacity of 125% rated capacity for 10 minutes and 150% rated capacity for 60 seconds and 300% for 4 msecs.

**ii** OVER LOAD, SHORT CIRCUIT AND LOAD LOSS

The inverter shall be provided with suitable HRC fuses at the input and output which will permit proper coordination with other protective devices and at the same time protect the inverter against damage due to internal faults. However, if the bidder's system design does not use fuses then the fuse free circuit breaker may also be permitted provided it meets the specification requirements. All necessary equipment shall be provided to protect the inverter against overload, short circuit & 100 % loss of load. The inverter shall be self protecting against damage if energized with full load connected.

**iii** Inverter equipment shall include all solid state circuitry and devices including stable oscillator etc to enable inverters to operate satisfactorily in parallel sharing mode each inverter taking 50 % load during normal operation.

In case of failure of either inverter, 100% load shall automatically be transferred to healthy inverter without any break and degradation in the quality of UPS output and disconnecting the faulty inverter automatically.

**iv** The inverter failure shall be alarmed and the healthy inverter shall get synchronizing signal from the standby AC source and remain synchronized within the set limits. The limits for the synchronization between healthy inverter and standby AC source shall be field adjustable.

**v** On failure of both inverters, the loads shall be transferred to standby AC power without a break if within synchronization limits. Provision of asynchronous transfer with a break in case of inverter being out of synchronization limits shall also be there with standby source.

**6.**0 Static Switch and Manual bypass switch: The static switch shall be provided to perform the function of transferring UPS loads automatically without any break from

(i) faulty inverter to healthy inverter in case of failure of one of the inverter and
(ii) from faulty inverter to stand by AC source in case of failure of both inverter.

Manual bypass switch shall be employed for isolating the UPS during maintenance

Continuous and overload capacity of the switches shall be equal to 100% of the continuous and overload rating of each inverter. Peak capacity shall be 1000% of continuous rating for 5 cycles.

7.0 STEP DOWN TRANSFORMER & VOLTAGE STABILIZER

**7.1** The transformer shall be of low impedance type and the rating shall be such that extremely fast fault clearance is achieved even in the largest rated branch circuit. The overload capacity of the transformer / stabilizer shall not be less than 300% for 200 ms. The voltage stabilizer shall employ state of art control circuitry and shall maintain the specified output voltage for 0-100% load with maximum input voltage variations as indicated above. The efficiency of the stabilizer shall be 95% or better. The stabilizer shall be servo controlled voltage stabilizer.

**7.2** AUXILIARY EQUIPMENT

All required auxiliary equipment / materials as finalized during detailed engineering shall be furnished with each charger / inverter / battery bank and shall include as a minimum various meters (AC / DC voltage / current, KVA, power factor, frequency meters etc., circuit breakers, selector switches, push buttons, indicating lights/ Lamps ground detector system) battery accessories like ( inter cell connectors, inter step connectors battery racks etc ) further, isolated 4 -20mA signals for important parameters and potential free contacts for important alarms shall be provided for use in DDCMIS.

**7.3 Each** inverter 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 each inverter on the input as well as the output side by means of DC and AC MCCBs.

**7.4** Indicating lights listed below with proper actuating devices, circuitry and legend shall be furnished on front of UPS panels. For these abnormal conditions which could be of a momentary nature, the indicating lights shall remain energized and the Contact remain closed until cleared by a reset push button furnished on the panel. The indicating lights shall be of make subject to BHEL/ YERAMARUS approval. The following indications shall be provided as a minimum.

a) DC voltage to the inverter : Low
b) DC voltage to the inverter : High
c) DC input loss to the inverter : High
d) Inverter A output voltage : High
e) Inverter B output voltage : High
Avoid unnecessary alarm due to low voltage on load in rush etc).
f) Inverter A output voltage low. - With a time delay.
g) Inverter B output voltage low. - With a time delay.
h) Inverter A failure.
i) Inverter B failure.
j) Inverter fuse failure.
k) Redundant fan failure and temperature high (if provided)
l) Standby AC source failure
m) Inverter A/Inverter B not synchronized with stand-by AC source in case of failure of inverter B/inverter A respectively.
n) Automatic transfer to stand by AC source & Inverter A/Inverter B feeding 100% UPS load.
o) Stand by source feeding 100% UPS loads.
p) Inverter A overload Trip.
q) Inverter B overload Trip.

