



**Electronics Division, Bangalore**

# **BHEL - EDN**

## **TENDER DOCUMENTS**

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

**FOR RFQ. NO. : KBS0000273 DATED 13.07.2013  
DUE DATE : 05.08.2013**

**PROJECTS : SAGARDIGHI (2 X 500 MW), DVC BOKARO (1 X 500 MW) &  
LALITPUR (3 X 660 MW)**

**ITEM : TURBINE SUPERVISORY SYSTEM, VIBRATION MONITORING  
SYSTEM AND ANALYSIS & DIAGNOSTICS SYSTEM AS  
APPLICABLE FOR EACH PROJECT.**

**PROJECT LOCATIONS: SAGARDIGHI IN WEST BENGAL, DVC BOKARO  
IN JHARKHAND AND LALITPUR IN UTTAR PRADESH.**



**Bharat Heavy Electricals Ltd.,**  
(A Government of India undertaking)  
**Electronics Division**

PB No. 2606 , Mysore Road Bangalore , 560026 INDIA

Page 1 of 1

Fax : +91 80 26989217

☎ : +91 80 26989086  
+91 80 26998377

Date: 13.07.2013

M/s.

Attn. Mr/Ms.

**Sub: Receipt of Tender Enquiry (RFQ) No.: KBS0000273 DATED 13.07.2013.**  
**with tender specifications for : T S S & V M S ALONG WITH A & D AS APPLICABLE.**  
**Project / Destination : SAGARDIGHI IN WEST BENGAL, BOKARO IN JHARKHAND &**  
**LALITPUR IN UTTAR PRADESH.**  
**Due Date for submission of Offer : 05.08.2013.**


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.

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PURCHASE EXECUTIVE

# REQUEST FOR QUOTATION

	<b>BHARAT HEAVY ELECTRICALS LIMITED</b> Electronics Division PB No. 2606, Mysore Road Bangalore - 560026 INDIA	RFQ NUMBER: KBS0000273  RFQ DATE : 13.JUL.2013	Due Date <b>05.AUG.2013</b> Time: 13:00 HRS  VENUE : <b>NEW ENGG. BLDG</b>
MMI:PU:RF:003			
		(for all correspondence) Purchase Executive : SIDDARAMAPPA KB Phone : 26998363 Fax : 00918026744227 E-mail: siddaramappa@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

SI No.	Description	Qty	Unit	Delivery qty	Delivery Date*
1	PR041000019 VMS (Imported portion) VIBRATION MONITORING SYSTEM (Imported portion)  <b>QUANTITY BREAK UP:</b> 1. LALITPUR - 3 SETS 2. SAGARDIGHI - 2 SETS 3. DVC BOKARO - 1 SET	6	ST	1 1 1 1 1 1 1	<del>09.DEC.2013</del> <del>09.DEC.2013</del> <del>09.DEC.2013</del> <del>09.DEC.2013</del> <del>09.DEC.2013</del> <del>09.DEC.2013</del> <del>09.DEC.2013</del>
2	PR041000051 VMS (Indigenous portion) VIBRATION MONITORING SYSTEM (Indigenous portion)  <b>QUANTITY BREAK UP:</b> 1. LALITPUR - 3 SETS 2. SAGARDIGHI - 2 SETS 3. DVC BOKARO - 1 SET	6	ST	1 1 1 1 1 1	<del>09.DEC.2013</del> <del>09.DEC.2013</del> <del>09.DEC.2013</del> <del>09.DEC.2013</del> <del>09.DEC.2013</del> <del>09.DEC.2013</del>
3	PR0520000170 VIBRATION AND ANALYSIS SOFTWARE VIBRATION AND ANALYSIS SOFTWARE  <b>QUANTITY BREAK UP:</b> 1. SAGARDIGHI - 2 SETS	2	NO	1 1	<del>09.DEC.2013</del> <del>09.DEC.2013</del>
4	PR0890000018 TSS IMPORTED PORTION TSS IMPORTED PORTION  <b>QUANTITY BREAK UP:</b> 1. DVC BOKARO - 1 SET	1	ST	1	<del>09.DEC.2013</del>
5	PR0890000026 TSI INDIGENOUS PORTION TSI INDIGENOUS PORTION  <b>QUANTITY BREAK UP:</b> 1. DVC BOKARO - 1 SET	1	ST	1	<del>09.DEC.2013</del>
6	PR0900000619 TURBINE SUPERVISORY SYSTEM AND VIBRATION ANALYSER FOR MAIN TG SET & VIBRATION ANALYSER FOR PLANT AUX.ITEMS IMPORTED ITEMS AS PER SPEC:CE/ENGG/TSS-VMS/PS VER:02	2	NO	1 1	<del>09.DEC.2013</del> <del>09.DEC.2013</del>
	<b>QUANTITY BREAK UP:</b> 1. SAGARDIGHI - 2 SETS				

For and On behalf of BHEL.

# REQUEST FOR QUOTATION

	<b>BHARAT HEAVY ELECTRICALS LIMITED</b> Electronics Division PB No. 2606, Mysore Road Bangalore - 560026 INDIA	RFQ NUMBER: KBS0000273  RFQ DATE : 13.JUL.2013	Due Date <b>05.AUG.2013</b> Time: 13:00 HRS  VENUE : <b>NEW ENGG. BLDG</b>
MMI:PU:RF:003			

	(for all correspondence) Purchase Executive : SIDDARAMAPPA KB Phone : 26998363 Fax : 00918026744227 E-mail: siddaramappa@bheledn.co.in
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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 at 13.00 hrs

SI No.	Description	Qty	Unit	Delivery qty	Delivery Date*
7	PR0900000627 TURBINE SUPERVISORY SYSTEM TURBINE SUPERVISORY SYSTEM AND VIBRATION ANALYSER FOR MAIN TG SET & VIBRATION ANALYSER FOR PLANT AUX.ITEMS INDIGENOUS ITEMS AS PER SPEC:CE/ENGG/TSS-VMS/PS VER:02 <b>QUANTITY BREAK UP:</b> <b>1. SAGARDIGHI - 2 SETS</b>	2	NO	1  1	<del>09.DEC.2013</del> <del>09.DEC.2013</del>
8	PR0900000643 TURBINE SUPERVISORY SYSTEM TURBINE SUPERVISORY SYSTEM AND VIBRATION ANALYSER FOR MAIN TG SET & VIBRATION ANALYSER FOR PLANT AUX ITEMS IMPORTED MANDATORY SPARES AS PER SPEC:CE/ENGG/TSS-VMS/PS VER:02 <b>QUANTITY BREAK UP:</b> <b>1. SAGARDIGHI - 1 SET</b>	1	NO	1	<del>09.DEC.2013</del>

**Total Number of Items - 8**

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.

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/three 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 SI. 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 60 days from date of price bid opening / reverse auction.
- 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 .

**\* DELIVERY SCHEDULE: 12 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.  
  
 Page 2 OF 2



## Bharat Heavy Electricals Ltd.,

(A Government of India undertaking)

### Electronics Division

PB No. 2606 , Mysore Road Bangalore , 560026 INDIA

Fax : +91 80 26989217

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## INSTRUCTIONS TO BIDDERS

BHEL RFQ No.& Date : KBS0000273 DATED 13.07.2013.

Due date : 05.08.2013. Project : SAGARDIGHI (2 x 500 MW), DVC BOKARO (1 X 500 MW) & LALITPUR (3 X 660 MW).

Item : T S S & V M S ALONG WITH A & D AS APPLICABLE 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.**

**THE PRICE BID SHOULD BE PROJECT WISE IN THREE SEPARATE SEALED ENVELOPES 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 deviation to commercial terms & conditions) =“TOTAL COST OF BHEL”.**

**Note :** Exchange Rate ruling on the date of tender opening (part -1) will be considered 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 SAGARDIGHI (2 x 500 MW), DVC BOKARO (1 X 500 MW) & LALITPUR (3 X 660 MW). 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, FOR SAGARDIGHI & LALITPUR PROJECTS

1. NO BENIFITS FOR DVC BOKARO PROJECT (NORMAL PROJECT).

2. CST/VAT, OCTROI, SERVICE TAX ON E & C, FREIGHT CHARGES WILL BE REIMBURSABLE BY ULTIMATE CUSTOMER FOR LALITPUR 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 required for SAGARDIGHI (2 x 500 MW), DVC BOKARO (1 X 500 MW) & LALITPUR (3 X 660 MW) project, which qualifies for following benefits :
  - a) Deemed Export project eligible for - "NIL" customs duty. - for SAGARDIGHI & LALITPUR PROJECTS.
  - ~~b) Physical export project eligible for complete exemption of Customs duty.~~
  - c) Project Imports project eligible for concessional customs duty - for DVC BOKARO PROJECT
  - ~~d) Captive Power plant eligible for Concessional Customs Duty.~~
  - ~~e) R & M project eligible for Concessional Customs duty.~~
  - ~~f) Merit duty applicable.~~
- ✓ 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 as "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 treated 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 participates 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 Foreign 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 : KBS0000273 DATED 11.07.2013**

SL. NO.	TERMS	BHEL ACCEPTABLE TERM	BIDDER'S CONFIRMATION	DEVIATION IF ANY
01	<b>PRICE BASIS</b>	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.  <b>(PVC clause not acceptable).</b>	<b>AGREE</b>	
02	<b>VALIDITY</b>	Valid upto 8 weeks from the date of opening of price Bid <b>(not technical bid), /date of Reverse Auction.</b>	<b>AGREE</b>	
03	<b>TERMS OF DELIVERY</b>	Ex works (including Packing & Forwarding charges but excluding Taxes and Duties). Packing shall be roadworthy, best suited for multiple transshipments and to take care of transit damages.  <b>Indicate Station of despatch :</b> <b>Indicate place of manufacturing:</b> <b>Indicate type &amp; method of packing being adopted:</b>	<b>AGREE</b>  _____ _____ _____	
04	<b>DESTINATION</b>	Items are for direct despatch to BHEL's customer site located at : SAGARDIGHI IN WEST BENGAL, BOKARO IN JHARKHAND & LALITPUR IN UTTAR PRADESH Road Permit if applicable will be issued by BHEL alongwith Despatch Clearance.  <b>Hence, vendor may take a special note to</b>  <b>indicate whether Central Sales Tax or Local</b>  <b>State Sales Tax or VAT will be applicable.</b>	<b>AGREE</b>	
05	<b>DOCUMENTS</b>  (Pl. see loading Factor)	<b>Along with quotation :</b> As called in purchase specification shall be furnished alongwith un-priced bid.  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.  <b>After issue of PO:</b> As called in Purchase specification for the complete scope of supply within two weeks on receipt of PO for BHEL/ customer/consultant approval.  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 <b>Two weeks</b> on receipt of PO for BHEL / Customer / Consultant approval.	<b>AGREE</b>	



RFQ No.: KBS0000273 DATED 13.07.2013

**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	<b>PENALTY (FOR DELAY IN SUBMISSION OF DOCUMENTS FOR BHEL / CUSTOMER APPROVAL): (PI see loading factor)</b>	<p>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.</p> <p>Penalty if applicable shall be deducted at the time of settlement of 75% payment.</p> <p>If penalty is applicable for duration of less than a week penalty @ 2% (two percent) of the basic material value will be charged.</p>	<b>AGREE</b>	
07	<b>EXCISE DUTY &amp; EDUCATION CESS</b>	<p>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 "<b>Total cost to BHEL</b>" 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.</p>	<p><b>AGREE</b></p> <p><b>Excise Duty rate at present</b> .....%</p> <p><b>Maximum rate of Excise duty</b> .....%</p> <p><b>Education Cess</b>.....%</p>	

BHEL-EDN

VENDOR'S SIGNATURE WITH SEAL



RFQ No.: KBS0000273 DATED 13.07.2013

## 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	<b>IN CASE PROJECT IS DEEMED EXPORT, MEGA AND NON MEGA AND WON AGAINST INTERNATIONAL COMPITITIVE BIDDING (ICB)</b>	<p>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.</p> <p>If there are no imported raw materials/components, same shall be confirmed in the offer. Excise duty is fully exempted. Necessary documents for availing Excise duty Exemption by suppliers will be furnished by BHEL.</p>	<p>Agreed</p> <p><b>Furnished</b></p> <p><b>Yes, benefit passed-on to BHEL in the quotation.</b></p> <p><b>We, confirm that there are no imported components.</b></p>	
<del>09.</del>	<del><b>IN-CASE PROJECT IS DEEMED EXPORT, WON AGAINST INTERNATIONAL COMPITITIVE BIDDING (ICB) BUT NOT A MEGA PROJECT.</b></del>	<p><del>The project is eligible for claiming Terminal Excise duty benefit from DGFT as per present EXIM policy. PL Confirm that you will submit (original)</del></p> <p><del>a) Disclaimer Certificate.</del></p> <p><del>b) Copy of Excise Invoice attested by Suptd of Central excise authorities with signature &amp; seal, in Blue ink to enable BHEL to claim terminal Excise duty benefit from DGFT.</del></p>	<del><b>CONFIRMED</b></del>	
10	<b>SALES TAX</b>	<p>To confirm whether applicable. If applicable, indicate current rate of sales tax against form "C" For issue of form "C", vendor has to furnish "E1/E2" form</p> <p><b>Please confirm that "E1/E2 Sale form" will be submitted</b></p> <p>For physical export project, Sales Tax is exempted against submission of necessary documents by BHEL. However, vendor to indicate rate of Sales Tax applicable (against form 'C/37') for the item enquired.</p>	<p><b>AGREE</b></p> <p><b>Sales Tax rate at present.....%</b></p> <p><b>CONFIRMED</b></p>	