**7.5** In addition to the above lamps one potential free change over contact shall be made available (wired up to the terminal block) for each of the above conditions to be connected to other systems.

**7.6** The following meters shall be provided as minimum, mounted on front of inverter panels for each inverter :-

i) DC input voltmeter.
ii) DC input Ammeter.
iii) AC output voltmeter.
iv) AC output Ammeter.
v) Frequency meter.
vi) Output KVA meter.
vii) Power factor meter.

**7.7** The above listed instruments shall be of ± 1% accuracy class. Inverter ON/OFF switch & Alarm reset Push Button shall also be provided for each inverter.

**7.**8 Bidder shall furnish the power supply distribution scheme, single line diagram, all calculation such as charger/inverter rating calculations, battery sizing calculation etc. during offer stage itself and during detailed engineering stage for owner's review and approval.

**7.9** ACDB

**7.9.1** AC distribution panel of CRCA sheet steel construction shall be supplied for 2 wire AC single phase distribution with a solid neutral bar.

**7.9.2** The phase and neutral bars shall be of copper.

**7.9.3** Rating of the main lugs shall be equal to the rated continuous full load current of each inverter.

**7.9.4** The panel boards shall be rated for 600V AC. All outgoing switches shall be load breaker, air break type provided with quick make breaker manual operating mechanism.

**7.9.5** Each UPS load shall be fed from redundant feeder from AC distribution board “A” and other AC distribution board “B " ie all the UPS loads shall be fed from both the distribution boards A & B. Each AC distribution panel board shall have all the required HRC slow acting fuses, switches and other devices. The exact nos and rating etc. of HRC slow acting fuses, switches shall be as finalized during detailed engineering without any price repercussions. BHEL/ YERAMARUS decision shall be final in case there is any disagreement in Bidder's opinion and BHEL/ YERAMARUS view.

**7.9.6** Each ACDB shall be provided with electrolytic grade tinned busbars as 3 numbers each of suitable capacity. One busbar caters to ACDB body earthing (broughtout by suitable screws), another to cable shields and third one is for zero potential busbar. All these busbars will be separately connected to Earth pit/risers (Earthing arrangement alongwith cables are not in vendor scope). Neutral of both ACDBs shall also be terminated to Earthpit.

**7.10** TESTS ON UPS SYSTEM

**7.10.1** Burning test on PCBs – Assembled PCBs shall be tested at 70 deg C for 72 hours in loaded condition.

.

**7.10.2** Rapid Temperature cycling test at 70 deg C and 0 deg C for 30 minutes at each temperature - 5 such cycles.

**7.10.3** Functional tests to demonstrate compliance with all specified requirements & published. Specifications such as frequency regulation, voltage regulation, current limiting, fuse clearing capability of inverters, demonstration of phase and frequency control of inverter for synchronization with range of adjustments transfer and retransfer of static switches under influence of under voltage and over current, tests on chargers, batteries and other system component to confirm compliance with specification.

**8.0** Factory Tests:

**8.1** The complete UPS system, including all instruments and devices shall be subjected to standard factory tests (i.e. Type Tests and Routine Tests) as per IS, NEMA, IEEE, IEC-146 standards wherever applicable.

**8.2** The following Factory Acceptance tests shall be conducted as a minimum requirement as per IEC-146 Standard.

i) Output Voltage & Frequency Tolerance (IEC 146-2)
ii) Input Voltage variation test (Approved Procedure)
iii) Current limiting test.
iv) Transfer time test.
v) Short circuit current capability test. (IEC 146-4-Clause 5.10)
vi) Power Efficiency test. (IEC 146-2, IEC 146) at 100% load, 50% load
vii) Transient response test.
viii) Meter accuracy test.
ix) Relative Harmonic content measuring test.(IEC -146.2)
x) Temp. Rise Test without redundant fans (IEC-146.2).
xi) Restart Test (IEC 146-2)
xii) Voltage Current Division (IEC 146-2).
xiii) Load Test (Approved Procedure)- Load Regulation Test
xiv) Audible Noise Test. (IEC 146-2)
xv) Synchronous Transfer & Synchronization Test. (IEC 146-4)
xvi) Radio Frequency Interference.
xvi) Parallel Redundancy Test (Simulation of Parallel Redundant Fault (IEC-146.4)).
xvii) Checklist of Auxiliary Devices.
xix) Insulation Test (IEC 146)
xx) Fuse Clearing Capability (Approved Procedure)
xxi) Overload Test on Inverter & Charger (Approved Procedure)
Also refer scope of supply.

8.3 BATTERY CHARGER

a) Short circuit current capability test. (IEC 146-2)
b) Temp. Rise Test without redundant fans (IEC-146.2)
c) SWC Test ( Approved Procedure)
d) Efficiency/PF Test (IEC 146-2, IEC 146)
e) Audible Noise Test (IEC 146-2)
f) Fuse Clearing Capability (Approved Procedure)
g) Relative Harmonic content (Approved Procedure)
h) Overload Test on charger (Approved Procedure)
i) Restart Test (IEC 146-2)
j) Output Voltage Tolerance (Approved Procedure)
k) Output Voltage Harmonic Content (Approved Procedure)

The above tests covered under Clause No. 8.2, 8.3 will be witnessed by Customer/Customer Representative

8.4 TYPE TEST

The following type tests shall be conducted at National/International Laboratories only.

a) IP degree
b) Surge Withstand Capability (SWC)
c) Dry Heat Test (IEC-68.2.2)
d) Dump Heat Test (IEC-68.2.3)
e) Vibration Test (IEC 68.2.8)
f) EMC Test (IEC-61000.4.2)

8.5 SITE TESTS

The Contractor shall also carry out the site tests on equipments/systems as specified below. However, these shall not be limited to this specification only and in case any other site test is required to be conducted as a standard practice of BHEL or deemed necessary by the Employer and mutually agreed between BHEL and YERAMARUS, the same shall also be carried out. Full load Test shall be demonstrated after commissioning of UPS and Charger with batteries at site for 72 hours.

Uninterruptible Power Supply System

Functional Test

On completion of installation and commissioning of the equipment the following tests/checks shall be carried out with the maximum available load, which does not exceed the rated continuous load. These tests/checks shall include but not limited to the tests as indicated below. The details of the tests are as indicated below:

1. Light Load Test

This test is carried out to verify that the UPS is correctly connected and all functions operate properly. The load applied is limited to some percent of rated value. The following points should be checked:

(a)Output voltage, frequency and the correct operation of meters;
(b)Operation of all control switches and other means to put units into operation.
(c)Functioning of protective and warning devices.
(d)Operation of remote signaling and remote control devices.

2. Checking of Auxiliary Devices

The functioning of auxiliary devices, such as lighting, cooling, pumps, fans annunciation, etc., should be checked, if convenient, in conjunction with the preliminary light load test.

3. Synchronization Test

If possible, frequency variation limits should be tested by use of a variable frequency generator, otherwise, by simulation of control circuit conditions. Applicable rate of change of frequency during synchronization shall be measured.

4. A. C_ Input Failure Test

The test is performed with a fully charged battery and is carried out by tripping input circuit breakers or may be simulated by switching off all UPS rectifiers and bypass feeder as at the same time. Output voltage variations are to be checked for specified limits with an oscilloscope or equivalent. Frequency variation is defined as the steady state frequency of the UPS with and without AC input. The rate of change of frequency is measured by the time it takes to reach steady-state values.

5. A. C Input Return Test

AC input return test is performed by closing AC input circuit breakers, or is simulated by energizing rectifiers and bypass feeders.

Proper operation of rectifier starting and voltage and frequency variations are to be observed.

Note: This test is normally performed with a fully of partially charged battery.

6. Simulation of Parallel Redundant UPS Fault

This test is applicable for UPS with parallel redundant connections. Faults of rectifier or inverter units may be carried out by simulation. Output transients are to be observed.

7. Transfer Test

This test is applicable for UPS with bypass, particularly in the case of an electronic bypass switch. Transients shall be measured during load transfer to bypass caused by a simulated fault and load retransfer after clearing of the fault.