BHEL-EDN

VENDOR'S SIGNATURE WITH SEAL



RFQ No.: KBS0000273 DATED 13.07.2013

**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
		<p>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.</p> <p>Furnish following :</p> <p>CST Regn No.</p> <p>LST Regn No.</p> <p>TIN No.</p>	INDICATED	
11	VALUE ADDED TAX	<p>Since it is inter-state movement of goods, VAT is not applicable. Only CST against form C is applicable.</p> <p>OR</p> <p>Both are in the same State, VAT is applicable please indicate VAT applicable @ _____%</p>	<p>AGREE</p> <p>QUOTED</p>	
12	OCTROI	To confirm whether applicable, if applicable indicate current rate of Octroi _____%	AGREE	
13	SERVICE TAX ONE & C & TRAINING CHARGES	<p>To confirm whether applicable, if applicable indicate current rate of Service Tax _____%</p> <p><i>Furnish following :</i></p> <p><i>Service Tax Regn. No.</i></p> <p><i>Confirmation that Service Tax register is maintained.</i></p>	<p>AGREE</p> <p>FURNISHED CONFIRMED</p>	
14	FREIGHT CHARGES	<p>Freight charges shall be to vendor's account. Please indicate Freight charges separately as lumpsum charges in priced offer, Plus service tax if any.</p> <p>Vendor's offer will be evaluated on "Total cost basis" including freight charges.</p> <p>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</p>	<p>Agreed and quoted in lumpsum with Service Tax in price bid</p> <p>Service Tax _____ %</p>	

BHEL-EDN

VENDOR'S SIGNATURE WITH SEAL



RFQ No.: KBS0000273 DATED 13.07.2013

**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
		<p>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 <b>lower</b>.</p> <p>Vendor shall furnish following details alongwith Freight payment Bill :</p> <ul style="list-style-type: none"> <li>a) Net weight</li> <li>b) Gross weight</li> <li>c) Volume of each package</li> <li>d) No. of packages</li> <li>e) Loose items, if any</li> <li>f) Distance from vendor's works to destination.</li> </ul> <p>This is needed for justifying freight amount quoted by you.</p>		
15	<p><b>TRANSIT INSURANCE</b></p> <p><b>(To BHEL A/c)</b></p>	<p>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</p> <p><u>NOTE</u> : BHEL will not send insurance intimations to insurance company on your behalf. Hence it is your responsibility to intimate to insurance agency.</p>	<b>AGREE</b>	

BHEL-EDN

VENDOR'S SIGNATURE WITH SEAL



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**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	<b>DELIVERY PERIOD</b> (Pl. see loading Factor)	Within_12__ weeks from the date of issue of document approval or manufacturing clearance by BHEL, whichever in earlier.	AGREE	
17	<b>WARRANTY</b> (Pl. see loading Factor)	36 months from the date of despatch or 30 months from the date of commissioning whichever is earlier.	AGREE	
18	<b>TERMS OF PAYMENT (FOR MATERIAL SUPPLY &amp; TYPE TEST CHARGES)</b> (Pl. see loading Factor)	<p>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.</p> <p>Original consignee copy of L/R (lorry receipt) shall accompany the goods.</p> <p><b>Note : In case PBG is not furnished only 65 % payment will be released against 75 % claim without the consent of Vendor.</b></p> <p><b>This 10% basic amount withheld amount towards PBG will be paid against submission of supplementary invoice &amp; 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.</b></p> <p>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&amp;M manuals in requisite sets, against a supplementary Invoice.</p> <p>c) Balance 15% basic amount with 30 days credit on completion of Erection &amp; commissioning work on pro-rata basis against supplementary Invoice with "<b>Proof of completion of E&amp;C</b>" (like MOM, Site protocol, Job completion certificate), signed by BHEL site office or Customer and your representative.</p> <p><b>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.</b></p>	AGREE	

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**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
	<b>TERMS OF PAYMENT (FOR E&amp;C)</b>	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 vendors' representative. Separate Invoice shall be submitted for charges towards E&C payment.	<b>AGREE</b>	
	<b>TERMS OF PAYMENT (FOR TRAINING)</b>	100% payable with 30 days credit on completion of Training. Separate invoice shall be submitted for Training charges	<b>AGREE</b>	
	<b>TERMS OF PAYMENT (FOR ENGINEERING &amp; DOCUMENTATION CHARGES)</b>	100% with 30 days credit on approval of final documents. Separate invoice to be submitted for Engineering & documentation charges	<b>AGREE</b>	
19	<b>GENERAL</b>	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.	<b>AGREE</b>	
20	<b>SHORTAGES / DAMAGES</b>	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.	<b>AGREE</b>	
21	<b>PENALTY</b> (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. 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.  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.  Hence please issue inspection call with test certificates/ reports compulsorily to avoid penalty.	<b>AGREE</b>	

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SL. NO.	TERMS	BHEL ACCEPTABLE TERM	BIDDER'S CONFIRMATION	DEVIATION IF ANY
		<p>Penalty will be applicable after 12 (twelve) weeks from the date of issue of document approval or manufacturing clearance whichever is earlier</p> <p>Penalty if applicable shall be deducted at the time of settlement of 75 % payment.</p> <p>If penalty is applicable for duration of less than a week, penalty @2 % ( two percent ) of the basic material value will be charged.</p> <p>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.</p>		
22	<p><b>PERFORMANCE BANK GUARANTEE</b></p> <p>(Pl. see loading Factor)</p>	<p>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.</p> <p>PBG shall be valid for 36 months + 6 months claim period from date of despatch (totally 42 months from the date of despatch)</p> <p>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)</p> <p>Please indicate the Banker name from whom PBG will Issuing bank name be furnished without fail.</p> <p>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.</p>	<p><b>AGREE</b></p> <p><b>Issuing Bank Name indicated</b></p>	

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SL. NO.	TERMS	BHEL ACCEPTABLE TERM	BIDDER'S CONFIRMATION	DEVIATION IF ANY
23	<b>INSPECTION</b>	<p>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 &amp; Customer / consultant.</p> <p>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.</p>	<b>AGREE</b>	
24	<b>MODE OF DESPATCH</b>	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.	<b>AGREE</b>	
25	<b>DESPATCH DOCUMENTS</b>	<p>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</p> <p>Original Performance Bank Guarantee (Directly from issuing bank to BHEL).</p> <p>One set of Invoice, Packing list and L/R shall be faxed immediately after despatch to BHEL-EDN, Bangalore.</p>	<b>AGREE</b>	
26	<b>O &amp; M MANUALS</b>	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.	<b>AGREE</b>	

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## 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
		<p>Note : Supply of above documents (O&amp;M) in required No. of sets along with Despatch documents and material shall be indicated in packing list.</p> <p>If not mentioned BHEL may insist for submission in required sets once again.</p>		
27	<b>SPLIT ORDERING</b>	Though RFQ common for three projects, bid evaluation will be done project wise & contract will be finalised for each project on a Techno-commercially acceptable lowest Bidder.	<b>AGREE</b>	
28	<b>QUANTITY TOLERANCE</b>	<p>Please <del>indicate Quantity tolerance applicable in each of the line item wherever Quantity tolerance applicable for the Quoted items.</del></p> <p><del>_____</del></p> <p><del>-</del></p>	<b>CONFIRMED</b>	<p><b>QUANTITY TOLERANCE</b> .....%PER <del>VARIETY</del></p>
29	<b>SLAB RATE</b>	If <del>the price quoted varies based on the quantity to be ordered, then slab rates may be quoted.</del>	<b>SLAB RATES INDICATED IN OFFER</b>	<b>SLAB RATES APPLICABLE/ NOT APPLICABLE</b>
30	<b>SPECIAL GLASS (-EXCIST DUTY DRAW BACK FROM DGFT )</b>	<p>Following <del>documents (Original) shall be submitted for availing Excise duty draw back benefit from DGFT along with despatch documents to BHEL-EDN, Bangalore</del></p> <p>a) <del>Disclaimer certificate as per the proforma, which will be, sent with the PO.</del></p> <p>b) <del>Copy of Excise Invoice duly attested by Suptd of Central Excise (- signature in blue ink &amp; seal) Pl. refer enclosure to RFQ.</del></p>	<b>AGREE</b>	
31	<b>ERECTION &amp; COMMISSIONING (E &amp; C) / INSTALLATION / ASSEMBLY AT SITE</b>	<p>Indicate lumpsum charges (includes To &amp; 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.</p> <p><b>Note : If E&amp;C is not quoted (wherever called for in the BHEL purchase specification) BHEL reserve the right to reject your offer.</b></p> <p><b>If lumpsum charges are not quoted, offer may be rejected.</b></p>	<b>AGREE &amp; CONFIRMED QUOTED IN LUMP SUM CHARGES IN PRICE BID</b>	

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## 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	<b>REVERSE AUCTION</b>	<p>Against this enquiry for the subject item/system with detailed scope of supply as per enquiry specifications, BHEL EDN reserves the right to follow <b>REVERSE AUCTION PROCEDURE i.e. ON LINE BIDDING ON NETWORK</b>, before finalising the Purchase order on technically competent bidders, as per the guidelines given in Annexure-IV.</p> <p>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.</p>	<b>AGREE</b>	
33	<b>SPECIAL CLAUSE APPLICABLE FOR EXPORT JOB ONLY</b>	<p>Article packed with raw/solid wood packing material should be treated as per ISPM - 15 (fumigation) and accomplished by Phytosanitary/Fumigation certificate <b>DESTINATION SEA PORT/ AIRPORT IN INDIA .....</b></p>	<b>AGREE</b>	

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).

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**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 MANUFACTURE - RING	PL INDICATE FOR THE TOTAL SCOPE OF SUPPLY <b>COUNTRY OF ORIGIN</b>  <b>PLACE OF MANUFACTURING (TOTAL PACKAGES)</b>	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 <b>(Price variation Clause not acceptable).</b> Currency :	AGREE	
05	VALIDITY	Valid up to 8 weeks from the date of opening of price Bid <b>(not technical bid).</b>	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.  Indicate Name of International Airport Indicate method of packing done:	AGREE	

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SL. NO.	TERMS	BHEL ACCEPTABLE TERM	BIDDER'S CONFIRMATION	DEVIATION IF ANY
		<p><b>Note : Name of Airport to be selected from any one of the ports indicated in Annexure-V which are acceptable BHEL ports.</b></p> <p><b>BHEL will do Customs Clearance after payment of Customs Duty as applicable at the time of customs clearance.</b></p>		
07	<p><b>DOCUMENTS</b> (Pl. see loading Factor)</p>	<p><b>ALONG WITH QUOTATION :</b> As called in Purchase specification shall be furnished alongwith un-price bid.</p> <p>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.</p> <p><b>After issue of PO :</b> As called in Purchase specification. For the complete scope of supply within 2 weeks from receipt of PO for BHEL/ customer/consultant approval.</p> <p>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 <b>two weeks</b> on receipt of PO for BHEL/ Customer/ Consultant approval.</p>	<b>AGREE</b>	
08.	<p><b>PENALTY (FOR DELAY IN SUBMISSION OF DOCUMENTS FOR BHEL/ CUSTOMER APPROVAL) :</b> (Pl. see loading Factor)</p>	<p>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.</p> <p>Penalty if applicable shall be deducted at the time of settlement of 90% payment.</p> <p>If penalty is applicable for duration of less than a week, penalty @ 2% (Two percent) of the basic material value will be charged.</p>	<b>AGREE</b>	

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SL. NO.	TERMS	BHEL ACCEPTABLE TERM	BIDDER'S CONFIRMATION	DEVIATION IF ANY
09	<b>TRANSIT INSURANCE</b>	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 negotiable documents.	<b>AGREE</b>	
10	<b>DELIVERY PERIOD</b> (Pl. see loading Factor)	Within___12___ weeks from document approval or manufacturing clearance by BHEL. whichever is earlier.	<b>AGREE</b>	
11	<b>WARRANTY</b> (Pl. see loading Factor)	36 months from the date of despatch or 30 months from the date of commissioning whichever is earlier.	<b>AGREE</b>	
12	<b>TERMS OF PAYMENT (FOR MATERIAL SUPPLY)</b> (Pl. see loading Factor)	Against " <b>SIGHT DRAFT</b> " on presentation of documents to our Bankers.  The payment terms are as follows :  a) 90% is payable on negotiation of complete set of original documents including original performance Bank Guarantee, b) Balance 10% on 60th day from the date of Air Way Bill / Bill of Lading & against specific authorisation by BHEL.  <b>Note : No advance payment will be made.</b>	<b>AGREE</b>	
13	<b>SHORTAGES/ DAMAGES AT CUSTOMER SITE</b>	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.	<b>AGREE</b>	