8. Full load test

Load tests are performed by connecting the actual load to the UPS output. Large UPS in parallel connection may be load tested by testing the individual UPS units separately. Load tests are necessary for testing output voltage and frequency, rated stored energy, recharge time, ventilation, temperature rise and determination of efficiency. Load tests are performed to prove, transient voltage deviations specified under step load conditions.

9. Efficiency

Efficiency should be determined by the measurement of the active power at input and output.

10. Actual Load Test

Conditions under actual load may differ from those with a dummy load Steady-state generation of current and voltage harmonics and transients a load switching conditions should be observed.

11. Current Division in Parallel -

Load sharing between the Modular DC power supply rectifier banks & UPE units shall be measured with actual load under conditions of parallel operation.

12. Rated Stored Energy Time (Battery Test)

This test is a load test to prove the actual possible time of battery operation.

If rated load is not available in the case of large UPS, it is possible to, apply a partial load to check the actual battery discharge characteristics and compare these with characteristics specified by the battery manufacturer Discharge time with rated load- shall then be calculated. The test shall be performed with a fully charged battery and also may be done under other battery conditions to be specified, if so agreed. Active power output of the UPS and the battery voltage shall be recorded during the test.

Since new batteries often do not provide full capacity during a starting up period, the discharge test may be repeated after a reasonable recharge time if the original test has failed.

13. Rated Restored Energy Time

Restored energy depends on the charging capacity of the rectifiers and the battery characteristics. If a certain recharging rate is specified, it shall be provided by repeating the discharge test after the specified charging period.

14. Battery Ripple Current

If battery ripple currents are specified, then the ripple current which depends on UPS operation shall be checked under normal operating conditions. Rough measuring methods are sufficient.

**15.** On Site Ventilation Test

The test is performed with the actual load. Temperatures conditions of all UPS cubicles are to be observed.

16. Overload Capability Test

Overload capability test is a load test. Specified values of short time overload or starting up sequences of actual load are to be applied for the time interval specified. Specifed values of voltage and current are to be recorded.

17. Short Circuit Current Capability

If short-circuit current capability is specified, it may be tested by applicable of a short circuit to UPS output if necessary, via suitable fuse, short circuit is to be recorded.

18. Short Circuit Fuse Test

Fuse tripping capability of a UPS shall be tested, by short-circuiting the UPS output via a fuse of specified type.

The test shall be repeated to ensure against fuse non-uniformity and switching time during the cycle. The test is carried out at an appropriate UPS load, under normal operation, if not otherwise specified by Owner.

19. Restart

Automatic or other restart means are to be tested after a completed shut-down of UPS as specified.

20. Output over voltage

Output over voltage protection is to be checked.

21. Periodic Output Voltage Modulation

When this test is specified, it may be checked by voltage recording at different loads and operating conditions.

22. Harmonic Conditions

Harmonic components of output voltage shall be checked with the actual load. Methods of specification and checking shall be subject to Owner's approval.

23. Earth Fault Test

If the UPS output is isolated from earth, then an earth fault can be applied to any output terminal. UPS output transients (if any) shall be measured.

If the battery is isolated from earth, then an earth fault can be applied to any output terminals. UPS output transient (if any) shall be measured.

## 9.0 RELIABILITY & AVAILABILITY:-

Each component and system offered by the Bidder shall be of established reliability. The minimum target reliability of each piece of equipment like each electronic module/card, Power supply, peripherals, etc. shall be established by the Bidder, considering its failure rate / mean time between failures (MTBF), meantime to repair (MTTR), such that the availability of the complete C&I system is assured for 99.7%.

Further the Bidder shall ensure that all equipment/Part of its system shall have normal life expectancy exceeding the expected life of the plant i.e. thirty years.

**9.1** In order to ensure the target reliability the Bidder shall ensure selection of proper materials, control manufacturing process, use quality controlled components and parts, take adequate design margins & derating of electronic components and parts and carry out necessary tests, etc.

**9.2** The equipment shall employ latest state of the art technology to guard against obsolescence. In any case, Bidder shall be required to ensure supply of spare parts for life time of the plant. In case, it is felt by the Bidder that certain equipment/component is likely to become obsolete the bidder shall clearly bring out the same in his offer and indicate steps proposed to deal with such obsolescence.

## **10.0** THERMAL DESIGN OF UPS SYSTEM PANELS

The UPS panels shall be preferably designed for natural cooling and shall be fabricated from not less than 3mm thick sheet steel. When the inverter is in operation the temperature rise in the panel shall not be more than 15 Deg. C above ambient for all operating conditions. All components like transistors, SCRs, ICs, capacitors, resistors etc. Shall be properly chosen and derated such that failure rate is reduced to absolute minimum.

### **10.1** Cooling System

If the equipment supplied requires forced air cooling, the cooling system furnished shall meet the following requirements:

(a) Reserve cooling equipment shall be furnished for each switch board assembly. Reserve fan capacity shall be equal to 100 percent of cooling fan requirements for full load operation at the specified maximum ambient temperature failure of air flow.

(b) Completely independent duplicate wiring and control system shall be provided for the normal cooling fan system the reserve cooling fan system.

(c) Each cooling fan shall normally run continuously and shall be powered from the output of the inverter whose enclosure if serves. Each cooling fan supply circuit shall be separately fused.

(d) Each cooling fan shall be equipped with an air low switch having an alarm contact that closes upon failure of air flow.

*****

PROJECT : YERAMARUS TPS (2x800 MW)

CUSTOMER : M/s RPCL

# TYPICAL BATTERY SIZING CALCULATION FOR UPS



REVISION:00

APPROVED

M GURURAJ

| PREPARED | ISSUED | DATE |
|---|---|---|
| SATHISH | 416 | 15/11/13 |

## Typical Battery sizing calculation:

UPS full load considered = 130 kVA at 50 deg C.

***Options shall be provided for 140 kVA, 150 kVA & 160 kVA also.***

Max. Output load on UPS in watts = 130 x 1000 x 0.8 (P.F)

= 104000 Watts

Inverter efficiency = '**A**' say
Type of Battery and Back up Time required = Lead Acid Plante, 1 hour at full load.
End cell voltage (ECV) = 1.85 Volts/cell.
Number of cells = '**B**' say
Ageing factor = 1.0 (Ageing Factor Not applicable for Lead Acid Plante Battery as per IEEE standard)
Design Margin = 1.15

Temperature correction factor (at 4 deg. C. based on IEEE 485 standard) = '**C**' say

Capacity Factor at ECV of 1.85V for 1 Hr. Back-up, K = '**D**' say

Then Battery Discharge Current required $= \dfrac{104000}{1.85 \times \mathbf{A} \times \mathbf{B}}$ = '**E**' say

AH required = '**E**' x '**D**' = '**F**' say

Total Discharge Current considering the factors such as temperature correction factor, design margin & ageing factor is

= '**F**' x '**C**' 1.15 x 1.0 = 'Z' say

Battery AH to an End Cell Voltage of 1.85V/cell and suiting the above discharge current = '**Y**' say

Hence, Battery selected = **„B" cells of „Y" "H type Battery" which can deliver „Z" for 1 Hr. back-up at ECV=1.85V**

**Note:** Inverter efficiency is to be taken as 90% and 91% with 180 cells in two separate options to be offered for Batteries.

PROJECT : YERAMARUS TPS (2x800 MW)