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SL. NO.	TERMS	BHEL ACCEPTABLE TERM	BIDDER'S CONFIRMATION	DEVIATION IF ANY
14	<b>PENALTY</b> (Pl. see loading Factor)	<p>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 ___12___ weeks from the date of document approval or manufacturing clearance, whichever is earlier.</p> <p>Penalty if applicable shall be deducted at the time of settlement of 90% payment. Penalty if any will be indicated in Despatch Clearance letter.</p> <p>If penalty is applicable for duration of less than a week, penalty @2 % ( two percent ) of the basic material value will be charged.</p>	<b>AGREE</b>	
15	<b>PERFORMANCE BANK GUARANTEE (PBG)</b> (Pl. see loading Factor)	<p>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. Copy of PBG shall be furnished to BHEL.</p> <p>PBG shall be valid for 36 months + 6 months claim period (totally 42 months) from the date of despatch PBG proforma enclosed herewith (Annexure-II).</p> <p>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".</p>	<b>AGREE</b>	

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SL. NO.	TERMS	BHEL ACCEPTABLE TERM	BIDDER'S CONFIRMATION	DEVIATION IF ANY
16	<b>TEST REPORTS / CALIBRATION REPORTS</b>	<p>Shall be furnished / faxed immediately on completion of testing to BHEL for verification</p> <p>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.</p>	<b>AGREE</b>	
17	<b>MODE OF DESPATCH</b>	BY <b>Air</b> freight on receipt of despatch clearance from BHEL and through BHEL approved Consolidator / freight Forwarder.	<b>AGREE</b>	
18	<b>DOCUMENTS DESPATCH</b>	<p>Complete set of despatch documents shall be forwarded to BHEL directly. Despatch documents include AWB, Invoice, Packing list, Country of origin certificate, Original performance Bank Guarantee, Warranty certificate, O &amp; M manuals and Insurance intimation letter.</p> <p>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.</p> <p><b>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.</b></p>	<b>AGREE</b>	
19	<b>WEIGHT &amp; VOLUME</b>	<p>Please indicate following for calculating Freight charges (<b>approximate</b>) :</p> <p>a) <b>Total Net Weight of the package/s.</b></p> <p>b) <b>Total Gross weight of the package/s.</b></p> <p>c) <b>VOLUME : Length (L) X Breadth (B) X Height (H) in feet X No. of packages. Please keep one copy of packing slip inside box.</b></p>	<b>FURNISHED</b>	
20	<b>O &amp; M MANUALS</b>	<p>As built Drawings, O&amp;M Manuals and other approved documents in 2 sets shall be furnished immediately after despatch to BHEL directly.</p> <p>1 set of above also shall be sent in soft media (CD ROM) wherever called in specification</p> <p>Two sets of hard copies shall be directly despatched to site alongwith the material.</p> <p>Refer Specification for details.</p>	<b>AGREE</b>	

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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. If not metioned, BHEL may insist above in required No. of sets.		
21	<b>SPLIT ORDERING</b>	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.	<b>AGREE</b>	
22	<b>QUANTITY TOLERANCE</b>	<del>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.</del>	<b>CONFIRMED</b>	<b>QUANTITY TOLERANCE .....% PER ITEM</b>
23	<b>SLAB RATE</b>	<del>If the price quoted varies based on the quantity ordered, then slab rates may be quoted.</del>	<b>AGREE</b>	
24	<b>PARTIAL SHIPMENT</b>	NOT ALLOWED WITH IN A PROJECT	<b>NOTED</b>	
25	<b>TRANSHIPMENT</b>	ALLOWED	<b>NOTED</b>	
26	<b>DESPATCH CLEARANCE</b>	BHEL will issue despatch clearance on receipt Test Certificates/calibration reports/ Certificates of Conformance and review / verification of the same.  Goods shall not be despatched without obtaining despatch clearance from BHEL.	<b>AGREE</b>	
27	<b>REPAIR OF COMPONENTS</b>	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.	<b>AGREE</b>  <b>INDIAN REPRESENTATIVE NAME INDICATED</b>	

BHEL-EDN

VENDOR'S SIGNATURE WITH SEAL



RFQ No.: KBS0000273 DATED 13.07.2013

**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	<p>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.</p> <p>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.</p>	AGREE	
29	REVERSE AUCTION	<p>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 finalising the Purchase order on technically competent and lowest bidder, as per the guidelines given in Annexure-VI.</p> <p>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.</p>	AGREE	
30	SPECIAL CLAUSE	Articles packed with raw/solid wood packing material should be treated as per ISPM-15 and accomplished by a phytosanitary 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: KBS0000273 DATED 13.07.2013**

**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 & freight 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 ADDITIONAL 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	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.: KBS0000273 DATED 13.07.2013**

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. BALANCE 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 CONSIGNEE 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.: KBS0000273 DATED 13.07.2013**

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.: KBS0000273 DATED 13.07.2013**

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.	<p><b>TERMS OF PAYMENT (WHERE SCOPE DOES NOT INCLUDE E&amp;C)</b></p>	<p>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&amp;M manuals in required sets, against a supplementary Invoice.</p>	<p>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.</p>	NIL



**Electronics Division, Bangalore RFQ No.: KBS0000273 DATED 13.07.2013**

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 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)
<p>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.</p>				
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 60 <sup>TH</sup> DAY FROM THE DATE OF AIR WAY BILL OR BILL OF LADING & AGAINST SPECIFIC AUTHORISATION BY BHEL. ALL BANK CHARGES OUTSIDE INDIA TO BENEFICIARY'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.	-SAME AS ABOVE-	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.
				If @ ½% (half percent) per week but limited to a max. of 10% (Ten percent) is agreed.	7.5 % OF THE BASIC MATERIAL VALUE
				If @ ½% (half percent) per week but limited to a max. of 5% (Five percent) is agreed.	10% OF THE BASIC MATERIAL VALUE.
				If @ 1% (one percent) per week but limited to a max. of 10% (Ten percent) is agreed.	5% OF THE BASIC MATERIAL VALUE.
				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.....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.
				IF SPECIFIED DELIVERY IN ENQUIRY (RFQ) IS AGREED BUT PENALTY CLAUSE IS NOT AGREED.	10% OF THE BASIC MATERIAL VALUE.
				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.
				IF BOTH DELIVERY & PENALTY NOT AGREED, AS PER BHEL TERMS.	10% OF THE BASIC MATERIAL 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	PERFORMANCE 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.





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 & Omissions 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 its 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)**

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**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 /  
PERFORMANCE BANK GUARANTEES**

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 be 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 : (Executive referred in PO)  
  
DGM/Purchase, Purchase Dept., NEB IIInd (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 SI 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 SI 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 SI 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.**

<b>SNo</b>	<b>Country</b>	<b>Air Ports</b>
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, Manihem, Nurnberg, Hamburg, Stuttgart, 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.**

<b>SNo</b>	<b>Country</b>	<b>Air Ports</b>
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 BETWEEN 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 CURRENCY.
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.**

**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.

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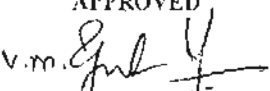
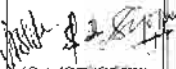
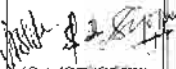
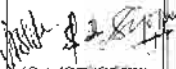
**Annexure-B**

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.

<b>SEARP (SRF) Clause No</b>	<b>Detail</b>
	<b>Name &amp; address of the firm</b>
<b>1.0</b>	<b>Products/ Systems / Services being considered for</b>
<b>2.0</b>	<b>General Information</b>
2.2	Name of Chief Executive
2.3	Details of authorized signatory
<b>3.0</b>	<b>Ownership Information</b>
3.1	Type of firm
3.2	Nature of Business <ul style="list-style-type: none"> <li>• <i>Attach authorization letter and agency agreement from Principal (from whom capital equipment is procured)</i></li> <li>• <i>Attach copy of declaration from Foreign Principal for total guarantee/ warranty of indigenous supplies</i></li> </ul>
3.3	Year of establishment
3.4	Year of commencement of business
<b>4.0</b>	<b>Registration particulars</b>
4.1	Permanent Account No.
4.2 / 4.3	Sales Tax / TIN no
4.6	Service tax no. (in case of E&C)
<b>5.0</b>	<b>Organisational strength</b>
<b>6.0</b>	<b>Other particulars</b>
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
<b>9.0</b>	<b>Financial information</b>
9.6	Sales/ Turnover details of last 3 years (or from the date of incorporation whichever is less )

---X---

			Ref.: CE / 409-416 / TSS-VMS / OT						
			REV. : 00						
<p style="writing-mode: vertical-rl; transform: rotate(180deg);"> <b>COPY RIGHT AND CONFIDENTIAL</b>          THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED . IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.       </p>		<h2 style="margin: 0;">PURCHASE SPECIFICATION FOR TURBO SUPERVISORY SYSTEM (TSS) &amp; VIBRATION MONITORING SYSTEM (VMS)</h2>	PAGE : 01 of 02						
	REVISION :		APPROVED  (VVM/TVV)						
			<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 33%;">PREPARED</th> <th style="width: 33%;">ISSUED</th> <th style="width: 33%;">DATE</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">             (SA/SP/SKT)         </td> <td style="text-align: center;">409-416</td> <td style="text-align: center;">29/06/13</td> </tr> </tbody> </table>	PREPARED	ISSUED	DATE	 (SA/SP/SKT)	409-416	29/06/13
PREPARED	ISSUED	DATE							
 (SA/SP/SKT)	409-416	29/06/13							



**Purchase Specification for  
Turbo Supervisory System (TSS) &  
Vibration Monitoring System (VMS)**

Ref.: CE / 409-416 / TSS-VMS / OT  
REV.NO.: 00  
PAGE : 02 of 02

**CONTENTS**

<b>SECTION</b>	<b>DESCRIPTION</b>	<b>REFERENCE NO.</b>
<b>A</b>	<b>GENERAL INSTRUCTIONS TO BIDDERS</b>	<b>CE/409-416/TSS-VMS/GI</b>
<b>B</b>	<b>PRE-QUALIFICATION REQUIREMENTS</b>	<b>CE/409-416/TSS-VMS/PQR</b>
<b>C</b>	<b>SPECIFICATION FOR TSS &amp; VMS OF WBPDCI – SAGARDIGHI PROJECT</b>	<b>CE/409-416/TSS-VMS/SGD</b>
<b>D</b>	<b>SPECIFICATION FOR VMS OF LALITPUR PROJECT</b>	<b>CE/409-416/TSS-VMS/LTP</b>
<b>E</b>	<b>SPECIFICATION FOR TSS &amp; VMS OF DVC-BOKARO PROJECT</b>	<b>CE/409-416/TSS-VMS/BOK</b>



# SECTION - A

Ref.: CE / 409-416 / TSS-VMS / GI

REV. : 00

PAGE : 01 of 02

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## GENERAL INSTRUCTIONS TO BIDDERS

REVISION :

APPROVED

*v.m. Gulati*  
(YVM / TVV)

PREPARED

ISSUED

DATE

*SA/SP/SKT*  
(SA/SP/SKT)

409-416

29/06/13



**Purchase Specification for  
Turbo Supervisory System (TSS) &  
Vibration Monitoring System (VMS)**

Ref.: CE / 409-416 / TSS-VMS / GI  
REV.NO.: 00  
PAGE : 02 of 02

**GENERAL INSTRUCTIONS 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 Turbo Supervisory System ( TSS ) for Steam Turbine & Generator of rating 210 MW and above, alongwith Vibration Monitoring System ( VMS ) for certain critical Pumps & Fans with their respective motors. This includes Analysis and Diagnostics packages for both TSS and VMS above.
  - 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 documents, BHEL shall open Bidder's Technical offers as per CI 2.0 of above for evaluation. In the event of acceptance of Bidder's technical offers, the names of such Bidders alongwith details provided by them for PQR and details of Technical offers , shall be submitted to Endusers/Customers for their acceptance/approval. Commercial bids of only accepted/approved Bidders by Endusers/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/TSS-VMS/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/TSS-VMS/PQR / CI BB of Section B" marked on it.
    - cc.** Technical offers/proposals for three Projects, whose requirements are mentioned in Sections C, D & E will be submitted in three separate covers with Project names & 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 Endusers/Customers, Vendor shall accompany BHEL representative for discussions.
-



Ref.: CE / 409-416 / TSS-VMS / PQR

# SECTION - B

REV. : 00

PAGE : 01 of 02

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# PRE-QUALIFICATIONS REQUIREMENTS

REVISION :

APPROVED

*(Signature)*  
(YVM / TVV)

PREPARED

ISSUED

DATE

*(Signature)*  
(SA/SP/SKT)

409-416

29 /06/13



**Purchase Specification for  
Turbo Supervisory System (TSS) &  
Vibration Monitoring System (VMS)**

Ref.: CE / 409-416 / TSS-VMS / PQR  
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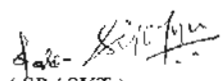

**AA. Pre-Qualification Requirements ( PQR ) of Bidders for TSS & VMS, as a part of Offer :**

- 1.0 Submit Reference List of Projects wherein offered system is supplied & commissioned, alongwith details of machines & similar measurements and Year of Commissioning of the system specified in Section C, D & E.
- 2.0 Submit Satisfactory Performance Certificates for atleast two years as on date of opening of bid, from three end users or more (Power Plants with Steam turbine / Coal-fired boiler of rating of 210 MW & above for similar measurements indicated in Section C, D & E of this specification), for verification.
- 3.0 Submit List of Projects ( rating of > or = 210 MW Power Plants ) for which Erection & Commissioning has been carried out by Vendors / Subsidiary / Authorised Indian representative for last Three years & minimum Five systems.
- 4.0 Submit duly-filled Source Request Form ( SRF ), which shall be downloaded by Bidder from our website "www.bhel.com".
- 5.0 Vendors who are making offer for this tender shall have authroised representatives in India for support related to Documentation, Erection , Commissioning & any other co-ordination work.