CUSTOMER : M/s RPCL

# TYPE & ROUTINE ACCEPTANCE TEST



REVISION:00

APPROVED

M GURURAJ

| PREPARED | ISSUED | DATE |
|---|---|---|
|  SATHISH | 416 | 15/11/13 |

## TYPE TEST REQUIREMENTS

| | |
|---|---|
| 1.00.00 | **TYPE TEST REQUIREMENTS** |
| 1.01.00 | General Requirements |
| 1.01.01 | The Contractor shall furnish the type test reports of all type tests as per relevant standards and codes as well as other specific tests indicated in this specification. A list of such tests are given for various equipment in table titled 'TYPE TEST REQUIREMENT FOR C&I SYSTEMS' at the end of this chapter and under the item Special Requirement for Solid State Equipments/Systems. For the balance equipment instrument, type tests may be conducted as per manufactures standard or if required by relevant standard.<br><br>(a) Out of the tests listed, the Bidder/ sub-vendor/ manufacturer is required to conduct certain type tests specifically for this contract (and witnessed by Employer or his authorized representative) even if the same had been conducted earlier, as clearly indicated subsequently against such tests.<br><br>(b) For the rest, submission of type test results and certificate shall be acceptable provided.<br><br>i. The same has been carried out by the Bidder/ sub-vendor on exactly the same model /rating of equipment.<br><br>ii. There has been no change in the components from the offered equipment & tested equipment.<br><br>iii. The test has been carried out as per the latest standards alongwith amendments as on the date of Bid opening.<br><br>(c) In case the approved equipment is different from the one on which the type test had been conducted earlier or any of the above grounds, then the tests have to be repeated and the cost of such tests shall be borne by the Bidder/ sub-vendor within the quoted price and no extra cost will be payable by the Employer on this account. |
| 1.01.02 | As mentioned against certain items, the test certificates for some of the items shall be reviewed and approved by the main Bidder or his authorized representative and the balance have to be approved by the Employer. |
| 1.01.03 | The schedule of conduction of type tests/ submission of reports shall be submitted and finalized during pre-award discussion. |
| 1.01.04 | For the type tests to be conducted, Contractor shall submit detailed test procedure for approval by Employer. This shall clearly specify test setup, instruments to be used, procedure, acceptance norms (wherever applicable), recording of different parameters, interval of recording precautions to be taken etc. for the tests to be carried out. |
| 1.01.05 | The Bidder shall indicate in the relevant BPS schedule, the cost of the type test for each item only for which type tests are to be conducted specifically for this project. |

The cost shall only be payable after conduction of the respective type test in presence of authorize representative of Employer. If a test is waived off, then the cost shall not be payable.

**2.00.00 SPECIAL REQUIREMENT FOR SOLID STATE EQUIPMENTS/ SYSTEMS**

2.01.00 The minimum type test reports, over and above the requirements of above clause, which are to be submitted for each of the major C&I systems shall be as indicated below:

i) Surge Withstand Capability ( SWC) for Solid State Equipments/ Systems

All solid state systems/ equipments shall be able to withstand the electrical noise and surges as encountered in actual service conditions and inherent in a power plant. All the solid state systems/ equipments shall be provided with all required protections that needs the surge withstand capability as defined in ANSI 37.90.1/ IEEE-472. Hence, all front end cards which receive external signals like Analog input & output modules, Binary input & output modules etc. including power supply, data highway, data links shall be provided with protections that meets the surge withstand capability as defined in ANSI 37.90.1/ IEEE-472. Complete details of the features incorporated in electronics systems to meet this requirement, the relevant tests carried out, the test certificates etc. shall be submitted along with the proposal. As an alternative to above, suitable class of EN 61000-4-12 which is equivalent to ANSI 37.90.1/ IEEE-472 may also be adopted for SWC test.

ii) Dry Heat test as per IEC-68-2-2 or equivalent.

iii) Damp Heat test as per IEC-68-2-3 or equivalent.

iv) Vibration test as per IEC-68-2-6 or equivalent.

v) Electrostatic discharge tests as per EN 61000-4-2 or equivalent.

vi) Radio frequency immunity test as per EN 61000-4-6 or equivalent.

vii) Electromagnetic Field immunity as per EN 61000-4-3 or equivalent.

Test listed at item no. v, vi, vii, above are applicable for electronic cards only as defined under item (i) above.

| TECHNICAL REQUIREMENTS | | | | | |
|---|---|---|---|---|---|
| *S. NO.* | *ITEM* | *TYPE TEST REQUIREMENT* | *STANDARD* | *TEST TO BE SPECIFICALLY CONDUCTED* | *NTPC'S APPROVAL REQD. ON TEST CERTIFICATE* |
| 1 | Battery | As per Standard | IS-10918 | NO | YES |
| 2 | UPS(Applicable for each model and rating) | Degree of Protection Test | IS-2147 | NO | YES |
| | | Power Efficiency | IEC 146-2, IEC 146 | NO | YES |
| | | Load test | Approved Procedure | YES | YES |
| | | Audible Noise Test | IEC 146- 2 | NO | YES |
| | | Fuse Cleaning Capability | Approved Procedure | YES | YES |
| | | Relative harmonic content | Approved Procedure | NO | YES |
| | | Radio interference | IEC 146 - 4 | NO | YES |
| | | Synchronous transfer test | IEC 146 - 4 | NO | YES |
| | | Temperature rise test without redundant fans | Approved Procedure | NO | YES |
| | | Input voltage variation test | Approved Procedure | NO | YES |
| | | Over load Test | Approved Procedure | NO | YES |
| | | Insulation test | IEC 146 | NO | YES |
| | | Restart Test | IEC 146 - 2 | NO | YES |
| | | Short circuit current capability | IEC 146 - 2 | NO | YES |
| | | Output voltage & frequency Tolerance | IEC 146 - 2 | NO | YES |
| | | Voltage/current Division | IEC 146 - 2 | NO | YES |
| | | Relative Harmonic Content | IEC 146 - 2 | NO | YES |

## QUALITY ASSURANCE

**POWER SUPPLY SYSTEM**

| ITEMS \ TESTS | Visual/dimension/rating/ Paint Adhesion/ Thickness (R) | General arrangement/BOM/make of components /Mimic® | Efficiency ,regulation(R) | Input voltage variation (A) | Out put voltage and frequency adj.range(A) | Premilinary light load test(R) | Load transfer retransfer test (R) * | AC input failure and return test (R) | Parralel operation and current divison(R) | Relative harmonic content(R) | Restart with PRI A.C and battery (separately)(R) | System transfer and retransfer (R)* | Asynchronous transfer(R) | Ripple content(R) | Load limiter operation (R) | IR/HV(R) | Tests as per standard &specification (R)&(A) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **UPS/CONVERTER (IEC-146 PT-4)** | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| **VOLTAGE STABILISER** | Y | Y | Y | Y | Y | | | | | Y | | Y | | | | Y | |
| **LEAD ACID BATTERY(TUBLAR )-IS-1651** | | | | | | | | | | | | | | | | | Y |
| **LEAD ACID BATTERY (PLANTE)-IS-1652** | | | | | | | | | | | | | | | | | Y |
| **NICKEL CADMIUM BATTERY(IS-10918/IEC-623)** | | | | | | | | | | | | | | | | | Y |

R-Routine Test A- Acceptance Test Y – Test applicable

* Transfer time and Over shoot /under shoot during load & system transfer shall be recorded .

Note: 1) **Detailed procedure of Burn-in and Elevated Temperature test shall be as per Quality Assurance Programme in General Technical Conditions**

2) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted alongwith relevant supporting documents.

PROJECT : YERAMARUS TPS (2x800 MW)

CUSTOMER : M/s RPCL

# QUALITY PLAN FORMAT



REVISION:00

APPROVED

M GURURAJ

| PREPARED | ISSUED | DATE |
|---|---|---|
|  SATHISH | 416 | 15/11/13 |

| Customer<br><br>**NTPC** | Manufacturer's Name & address | MANUFACTURER'S QUALITY PLAN<br>ITEM: | QP no.<br>Rev:<br>Date:<br>Page of | Project:<br>Package:<br>Contract no:<br>Contractor: BHEL, EDN |
|---|---|---|---|---|

| SL No. | Components & Operation | Characteristics | Class | Type Of Check | Quantum Of Check | Reference Document | Acceptance norms | Format of record | Agency | | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | M | | C | N | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D* | ** | 10 | | 11 |
| | | | | | | | | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | |

| | | | |
|---|---|---|---|
| | | LEGEND:<br>* Records identified with v/ shall be essentially included by the contractor in QA documentation.<br>** M: Manufacturer / Sub contractor<br>C: contractor nominated inspection agency<br>N: Customer<br>Indicate " P " – Perform<br>" W " – Witness<br>" V " - Verification | For Customer use / Doc.No. |
| Manufacturer/ Subcontractor | Contractor | | |
| Signature | | | Reviewed By<br>Name & SIGN. Of approving Authority & Seal. |