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

- 1.0 Technical literature / Manuals of offered Sensors , Power supply & Vibration modules etc., and Analysis & Diagnostic systems.
- 2.0 Unpriced Purchase Order copies
- 3.0 Reports of successful erection & commissioning Protocols & Minutes of the meetings which includes Analysis & Diagnostics systems also.
- 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 System , Stocking of Spares..etc.. Submit these details.
- 7.0 Bidders shall submit following Type test reports for Electronic cards of offered system:
  - 7.1 Surge withstanding capacity (SWC) as per NSI 37.90 / IEEE-472
  - 7.2 Dry heat test as per IEC-68-2-2 or equivalent
  - 7.3 Damp heat test as per IEC-68-2-3 or equivalent
  - 7.4 Vibration test as per IEC-68-2-6 or equivalent
  - 7.5 Electrostatic discharge tests as per EN 61000-4-2 or equivalent
  - 7.6 Radio frequency immunity test as per EN 61000-4-3 or equivalent
  - 7.7 Electromagnetic Field immunity test as per EN 61000-4-3 or equivalent.
- 8.0 If Bidder is not Original Equipment Manufacturer (OEM), than Bidder to include Authorisation letter from OEM for Design, Engineering, Manufacture, Testing, Supply, Erection, Commissioning and Servicing of the offered System. This Authorisation letter provided by OEM to Bidder shall indicate the Type and Duration of the agreement.

**Important 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 specifications.

	 A4-10	<h1>SECTION - C</h1>	Ref.: CE / 409-416 / TSS-VMS / SGD		
			REV. : 00		
			PAGE : 01 of 19		
<b>COPY RIGHT AND CONFIDENTIAL</b> THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BIHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.	<h2>SPECIFICATION FOR TSS &amp; VMS OF WBPDCL-SAGARDIGHI PROJECT</h2> <p>Consultant : DCPL , Kolkata</p>				
	REVISION :	APPROVED  ( SP / SKT )			
		PREPARED  (SP/DC)	ISSUED 409-416	DATE 27/ 06/13	



**Purchase Specification for  
Turbo Supervisory System (TSS) &  
Vibration Monitoring System (VMS)**

Ref.: CE / 409-416 / TSS-VMS / SGD  
REV.NO.: 00  
PAGE : 2 of 19

**Project Synopsis in brief : WBPDCCL – Sagardighi TPP Units 3 & 4 (2x500 MW)**

Location: Sagardighi, Murshidabad district, West Bengal, India  
Access Road: 13 Km north of Sagardighi town. 20 Km from NH-4 in Murshidabad district.  
Nearest Railway station: Murshidabad  
Nearest Airport: Kolkata  
Nearest Sea Port: Kolkata

**AA SCOPE:** Vendor shall offer Turbine Supervisory System (TSS) for Turbine-Generator Exciter and Vibration Monitoring System (VMS) for Plant Auxiliaries namely Boiler Feed Pump – BFPs & Motors, Cond. Extr. Pump – CEPs & Motors, DMCW Pumps & Motors, ACW Pumps & Motors, Mill Motors, ID Fans & Motors, FD Fans & Motors, PA Fans & Motors alongwith **Analysis and Diagnostics** for all these Machines covered under TSS and Plant Auxiliaries (VMS) for **WBPDCCL Sagardighi – 2 x 500 MW** Power plant. **Technical requirements for the above machines are as per Cl. BB of this Purchase specification.** Scope of Supply shall include Engineering, Testing, Erection & Commissioning activities as per this specification.

**BB Technical Requirements:**

**1.0 Turbine Supervisory System ( TSS ) :**

**Measurement required for TSS shall be as per Table-1**

Vendor to indicate the IP class to which the sensors are complied.

**1.1 Absolute Bearing Vibration Measurement:**

For measurement of Vibration, Piezo-Velocity type sensor complete with connecting leads, terminal connectors are to be provided at all bearing as per Annexure-1. The sensors shall meet at least following specifications: -

- Freq.range : 5 Hz to 5 KHz
  - Operating temp. : 0 – 120 Deg . C
  - Environmental Protection : Hermetically sealed
  - Sensitivity : 100mV /inch/sec, ± 5%
- M6 Mounting Stud to be supplied

The Mounting Blocks / Pads required to fix these sensors on Generator Bearings are also to be included in the Offer. Vendor to mention Quantity of such Mounting Blocks/Pads required to be supplied. The mounting arrangement for Turbine & Exciter Bearings shall be in line with the Diagram as per Annexure – 2. (This mounting arrangement for Bearing 1,2,3,4 and 7 is supplied by BHEL NOT in Vendor's scope. The Mounting arrangement for Generator i.e bearing 5,6 to be supplied by Vendor as per typical drawing in a Annexure-3. Vendor shall make the exact drawing based on Visit to site). The length of the cable from Sensor up to nearest local junction box (JB also included in the scope of vendor) shall be equal to or more than 9 meters.

The Sensor integral cable and the extension cable shall be Teflon insulated and to meet the high operating temperature > 205<sup>0</sup>C requirement of the respective sensor.

**1.2 Relative Shaft Vibration Measurement :**

For measurement of Relative Shaft Vibration, Non-contact type sensors with connecting leads and terminal connectors are to be provided at all bearing as per Annexure-1.



**Purchase Specification for  
Turbo Supervisory System (TSS) &  
Vibration Monitoring System (VMS)**

Ref.: CE / 409-416 / TSS-VMS / SGD  
REV.NO.: 00  
PAGE : 3 of 19

The sensors shall meet at least the following specifications: -

- Location of the sensor : Inside Bearing Casing
- Temp. range : 0 – 177<sup>0</sup> C
- Environmental protection : Encapsulated/ Hermetically sealed.
- Frequency Range : 10 Hz to 10 KHz.
- Sensitivity : 8 mV/um, ± 5%

Reverse mount sensors: For Turbine & Exciter Brg (Brg 1, 2,3, 4 & 7)

Forward mount sensors: For Generator Brg (Brg 5 & 6).

Typical Dimension of Sensor: Thread Size M10 x 1  
Threaded Length : 30 mm  
Sensor Tip Diameter: 8 MM

The sensors shall be capable of operation in an atmosphere of oil fumes. The casing of the sensor shall be made of stainless steel and the measurement shall not be affected by the presence of oil in the air gap.

The Sensor integral cable and the extension cable shall be teflon insulated and to meet the high operating temperature >205<sup>0</sup> C requirement of the respective sensor.

The Mounting Blocks / Pads required to fix these sensors on Generator Bearings are also to be included in the Offer. Vendor to mention Quantity of such Mounting Blocks/Pads required to be supplied. The mounting arrangement at Turbine & Exciter Bearings shall be in line with the Diagram as per Annexure – 2. (The mounting arrangement NOT in Vendor's scope). The length of the cable from Sensor up to nearest local junction box (JB also included in the scope of vendor) shall be equal to or more than 9 meters.

### 1.3 Absolute Shaft Vibration Measurement :

The necessary Computation Circuitry for the calculation of the Absolute Shaft Vibration with the Absolute Bearing Vibration and Relative Shaft Vibration at each location is to be provided. The Details of such computation is to be furnished.

### 1.4 Rotor Expansion HPT & IPT :

- Type : Non-contact eddy current
- Temp. Range : 0 – 177<sup>0</sup>C.
- Environmental protection : Encapsulated/ Hermetically sealed
- Location of the sensor : Inside the bearing casing.
- Sensitivity : 0.4 V/mm +/-5%
- Calibration Matrl : JIS SCM440(AISI4140 Steel) Flat Surface or VCL140Steel

Typical dimension of Sensor shall be as follows

- Thread Size : M24 x1.5
- Threaded Length : 30 MM
- Sensor tip Diameter : 8 MM

Overall Body Length (Threaded + Unthreaded + Sensor tip etc.) not to exceed 125 MM for Sensor

The sensors shall be capable of operation in an atmosphere of oil fumes. The casing of the sensor shall be made of stainless steel and the measurement shall not be affected by the presence of oil in the air gap. The Sensor integral cable and the extension cable shall be teflon insulated and to meet the high operating temperature > 205<sup>0</sup> C requirement of the respective sensor. Mounting Bracket required shall be in scope of Vendor. Due to Space Limitation, only one sensor measurement is possible for HPT and for IPT two coil measurement is possible.



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**1.5 Overall expansion HPT and IPT:**

Type	:	LVDT.
Temp. Range	:	0 – 120°C.
Environmental protection	:	Weatherproof Enclosure.
Location of the sensor	:	Outside the bearing casing.

The mounting bracket required shall be included in the scope of vendor. The Sensor integral cable and the extension cable shall be Teflon insulated and to meet the high operating temperature >205 degc requirement of the respective sensor. Computation circuitry for the calculation of the HPDE with Rotor Expansion and Over-all expansion to be included.

**1.6 Differential Expansion HPT , IPT and LPT :**

Type	:	Non-contact eddy current.
Temp. Range	:	0 – 177°C.
Environmental protection	:	Encapsulated/ Hermetically sealed
Location of the sensor	:	Inside the bearing casing.
Sensitivity	:	0.4 V/mm +/-5%
Calibration Material	:	JIS SCM440(AISI4140 Steel) Flat Surface or VCL140Steel
Typical dimension of sensor	:	Thread size M30 x 1.5 Thread Length 40 MM Tip Diameter 25 MM

Overall body length of sensor shall not exceed 110 MM

The sensors shall be capable of operation in an atmosphere of oil fumes. The casing of the sensor shall be made of stainless steel and the measurement shall not be affected by the presence of oil in the air gap. The Sensor integral cable and the extension cable shall be teflon insulated and to meet the high operating temperature (>205 DegC) requirement of the respective sensor. Mounting bracket for LPDE shall be in scope of Vendor. Computation circuitry for the calculation of the HPDE and IPDE with rotor expansion and overall expansion to be included.

**1.7 Axial Shift :**

Type	:	Non-contact eddy current.
Temp. Range	:	0 – 177°C.
Environmental protection	:	Encapsulated
Location of the sensor	:	Inside the bearing casing.
Sensitivity	:	04mV/microns +/- 5%
Calibration Matrl	:	JIS SCM440(AISI4140 Steel) Flat Surface or VCL140Steel
Typical Dimension of snesor	:	Thread Size M14 x 1.5 Thread Length 25 MM Tip Diameter : 11.3 MM

Overall Body length of, sensor shall not exceed 110 MM

The sensors shall be capable of operation in an atmosphere of oil fumes. The casing of the sensor shall be made of stainless steel and the measurement shall not be affected by the presence of oil in the air gap. The mounting bracket required shall



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be included in the scope of vendor. The Sensor integral cable and the extension cable shall be teflon insulated and to meet the high operating temperature 205<sup>0</sup> C requirement of the respective sensor. All three sensors to be mounted in one bracket. Three different modules to be used for monitoring and different cables to be used from JB to cabinet.

**1.8 Reference Phase Measurement :**

For phase reference measurement, one Non-contact eddy current type sensor and matching converter shall be supplied. The converter will be located near the TG set. The sensor will be mounted in bearing No 2 of the turbine. A key phasor slot of 2mm-depth and 26 mm width is made on a collar provided in bearing No 2. The sensors shall be capable of operation in an atmosphere of oil fumes. The casing of the sensor shall be made of stainless steel and the measurement shall not be affected by the presence of oil in the air gap. The exact sensor mounting arrangement will be finalised after award of contract. The mounting bracket required shall be included in the scope of vendor.

**LIST OF MEASUREMENT FOR TSS : TABLE-1**

Sl No	Measurement	Type	No. of Measurements	Range of Measurement	Remarks
01	Absolute Bearing Vibration (X & Y)	Seismic/velocity	14	0-200 $\mu$ peak to peak	
02	Absolute & Relative Shaft Vibration(X & Y)	Non-contact	14	0-800 $\mu$ peak to peak	
03	Rotor Expansion HPT	Non-contact	1*	0 – 25 mm	Sensor single coil
04	Overall Expansion-HP Casing	LVDT	1*	0 -25 mm	
05	Rotor Expansion IPT	Non-contact	1*	0 - 21 mm	Sensor Two Coil
06	Overall Expansion – IP Casing	LVDT	1*	0 -20 mm	
07	HP diff expansion	Computed	-	-8/0/+12 mm	
08	IP diff expansion	Computed	-	-8/0/+12 mm	
09	LP Differential Expansion	Inductive/ Non contact	1 **	-15/0/+48 mm	Sensor two coil
10	Axial Shift	Non contact	3***	-1.5/0/+1.5 mm	

\* The signals of Overall Expansion and Rotor Expansion to be used to Compute the Differential Expansion of HPT and IPT which will have the Measuring Range of -8/0/+12 mm.

\*\* A Conical Collar with Dual Ramp measuring surface at an angle of 14.3 Deg to Horizontal is provided.

**\*\*\*The three signals of Axial Shift measurement shall be connected to three different monitors. Three different cable shall be used for interconnection of these sensors from JB to Panel.**



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**Apart from Table-1 above** Vendor to Consider Analysis and Diagnostic for BFPDT Signals as listed in Table-2 of this Purchase Spec. Necessary Hardware for interfacing these RAW Buffered Signals from M/s Shinkawa VM-5 System shall be considered

**Table-2**

<b>BFPDT VIBRATION SIGNALS TO BE CONSIDERED FOR ANALYSIS AND DIAGNOSTICS FOR BFPDT-A</b>		
<b>KKS</b>	<b>DESCRIPTION</b>	<b>RANGE</b>
XKD14CY042A	GEAR BOX O/P VIBRN(LO SPD)	0-200 microns
XKD14CY042B	GEAR BOX O/P VIBRN(LO SPD)	0-200 microns
XKD11CY041A	GEAR BOX(HI SPD) VIBRN(FJB)	0-200 microns
XKD11CY041B	GEAR BOX (HI SPD) VIBRN(FJB)	0-200 microns
XAD12CY041A	TURBINE FJB REL SFT VIBRN	0-200 microns
XAD12CY041B	TURBINE FJB REL SFT VIBRN	0-200 microns
XAD12CY042A	TURBINE RJB REL SFT VIBRN	0-200 microns
XAD12CY042B	TURBINE RJB REL SFT VIBRN	0-200 microns
XAD12CY021	Key Phasor	
<b>BFPDT VIBRATION SIGNALS TO BE CONSIDERED FOR ANALYSIS AND DIAGNOSTICS FOR BFPDT-B</b>		
<b>KKS</b>	<b>DESCRIPTION</b>	<b>RANGE</b>
XKD24CY042A	GEAR BOX O/P VIBRN(LO SPD)	0-200 microns
XKD24CY042B	GEAR BOX O/P VIBRN(LO SPD)	0-200 microns
XKD21CY041A	GEAR BOX(HI SPD) VIBRN(FJB)	0-200 microns
XKD21CY041B	GEAR BOX (HI SPD) VIBRN(FJB)	0-200 microns
XAD22CY041A	TURBINE FJB REL SFT VIBRN	0-200 microns
XAD22CY041B	TURBINE FJB REL SFT VIBRN	0-200 microns
XAD22CY042A	TURBINE RJB REL SFT VIBRN	0-200 microns
XAD22CY042B	TURBINE RJB REL SFT VIBRN	0-200 microns
XAD22CY021	Key Phasor	

**Note: Sensors/Drivers/Monitors for above BFPDT measurements are not part of this scope**

**1.9 Other items :**

Following shall be offered: Sensor Mounting blocks, Fasteners, Junction box with terminals, flexible conduits...etc..

**1.9.1 Measuring Attachment (TRANSDUCER):**

The Measuring Attachment Unit shall be suitable for mounting near the turbine. The operating temperature range shall be 0 to 85 DegC and environment protection class of IP 55 or better.

The connection between the sensor and measuring attachment will be made with a cable, which forms an integral part of the sensor. The length of such a cable shall be at least 9 meters (1 meter Integral+8 meter extension). Suitable protection for the cable like Protective hose/ Armouring to be provided the size of which shall meet the cable seal Requirements as per Cl 1.9.10. The connectors to be protected from the Environment & Electrical isolation.



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**1.9.2 Local Junction Box (Metal):**

Required No. of Local JB's made of sheet steel , 3mm thick CRCA sheet are to be included in the scope of supply. The JB's shall be of Standard Design of Vendor and conform to IP 65 class of protection and shall be provided with adequate No. of cable glands and Terminal Blocks. Separate JB for each of the Bearing shall be provided. The JB arrangement drg is to be furnished. JB color shall be Exterior = RAL 7032 ,Interior = Brilliant White. Type Test for IP-65 to be included.

**1.9.3 Electronic Racks:**

(i) The Electronic Transmitter modules, to drive the various sensors as detailed in Table-1 above shall be housed in adequate No of 19" Instrument racks. The hardware design shall allow online replacement of monitors without isolation/disconnection of input/output cable connections. The Instrument racks and necessary power.

(ii) Power Supply:

The equipment shall work with 24V +/-1V DC dual redundant power supply feeder. The Common Power Supply to electronic rack shall be Redundant such that on failure of one power supply(Power Supply modules in each rack shall be redundant), the other power supply shall cater to the requirement of the equipment. All the components required to achieve this shall be supplied, mounted and necessary wiring to be done. Any deviation/alternate scheme proposed to be clearly brought out in the offer.

(iii) The Microprocessor based Electronic Transmitter modules shall not have more than 4 Channels per module. The Transmitter modules shall receive the sensor signals and give buffered 4 - 20mA signal FOR EACH CHANNEL AND COMPUTATION CHANNEL. One 4-20 mA output signals shall be provided from each channel and computing channel of modules for hardwired link to DCS

Transmitter module shall have in built indication to show at least,

- Alarm indication
- Module Healthy / Fault indication.
- The transmitter module shall have facility to set the Measuring Range
- No separate alarm contacts are envisaged for individual measurement.
- One no each potential free contacts to be provided for system failure,(rack wise or system wise as per manufactures standard practice) power supply OK/failure for hooking up the status to DDCMIS. The rating of the contact shall be 60V DC, 3 Watts.
- Vendor to indicate the available feature in their system for indication of measured values on rack/module.
- 4-20 mA signal output shall be less than 4 mA for related sensor failure.
- Separate monitor to be allotted for each bearing measurement.

**1.9.4 Calibration/ Configuration Equipment:**

One set of Calibration Kit and Portable Shaker table for both the units shall be included in the offer.

**1.9.5 Link to DDC/DAS:**

All the measured signals and the other Related Parameters shall be hooked up to the DAS to be supplied by BHEL through redundant RS 232 MODBUS link. Necessary Hardware and Software Interface required to be included in the offer and the details of Signal Transfer Protocol to be furnished.

**1.9.6** The Instrument rack shall have 10% of Rack Space free for any future expansion.

**1.9.7** Spare 10% or 2 nos (whichever is more) channels of each variety of module shall be provided in the TSS. 10% or minimum one number of each variety of I/O module to be provided wired in the rack. 10% empty slots to be kept in the rack



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**1.9.8** All the signals coming from field & going to other instruments shall be terminated on cage clamp type terminal blocks.

**1.9.9 Cables:**

All Instrumentation Cables (0.5 sq.mm) shall be Annealed Tinned Copper conductor provided with Individual Pair Shielding in addition to Overall Shielding and armored. The Cables shall be FRLS type twisted multi-pair cables or triad/multi-triad cables supplied in Drum lengths of 500mtr(+/-5%). All Instrumentation Cables shall be suitable for Continuous operation at 70 Deg.C and shall at least meet the following specifications:

Mutual Capacitance at 0.8KHz	:	120 nF/Km
Conductor resistance(max)	:	73.4 ohm/Km
Insulation resistance	:	100 M Ohm/Km
Cross-talk at 0.8 KHz	:	60 dB
Characteristic impedance (max)	:	320 Ohms at 1 KHz
Attenuation at 1 KHz	:	1.2 dB/Km
Voltage Grade	:	225V
Colour Code	:	As per VDE0815 STD

Cables between local JB'S to System racks, heat resistant hose, converters and extender cables are in Vendor's scope. Vendor to consider about 150 meter Route length between local JB to system rack. Vendor to furnish full details of the cable being offered. All the cables shall have PVC insulation for conductor and PVC with FRLS properties for both inner and outer sheaths. Vendor to consider 20% of extra length of Cables.

**1.9.10 Cable Seals:**

Necessary Cable seals meeting suitable environment conditions of medium, temperature and pressure (at least 25 psi) shall be included for Routing the cables from inside the bearing to outside. The Seals shall be suitable for M12x1.5 tapped hole of length 25 mm provided on the Bearing Casing. Also any other items required to complete the equipment /system shall be included by the vendor. This item is required for following measurements.

- Key Phase
- Axial Shift
- Rotor expansion of HPT & LPT
- LPDE

**1.9.11 Panel : TSS Panel will be supplied by BHEL and Monitors with Rack will be mounted at Site by BHEL.**

**1.9.12 Teflon insulated SS flexible conduit to be used from sensor to JB routing.**



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**2.0 Vibration Monitoring System ( VMS ) for Auxiliaries :**

**2.1 Requirement for VMS Hardware :**

- (i) Microprocessor based Vibration Monitoring System shall be offered for Monitoring the Vibration levels of various Machines or Plant auxiliaries of a Power plant. The Machines to be monitored for Vibration levels are Pumps (BFP, CEP, ACWP and DMCWP), Fans (ID, FD and PA), Motors (of Fans, Pumps and Mills) detailed in Machine Data ref. CE/416/SAGARDIGHI/VMS-D / Page 12 of 19 of this specification.
  - (ii) The measurement of Vibration levels shall be carried out on the Bearing housings of the above machinery in both Horizontal & Vertical planes ( X – Y planes ).
  - (iii) The offered Vibration Monitoring System shall as a minimum consists of Vibration Sensors & Phase measurement sensors with low noise cables of 10 meters length in SS flexible conduits, Local terminal box / Junction boxes, necessary per-amplifier/ electronics mounted in local weather –proof boxes, Vibration monitors, Monitor Racks, Power supplies, integrating units, Signal conditioning devices, sensor-mounting accessories, interconnecting cables, calibration equipment, Panel/s ..etc..
  - (iv) Sensors shall be Velometer type & selected based on the service requirement / parameters w.r.t machine Speed and the Vibration ranges, for each of the Machine. The Project-specific details of various machines have been provided at Machine Data ref. CE/416/SAGARDIGHI/VMS-D / Page 12 of 19 of this specification. Offered sensor shall be with sensitivity of  $\pm 5\%$ .
  - (v) The offered Sensors with mounting accessories shall be mounted on Bearing housing of the Machine, in Horizontal and Vertical directions. Weatherproof housing shall be provided for these sensors and shall be suitable for field conditions of the Power plant. Vendor to note that the Cables from Sensor-Local Junction box in field to Vibration monitoring System Panel/s in Main control room shall be provided by BHEL which is 4Pair x0.5 Sq. mm – PVC, FRLS, Individual & Overall shielded Pair Copper Cable. 2Triad x 0.5 Sq.mm Individual & Overall shielded Pair Copper Cable will be provided by BHEL for Phase measurement sensors.
  - (vi) The offered Vibration Monitors shall be 2 to 4 channel with 4-20 mA output per channel. Independent potential free contacts shall be made available for high alarm & trip purposes for each channel being monitored. The Power supply in the Rack shall be Redundant power supply modules in each rack such that on failure of a single power supply, the power supply shall cater to the requirement of offered equipment. The output of each channel shall be in Velocity units and field programmable to Displacement units MODBUS / TCP IP output shall be provided from TSS & VMS as soft link to DCS.
  - (vii) The front of the offered monitors shall have digital bar graph display for the measured Vibration levels and also have facility to connect another device to analyse the Vibration, of each channel. The front face of these monitors shall have status indications for healthy conditions for Sensor circuit, monitor circuit and power supply. Set point indication with set point adjustment facility for setting Alarm and Trip levels shall be provided. Offered monitors shall be modular in construction, plug-in type and suitable for mounting in 19" Rack. A facility shall be
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available from front of mounting rack for functional checking of monitors with inhibition of alarm & trip contact outputs during test. Alarm inhibition shall also be provided during start-up. If in case the offered monitors does not have digital bar graph display, then Panel PC / Panel LCD display of minimum 15 inch display size shall be offered per Unit wise for digital bar graph display of the measured vibration levels.

- (viii) Offered Vibration monitoring equipment shall be functionally tested for circuit continuity and output response. All the components & interconnection cables shall be tested to ensure compliance with the specification requirement & all other applicable codes & standards.
- (ix) For Analysis & Diagnostic package along with VMS, Sensors and related Electronics shall be offered for measurement of Phase angle / speed of the Machine. A Key-slot of dimension "30 mms x 15 mms x 3 mms" typically, is provided on the Machine-Shaft / Coupling. Suitable mounting brackets for these sensors shall also be offered.
- (x) Vibration Monitors shall be offered / grouped / assigned in such a way that the channels being monitored for Vibration for a machine will not be in same monitor. Eg..BFP DE – X & Y and BFP NDE – X & Y channels, will be in different vibration monitor...etc..
- (xi) Vendor to note again that the sensors & monitors offered finally shall be as per Machine Data ref. CE/416/SAGARDIGHI/VMS-D / Page 12 of 19 of this specification. Spare 10% channels of each variety wired in the rack shall be provided in the VMS. 10% empty slots to be kept in the rack. Any revision in selected / offered models of sensors & monitors during detailed Engineering shall be done without any Commercial implications.

## **2.2 Panel for above equipment :**

Vendor shall supply the panel for VMS as per below specification:

- Panel shall be of size 800 mm X 800 mm X 2415 mm H ( including top canopy- 60 mm + Bottom frame 50 mm + Antivibration pad 15mm ) in mm
- Panel shall be made up of 2mm thick CRCA steel sheet.
- Anti-vibration pad of about 15 mm shall be provided.
- Panel protection class shall be IP – 32; Panel height shall be 2415 mms.
- Door shall be provided in the front & rear sides, shall be of 2 mm thick CRCA steel sheet.
- 3 point locking system
- Paint shade/s shall be :
  - Exterior (front & rear) = RAL 7032, Semi-Glossy
  - Exterior (sides) = RAL 7032, Semi-Glossy
  - Interior = Brilliant White (Glossy)
- Panel painting shall be powder coated 100 microns thick or more.
- Cutout with cable-gland plates shall be provided on the bottom of the Panel, for Cabling.
- Suitable Lifting Hooks shall be provided on the Panel.
- Provision shall be made in the Panel to accept two power supply feeders with required MCB's.
- Terminals shall be Clip-on type for cable termination. 20 % spare terminals shall be offered.
- Illumination shall be provided in the panel.



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**2.3 Other items :**

Following shall be offered:

- Vibration-Sensor Mounting blocks,
  - Phase-angle measurement-Sensor with Mounting brackets, required Fasteners,
  - Field Junction box with Terminals...etc.. The offered field Junction boxes (JB) shall be with IP- 65 protection class and vendor shall furnish the Type test reports for acceptance. The material of these Junction boxes shall be CRCA Sheet steel of 3 mm. Paint shade/s of JB shall be as below:
    - Exterior = RAL 7032,
    - Interior = Brilliant White
  - One (1 no.) Portable Data Collector shall be offered, common for both Units. Instrument shall be capable for machine condition monitoring and analyzing the data. Instrument shall be microprocessor based and ready for use in harsh environment. Integral LCD display shall provide the necessary display of readings & spectral data. Minimum 02 channels along with additional input for phase reference measurement shall be available with the instrument. Instrument shall include necessary accelerometers and other devices with accessories for collection of machine parameters. A long life Ni-Cd battery pack shall be offered. Replacement of battery shall not lead to loss of stored data.
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**Machine Data for Auxiliaries**

Machine Data of SAGARDIGHI (2 x 500 MW) TPS:						Ref.: CE/416/SAGARDIGHI/VMS-D					
Sl. No.	Machine	Machine Qty. per Unit	Machine Qty. for 2 Units + common	No. of Bearings for monitoring vibration (in X & Y direction)	Installation (Horizontal / Vertical)	Machine RPM	Alarm Level (ref. Note 2)	Trip Level (ref. Note 2)	Mounting Details	NO OF SENSORS total for 2 units	Key phasor sensors total for 2 units
1	TD Boiler Feed Pump - TDBFP	2	4	2	Horizontal	800-6500	11 #	18 #	C	16	4
2	MDBFP	1	2	2	Horizontal	800-6500	11 #	18 #	C	8	2
3	MDBFP - Motor	1	2	2	Horizontal	1500	4.5 **	7.1 **	B	8	2
4	Condensate Extn. Pump - CEP	3	6	1	Vertical	1485	11 #	18 #	A	12	6
5	CEP - Motor	3	6	2	Vertical	1500	4.5 **	7.1 **	B	24	
6	ACW Pump	3	6	2	Horizontal	1500	7 **	10 **	A	24	6
7	ACWP - Motor	3	6	2	Horizontal	1500	4.9 **	8.5 **	A	24	
8	DMCW (SG) Pump	2	4	2	Horizontal	1500	7 **	10 **	A	16	4
9	DMCWP (SG) - Motor	2	4	2	Horizontal	1500	4.9 **	8.5 **	A	16	
10	Mill Motor	9	18	2	Horizontal	1000	4.5 **	7.1 **	B	72	18
11	ID Fan	2	4	2	Horizontal	100-580	9.9**	19.8**	E1	16	4
12	IDF - Motor	2	4	2	Horizontal	600	4.5 **	7.1 **	B	16	
13	FD Fan	2	4	1	Horizontal	990	6.3**	12.6**	E	8	4
14	FDF - Motor	2	4	2	Horizontal	1000	4.5 **	7.1 **	B	16	
15	PA Fan	2	4	1	Horizontal	1490	6.3**	12.6**	E	8	4
16	PAF - Motor	2	4	2	Horizontal	1500	4.5 **	7.1 **	B	16	
	<b>Grand Total</b>	<b>41</b>	<b>82</b>							<b>300</b>	<b>54</b>

Note:

1) Mounting Details:  
A: 60 x 60 x 10 mm pad on bearing housing  
B: 60 mm cube vibration pad welded on both end shields  
C: 40 x 100 mm machined surface provided on DE & NDE bearing housing  
D: 60 x 60 mm machined surface provided on the thrust bearing + Block provided on Motor NDE side  
E / E1: 80 x 80 mm / 70 x 80 mm machined pads screwed with bearing housing respectively.

2) \*\* mm/sec - Peak ; # mm/sec - rms  
3) Key slot 30 mm (L) x 15 mm (W) x 3 mm (D) are provided on connecting coupling hubs  
4) KKS Tag nos. of sensors will be provided during detailed engineering



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**3.0 Analysis Requirements :**

**3.1** Microprocessor/ Computer based Analysis Unit, with required software, is to be offered to achieve the following functions as minimum.

- Storage and comparative analysis of vibrations
- Spectrums and Spectral Alarms
- Generation / analysis of bode plot
- Orbit plot & Polar plot
- Time waveform
- Nyquist plot
- Shaft center line plot for TG
- Cascade
- Waterfall plots
- Transient data ( during Start-up and Shut-down )

Vendor shall furnish the List of process signals required for further analyzing vibration data and include necessary hardware and software for accepting such signals from BHEL system.

**3.2** The FFT analyzer units shall have a frequency range from 1Hz to 20 kHz, Spectrum resolution of 600 lines minimum. Provision for selecting high and low resolution display shall be provided. The scan rate shall be specified by vendor.

**3.3** The FFT analyzer offered may be an independent unit or a part of Monitor rack/s housing input modules ..etc. ( discussed in Clauses 1.0 & 2.0 of this Specs. ) and in-line with the manufacturer's practice.

**3.4** The output from FFT analyzer unit and/or Monitor rack/s above shall be connected to a computer system to perform analysis of the Vibration data of the machine/s ( discussed in Clauses 1.0 & 2.0 of this Specs. ).

**3.5** The Computer for analyzer unit shall consist at-least of following configuration.

- PC/server of reputed make (with 22" TFT monitor) and Latest model and version.
- Intel Xeon /Quad Core Processor
- Minimum 4 GB RAM
- Min 500 GB hard disc with mirroring type hard disc to ensure data integrity.
- Combo Drive
- Master Slave Card for Time synchronization
- Colour Laser printer upto A4 printing. Ref Models (XEROX Phaser 6500 & equivalent or better)
- Network card.(2 No;s)
- Necessary Cables with accessories for inter connecting and connecting to TSS / VMS Panels and DCS/ DAS Panel/s. Software CDs with License/s.
- Anti-Virus Package to be included

Vendor shall clearly bring out in his offer the configuration proposed. Vendor shall ensure that the capacity of the analyzer unit is sufficient to meet the specification requirements of the points being monitored. Also a spare capacity of 20% points of measurement, for future expansion shall be provided. Vendor shall specify the type of communication

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between the offered FFT unit and Analyzer unit. Vendor shall clearly bring out in their offer the Data Backup and Security procedures. Necessary no. of Ethernet hubs, cables, etc., shall be included in the offer. All items required to make the system complete shall be included in the offer.

### 3.6 Configuration Requirements:

- 3.6.1 The offered Panels for TSS of TG, VMS for auxiliaries with FFT analyzer for TSS of TG, VMS for auxiliaries shall be located in Main Control equipment room.
- 3.6.2 Offered Computer hardware shall be located in Computer room near Main Control equipment room.
- 3.6.3 The distance between Panels in Main Control equipment room (3.6.1) & Computer room (3.6.2) is about 75 meters. Vendor shall offer FO Cable and accessories for interconnection between Panel and Computer.
- 3.6.4 Vendor to propose a detailed configuration diagram of the equipment to be supplied along with a list of equipment, which shall be approved by BHEL.

### 4.0 Diagnostics / Expert System Requirements:

Vendor shall utilize the Vibration data, Process information and Analysis data to provide Diagnosis and recommendations for machinery management, effectively. It shall be an extensive and accurate knowledge base to enable quick determination of the condition of a machine by providing alarm notification or advisories of the machinery malfunction. The offered system shall be able to specifically evaluate the available data while checking for the presence of the most frequently occurring machine malfunctions such as,

- High synchronous vibration
- Shaft bow / crack
- Fluid induced instability (Whirl and Whip)
- Radial pre-load forces (including misalignment)
- Vector change
- Rotor rub
- Loose rotating parts
- Electric motor non-uniform air gap
- Gear mesh problems, pump cavitations.



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## 5.0 Mandatory Spares

- 5.1 Probes with extension cable: 5 % of total quantity used in the system or minimum 2 (two) nos. whichever is more for each type and model
- 5.2 Signal converter/ Proximitors for Transducer system: 5 % of total quantity used in the system or minimum 2 (two) nos. whichever is more for each type and model
- 5.3 Rack mounted Monitors for Transducer system: 5 % of total quantity used in the system or minimum 2 (two) nos. whichever is more for each type and model
- 5.4 Rack Interface Module: 5 % of total quantity used in the system or minimum 2 (two) nos. whichever is more for each type and model
- 5.5 Configurable type Relay Output Modules: 5 % of total quantity used in the system or minimum 2 (two) nos. whichever is more for each type and model
- 5.6 Communication / Gateway Modules: 5 % of total quantity used in the system or minimum 2 (two) nos. whichever is more for each type and model
- 5.7 Rack Mounted Power Supply Modules: 5 % of total quantity used in the system or minimum 2 (two) nos. whichever is more for each type and model
- 5.8 Probes with extension cable & signal converter / Proximitors for axial shift: 3 nos.

Note:

1. Calculation shall be based on overall quantity of TSS & VMS scope for 2 Units.
2. In case of decimals value, next higher integer value shall be considered.
3. Unit prices of each item shall be indicated separately.

## 6.0 Following Vendors for the items listed , are approved by Enduser/Customer:

- |   |  |
|---|--|
| 6.1 Cabinet / Panel ( for VMS )               | - Rittal / Pyrotech  |
| 6.2 PC/Server & TFT Monitor ( for TSS & VMS ) | - DELL/HP  |
| 6.3 Fiber Optic Cable ( for TSS & VMS )       | - Akash Fiber, Birla Ericsson and Finolex.   |
| 6.4 FRLS Cables-Armoured (for TSS)            | - Advance Cable technologies, Bangalore<br>Polycab, Daman<br>Nikko , Kolkata<br>Habia Cables, Sweden<br>Delton, Faridabad<br>KEI Industries Ltd, Chennai<br>Universal Cables, Satna<br>Kerpen Cables, Germany<br>Lapp Cables, Germany<br>Thermo Cables, Hyderabad<br>Thermo Electric, Netherland/USA |

**Note : Anyother vendors other than above, shall be accepted subject to approval by Enduser/Customer.**



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**7.0 Quality Requirements ( common for TSS & VMS , Analysis / Diagnostic Systems ) :**

7.1 Following minimum test requirements to be met :

- Calibration report of Sensors for the selected / approved Range with curves shall be furnished.
- For Vibration Sensors, Frequency response curves and for Proximity probes, Gap v/s voltage data to be furnished. Sample reports shall be included as a part of Quality plan.
- Calibration report for LVDT Sensors to be furnished
- Calibration of Monitors for the approved Range shall be submitted.

**The above documents shall form part of Acceptance documentation.**

**7.2 TESTING & INSPECTION:**

- The equipment covered under this specification shall be subject to vendor's Quality Plan to be approved by M/s WBPDCCL before start of manufacture. To ensure that quality is in-built in each equipment the Quality Assurance System manual & Quality Plan indicating the system followed by the vendor shall be submitted to purchaser for his review along with the offer.
- The Testing shall include following Type test, in addition to the Routine Tests,

**7.3 TYPE TEST:**

The Vendor shall furnish the type test reports for the VMS & TSS System and the test requirement shall cover CMRR, NMRR Verification. Submission of type test results and certificate shall be acceptable provided.

- i) The same has been carried out by the Vendor on exactly the same model / rating of equipment.
- ii) There has been no change in the components from the offered equipment & tested equipment.
- iii) **The test has been carried out as per the latest standards along with amendments as on the date of Bid opening and as indicated below**

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

The minimum type test reports, 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/ IEC-255.4. 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/ IEC-255.4. 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

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IEC-255-4 which is equivalent to ANS/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 IEC 801-2or equivalent.
- vi) Radio frequency immunity test as per IEC 801-6 or equivalent.
- vii) Electromagnetic Field immunity as per 801-3 or equivalent.

Test listed at item no. v, vi, vii, above are applicable for electronic cards only.

**8.0 Documents :**

- All documentation shall be in English language.
  - Following documents shall be supplied along with offer.
    - a) Mounting details of the sensors, mounting blocks/pads and local junction boxes.
    - b) Configuration diagram of the system offered.
    - c) Specification / data sheets of various devices offered.
    - d) General arrangement drawing of the cabinet showing mounting details and dimensions, maximum length between cabinets, cabinet to PC are to be indicated.
    - d) Reference list of users for fossil fired Turbine generator set of similar rating.
  - After award of contract, following documentation in no. of copies as mentioned below shall be supplied.
    - a) Quality plan
    - b) Storage instruction
    - c) Configuration diagram & Machine train diagram
    - d) Mounting details for sensors
    - e) Wiring and cabling diagrams for Cabinets & other devices  
BOM, GA drawing & Rack layout drg  
Loop scheme and cable schedule  
Mounting blocks and JB Drawings  
Datasheet and technical literatures

6 copies, within 2 weeks of placements of P.O
  - f) Test certificate & test results
  - g) Calibration results for sensors
  - h) Test results for Cables
  - i) Type test results
- 2 copies After completion of tests
- j) Operation & maintenance manual for the system including wiring diagram, circuit diagrams, Sensor details, etc..
- 2 copies along with the equipment + 1 copy to BHEL

Also one set of soft copy on CD ROM for all the datasheet/drawings/test reports are to be furnished to BHEL after placement of Purchase order.



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The drawings under (a),(c),(d),(e),(f) & (i) will be for approval & others are for information & records.

**9.0 Training :**

Vendor shall provide necessary training on the operation & application to BHEL / End-User. The training shall cover the basic aspects of Vibration monitoring, details of the System supplied, Analysis method, Operation and Maintenance.

**10.0 Warranty :**

The offered systems / equipments shall be Guaranteed for Satisfactory operation of 18 months from date of Commissioning or 24 months from date of supply, whichever is earlier.

**11.0 Vendor to note that any Item / services required to complete the Equipment to meet the Specification requirement shall be taken care without any Cost implication to BHEL.**

**12.0 Vendor to compulsorily indicate for the offered system's, reference list and operating experience of the listed services in thermal power plants, for more than two years. The rating of the power plant shall be at least 250 MW.**

**13.0 Erection & Commissioning ( E & C ) Scope :**

**13.1 Turbo Supervisory System portion :**

13.1.1 Vendor shall give a separate offer for erection and commissioning of the complete Turbine Supervisory system covered in this specification.

13.1.2 The total responsibility of erection and commissioning of the system supplied shall rest with the vendor. The important events are listed below:

- Collection of material from stores.
  - Preparation of mounting surface and mounting arrangement to suit the surface of the machine
  - Mounting of Sensors on the Machine/s
  - Mounting of local JB's and termination of cables between sensor to local JB.
  - Laying of cable between Local JB and Control Panels , is by BHEL
  - Termination of cables between local JB's to cabinet
  - Termination of cables between cabinet and PC ( as applicable )
  - Carrying out pre-commissioning checks,energizing Cabinets & PC (as applicable)
  - Commissioning of individual services.
  - Installing various software packages on PC & establishing the operation.
  - Checking for all functions of hardware and software when the plant is totally commissioned with all auxiliaries
  - Handing over the system to End-User.
  - Training the operation personnel on operation and maintenance aspects.
  - **Relevant documentation for commissioning of this system inline with specification requirement.. such as signed protocol with end user to be furnished along with calibration data.**
-



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**13.2 Vibration Monitoring System portion :**

Vendor shall provide separate offers for Erection activity (as applicable), Supervision of Erection and total Commissioning of the offered Vibration Monitoring System as detailed below.


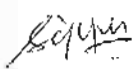



- Collection of material from stores
- Mounting of offered sensors with its mounting block on the machine bearing and terminate the sensor cable to Local Junction box supplied.
- Mounting of Key-phasor sensor and its bracket shall be suitably installed by Vendor at site and terminate the sensor cable to Local Junction box supplied.
- Supervision of Erection of offered System
- Commissioning of offered System
- Handing Over the system to End-User
- Training the operation personnel on operation and maintenance aspects while carrying out the above E & C activities.
- **Relevant documentation for commissioning of this system inline with specification requirement.. such as signed protocol with end user to be furnished along with calibration data.**

Note: The total responsibility of above activities on the offered system shall rest with the vendor.

**13.3 For Analysis & Diagnostics systems :**

Vendor shall provide separate offers for Erection activity (as applicable), Supervision of Erection and total Commissioning of the offered Analysis & / or Diagnostics system, as detailed below

- Termination of cables between cabinet and PC
- Carrying out pre-commissioning checks, energizing Cabinets & PC.
- Commissioning of individual services.
- Installing various software packages on PC & establishing the operation.
- Checking for all functions of hardware and software when the plant is totally commissioned with all auxiliaries
- Handing over the offered system/s to End-User.
- Training the operation personnel on operation and maintenance aspects while carrying out the above E & C activities.
- **Relevant documentation for commissioning of this system inline with specification requirement.. such as signed protocol with end user to be furnished along with calibration data.**

	 A4-10	<h1>SECTION - D</h1>	Ref.: CE / 409-416 / TSS-VMS / LTP						
			REV. : 00						
<b>COPY RIGHT AND CONFIDENTIAL</b> THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BIHAR HEAVY ELECTRICALS LIMITED . IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.		<h2>SPECIFICATION FOR VMS OF LPGCL-LALITPUR PROJECT</h2> <p>Consultant : M/s TCE Bangalore</p>	PAGE : 01 of 16						
	REVISION :		<b>APPROVED</b>  ( SKT )						
			<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 33%;">PREPARED</th> <th style="width: 33%;">ISSUED</th> <th style="width: 33%;">DATE</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">             (DG)         </td> <td style="text-align: center;">409-416</td> <td style="text-align: center;">27 /06/13</td> </tr> </tbody> </table>	PREPARED	ISSUED	DATE	 (DG)	409-416	27 /06/13
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**Purchase Specification for  
Vibration Monitoring System (VMS) &  
Analysis & Diagnostic**

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**Project Synopsis in brief : Bajaj Hindustan Limited – 3 x 660 MW Supercritical Thermal Power Project**

Location: At Mirchwara and Buraugaon near Utari river, Lalitpur district, U.P. , India.

Access Road: 23 Km from Bansi on NH-26 which connects Jhansi and Sagar

Nearest Railway station: Lalitpur railway station ( 37 Km from site)

Nearest Airport: Gwalior Airport (186 Km from site)

Nearest Sea Port: Kolkata

**AA) SCOPE:** Vendor shall offer **Vibration Monitoring System (VMS)** for Plant Auxiliaries (namely Boiler Feed Pump – BFP, BFP - Motor , Cond. Extr. Pump – CEP, CEP – Motor, DMCW TG Pumps, DMCWP TG Motors, DMCW SG Pump , DMCWP SG Motor, Cooling Water Pump, CWP – Motor, Mill Motor, ID Fan, IDF – Motor, FD Fan, FDF – Motor, PA Fan, PAF – Motor )and **Analysis and Diagnostic system** for Main Turbine(TSI), BFPDT and Plant Auxiliaries (VMS), for **3X660MW SUPER CRITICAL TPP AT LALITPUR, U.P. Technical requirements for the above machine are as per Cl. BB of this Purchase specification.** Scope of Supply shall include Engineering Testing, Erection & Commissioning activities as detailed in this specification.

**BB Technical Requirements:**

**1.0 Vibration Monitoring System ( VMS ) for Auxiliaries :**

**1.1 Requirement for VMS Hardware :**

- (i) Microprocessor based Vibration Monitoring System shall be offered for Monitoring the Vibration levels of various Machines or Plant auxiliaries of a Power plant. The Machines to be monitored for Vibration levels are typically Boiler Feed Pump – BFP, BFP - Motor , Cond. Extr. Pump – CEP, CEP – Motor, DMCW TG Pumps, DMCWP TG Motors, DMCW SG Pump , DMCWP SG Motor, Cooling Water Pump, CWP – Motor, Mill Motor, ID Fan, IDF – Motor, FD Fan, FDF – Motor, PA Fan, PAF – Motor as detailed in Machine Data ref. CE/416/LPGCL/VMS-D / Page 5 of 15 of this specification.
- (ii) The measurement of Vibration levels shall be carried out on the Bearing housings of the above machinery in both Horizontal & Vertical planes ( X – Y planes ).
- (iii) The offered Vibration Monitoring System shall as a minimum consists of Vibration Sensors & Phase measurement sensors with low noise cables of 10 meters length in SS flexible conduits, Local terminal box / Junction boxes, necessary per-amplifier/ electronics mounted in local weather–proof boxes, Vibration monitors, Monitor Racks, Power supplies, integrating units, Signal conditioning devices, sensor-mounting accessories, interconnecting cables, calibration equipment, Panel/s ..etc..
- (iv) Sensors shall be Velometer type & selected based on the service requirement / parameters w.r.t machine Speed and the Vibration ranges, for each of the Machine. The Project-specific details of various machines have been provided at Machine Data ref. CE/416/LPGCL/VMS-D / Page 5 of 15 of this specification. Offered sensor shall be with sensitivity of  $\pm 5\%$ .
- (v) The offered Sensors with mounting accessories shall be mounted on Bearing housing of the Machine, in Horizontal and Vertical directions. Weatherproof housing shall be provided for these



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sensors and shall be suitable for field conditions of the Power plant. Vendor to note that the Cables from Sensor-Local Junction box in field to Vibration monitoring System Panel/s in Main control room shall be provided by BHEL which is 4Pair x 0.5 Sq. mm – PVC, FRLS, Individual & Overall shielded Pair Copper Cable. 2-Triad cable will be provided for phase angle measurement sensors. 2Triad x 0.5 Sq.mm Individual & Overall shielded Pair Copper Cable will be provided by BHEL for Phase measurement sensors.

- (vi) The offered Vibration Monitors shall be 2 to 4 channel with 4-20 mA output per channel. Independent potential free contacts shall be made available for high alarm & trip purposes for each channel being monitored. The Power supply in the Rack shall be Redundant power supply modules in each rack such that on failure of a single power supply, the power supply shall cater to the requirement of offered equipment. The output of each channel shall be in Velocity units and field programmable to Displacement units.
- (vii) The front of the offered monitors shall have digital bar graph display for the measured Vibration levels and also have facility to connect another device to analyse the Vibration, of each channel. The front face of these monitors shall have status indications for healthy conditions for Sensor circuit, monitor circuit and power supply. Set point indication with set point adjustment facility for setting Alarm and Trip levels shall be provided. Offered monitors shall be modular in construction, plug-in type and suitable for mounting in 19" Rack. A facility shall be available from front of mounting rack for functional checking of monitors with inhibition of alarm & trip contact outputs during test. Alarm inhibition shall also be provided during start-up. If in case the offered monitors does not have digital bar graph display, then Panel PC / Panel LCD display of minimum 15 inch display size shall be offered per Unit wise for digital bar graph display of the measured vibration levels.
- (viii) Offered Vibration monitoring equipment shall be functionally tested for circuit continuity and output response. All the components & interconnection cables shall be tested to ensure compliance with the specification requirement & all other applicable codes & standards. All the signals coming from field & going to other instruments shall be terminated on cage clamp type terminal blocks.
- (ix) For Analysis & Diagnostic package along with VMS, Sensors and related Electronics shall be offered for measurement of Phase angle / speed of the Machine. A Key-slot of dimension "30 mms x 15 mms x 3 mms" typically, is provided on the Machine-Shaft / Coupling. Suitable mounting brackets for these sensors shall also be offered.
- (x) Vibration Monitors shall be offered / grouped / assigned in such a way that the channels being monitored for Vibration for a machine will not be in same monitor. Eg..BFP DE – X & Y and BFP NDE – X & Y channels, will be in different vibration monitor...etc..
- (xi) Vendor to note again that the sensors & monitors offered finally shall be as per Machine Data ref. CE/416/LPGCL/VMS-D / Page 6 of 16 of this specification. The Instrument rack shall have 20% of Rack Space free for any future expansion. Any revision in selected / offered models of sensors & monitors during detailed Engineering shall be done without any Commercial implications.
- (xii) Link to DDC/DAS:
  - Redundant uni-directional OPC DA 2.0 or equivalent communication link to DCS shall be provided by the vendor.



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### 1.2 Panel for above equipment :

Vendor shall supply the panel for VMS as per below specification:

- Panel shall be of size 800 mm X 800 mm X 2415 mm H ( including top canopy- 60 mm + Bottom frame 50 mm + Antivibration pad 15mm ) in mm
- Panel shall be made up of 2mm thick CRCA steel sheet.
- Anti-vibration pad of about 15 mm shall be provided.
- Panel protection class shall be IP – 32, Panel height shall be 2415 mms.
- Door shall be provided in the front & rear sides, shall be of 2 mm thick CRCA steel sheet.
- 3 point locking system
- Paint shade/s shall be:
  - Exterior : Pebble Grey, Shade RAL 7032, Semi Glossy
  - Interior : Brilliant White, Glossy
  - Epoxy Based (Powder Coated) for both Interior & Exterior
- Panel painting shall be powder coated to 80 to 100 microns thick.
- Cutout with cable-gland plates shall be provided on the bottom of the Panel, for Cabling.
- Suitable Lifting Hooks shall be provided on the Panel.
- Provision shall be made in the Panel to accept two power supply feeders with required MCB's.
- Terminals shall be Clip-on type for cable termination. 20 % spare terminals shall be offered.
- Illumination shall be provided in the panel.

Note : A separate Panel housing the VMS hardware shall be offered for CW-Pumps and this shall be located in the CWP - Control room. CWP VMS Racks shall be Unit specific, however common panel/s for 3 Units may be offered.

### 1.3 Other items :

Following shall be offered:

- Vibration-Sensor Mounting blocks,
- Phase-angle measurement-Sensor with Mounting brackets, required Fasteners
- Vendor shall provide suitable sensor protective housing for the proximity type sensors of BFP. Refer drawing no. P1-R6235 / Page 7 of 16 of this specification.
- Time synchronization card NTP / SNTP or equivalent type shall be provided by the vendor.
- Panel PC / Panel LCD display of minimum 15 inch display size shall be offered for digital bar graph display of the measured vibration levels; in case display is not available in the monitor.
- Field Junction box with Terminals...etc.. The offered field Junction boxes (JB) shall be with IP– 65 protection class and vendor shall furnish the Type test reports for acceptance. Specification of Junction box is as below:
  - Type of Enclosure: IP-65. Single lockable door with gaskets able to open side ways with common keys. Door shall not be screwed type, it shall be turnable hinge type.
  - Material: Galvanized die cast aluminium
  - Paint: Inside – Glossy white. Outside –IS 5 shade 631.
  - Cable Entry: Bottom & sealed with fire proof compound
  - Terminals: 6.6 polyamide, metallic portion shall be coated against rust, vertical type, separate TBs shall be used for analog & digital signals
  - Gland plate: Removable type
  - Accessories: a) Lock & Key  
b) Cable gland



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- c) Ferrules
- d) Canopy at top
- e) Metal tag (SS)
- f) Clamp fixture
- g) Bolts (SS), Nuts (SS), Gaskets (Neoprene)
- h) Fire proof compound for sealing

- Calibration kit for Proximity type Sensors and Portable Shaker unit shall be offered as common for 3 Units.
- **Following Vendors for the items listed , are approved by Enduser/Customer:**

Sl. No.	Item Description	Sub – Vendor
1.	Cabinet / Panel	Rittal
		Pyrotech
		MPP technologies Pvt. Ltd.
2.	PC/Server	DELL
		HP
		IBM-Lenovo
3.	TFT Monitor	DELL
		HP
		IBM-Lenovo
		Samsung
		NEC
4.	Printer	HP
		IBM
		Canon
		Xerox
5.	Panel PC / LCD display	Portwell Laxson
		Mitsubishi
		Schneider Electric

**Note : Anyother vendors other than above, shall be accepted subject to approval by Enduser/Customer.**

- No raw material/ component/ sub-component/ sub-assembly/ assembly/ equipments shall be sourced from China either directly or indirectly, for manufacture or supply.



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Machine Data of LALITPUR (3 x 660 MW) TPS:										Ref.: CE/416/LPGCL/VMS-D					
Sl. No.	Machine	Machine (Qty. per Unit)	Machine (Qty. for 3 Units + common)	Appx. Cabling dist. from EER (in mtr)	No. of Bearings for monitoring vibration (in X & Y direction)	Installation (Horizontal/ Vertical)	Measurement parameter	Machine (RPM)	Vibration Range (ref. Note 2,3,4)	Alarm Level (ref. Note 2,3,4)	Trip Level (ref. Note 2,3,4)	Mounting Details	NO OF SENSORS (total for 3 units)	Key phasor sensors (total for 3 units)	
1	Boiler Feed Pump - TDBFP	2	6	100	2	Horizontal	Rel shaft vib	800-6500	0-200 <sup>p-p</sup>	90 <sup>p-p</sup>	150 <sup>p-p</sup>	D	24	6	
2	MDBFP	1	3	130	2	Horizontal	Rel shaft vib	800-6500	0-200 <sup>p-p</sup>	90 <sup>p-p</sup>	150 <sup>p-p</sup>	D	12	3	
3	MDBFP - Motor	1	3	130	2	Horizontal	Abs Brg Vib	1500	0-25 <sup>2</sup>	4.5 <sup>2</sup>	7.1 <sup>2</sup>	B	12	6	
4	Condensate Extn. Pump - CEP	3	9	120	1	Vertical	Abs Brg Vib	1485	0-25 <sup>3</sup>	7 <sup>3</sup>	7.6 <sup>3</sup>	A	18	9	
5	CEP - Motor	3	9	120	2	Vertical	Abs Brg Vib	1500	0-25 <sup>2</sup>	4.5 <sup>2</sup>	7.1 <sup>2</sup>	B	36		
6	CW Pump - CWP	3	9	-	1	Vertical	Abs Brg Vib	329	0-25 <sup>2</sup>	11 <sup>2</sup>	13 <sup>2</sup>	A	18	9	
7	CWP - Motor	3	9	-	2	Vertical	Abs Brg Vib	333.3	0-25 <sup>2</sup>	4.5 <sup>2</sup>	7.1 <sup>2</sup>	B	36		
6	DMCW TG Pump	3	9	200	2	Horizontal	Abs Brg Vib	1500	0-25 <sup>2</sup>	10 <sup>2</sup>	15 <sup>2</sup>	A	36	9	
7	DMCW TG Pump - Motor	3	9	200	2	Horizontal	Abs Brg Vib	1500	0-25 <sup>2</sup>	7 <sup>2</sup>	12 <sup>2</sup>	A	36		
6	DMCW SG Pump	2	6	200	2	Horizontal	Abs Brg Vib	1500	0-25 <sup>2</sup>	10 <sup>2</sup>	15 <sup>2</sup>	A	24	6	
7	DMCW SG Pump - Motor	2	6	200	2	Horizontal	Abs Brg Vib	1500	0-25 <sup>2</sup>	7 <sup>2</sup>	12 <sup>2</sup>	A	24		
8	Mill Motor	8	24	230	2	Horizontal	Abs Brg Vib	1000	0-25 <sup>2</sup>	4.5 <sup>2</sup>	7.1 <sup>2</sup>	B	96	24	
9	ID Fan	2	6	460	1	Horizontal	Abs Brg Vib	745	0-25 <sup>2</sup>	9.9 <sup>2</sup>	19.8 <sup>2</sup>	E1	12	6	
10	IDF - Motor	2	6	460	2	Horizontal	Abs Brg Vib	750	0-25 <sup>2</sup>	4.5 <sup>2</sup>	7.1 <sup>2</sup>	B	24		
11	FD Fan	2	6	300	1	Horizontal	Abs Brg Vib	990	0-25 <sup>2</sup>	6.3 <sup>2</sup>	12.6 <sup>2</sup>	E	12	6	
12	FD Fan - Motor	2	6	300	2	Horizontal	Abs Brg Vib	1000	0-25 <sup>2</sup>	4.5 <sup>2</sup>	7.1 <sup>2</sup>	B	24		
13	PA Fan	2	6	290	1	Horizontal	Abs Brg Vib	1490	0-25 <sup>2</sup>	6.3 <sup>2</sup>	12.6 <sup>2</sup>	E	12	6	
14	PAF - Motor	2	6	290	2	Horizontal	Abs Brg Vib	1500	0-25 <sup>2</sup>	4.5 <sup>2</sup>	7.1 <sup>2</sup>	B	24		
<b>Grand Total</b>		<b>46</b>	<b>138</b>										<b>480</b>	<b>90</b>	
													<b>Quantity Per Unit</b>	<b>160</b>	<b>30</b>

**Note:**

**1) Mounting Details:**

- A: 60 x 60 x 10 mm pad on bearing housing
- B: 60 mm cube vibration pad welded on both end shields
- C: 40 x 100 mm machined surface provided on DE & NDE bearing housing
- D: NPT 3/4" tapped hole provided on DE & NDE bearing housing. Ref. drawing no. P1-R6235 / Page 5 of 14 of this spec.
- E / E1: 80 x 80 mm / 70 x 80 mm machined pads screwed with bearing housing respectively.

**2) Vibration level in 'mm/sec - Peak'**

**3) Vibration level in 'mm/sec - RMS'**

**4) Vibration level in 'mm/sec - Peak - Peak', represented by p-p**

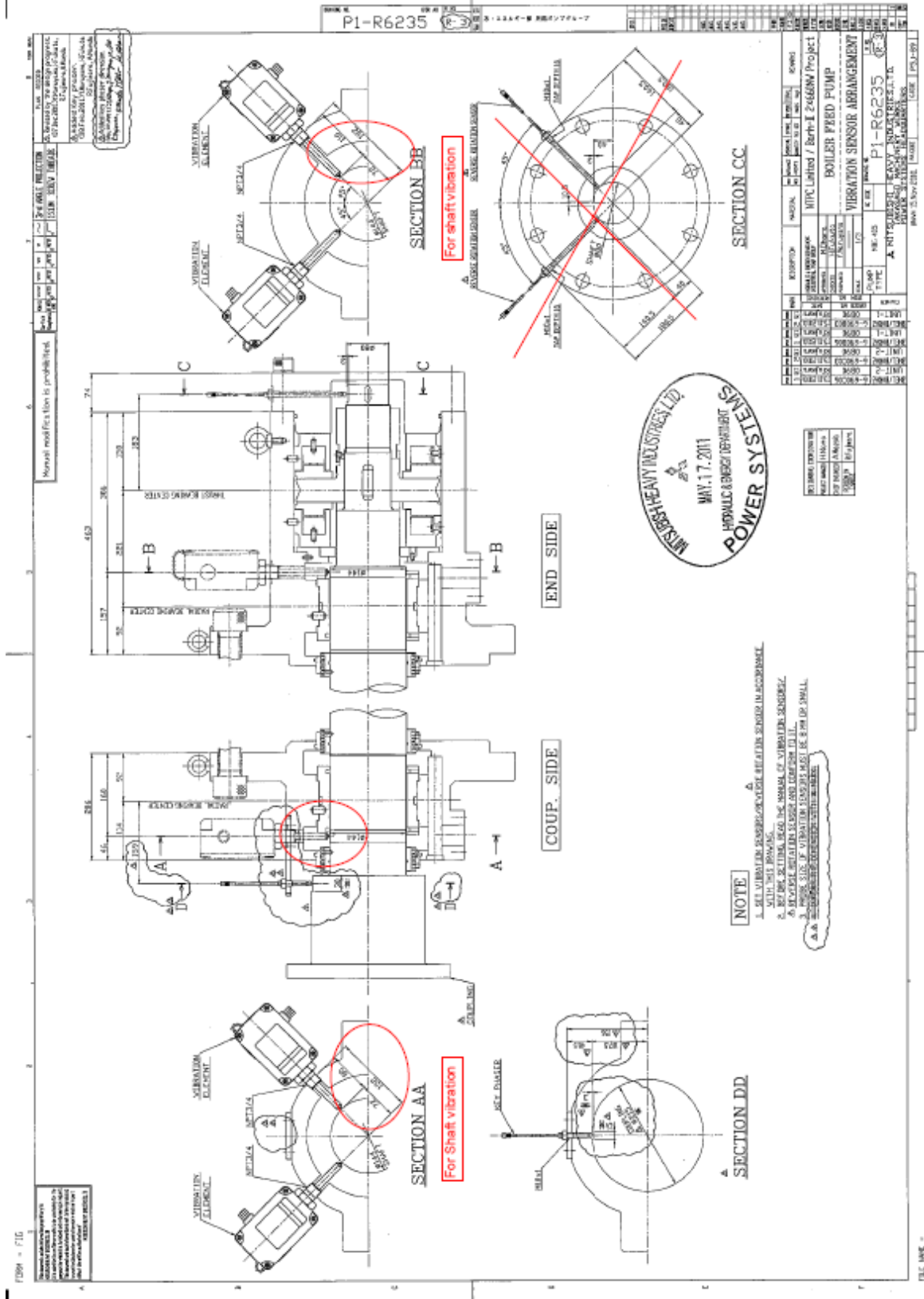
**5) Cabling distance from VMS panel in CWPH ( pump house ) to ' Main Control room - EER-U 1, 2, 3 ' is 260m, 400m & 550m respectively. (Refer Cl. 2.10.4 of this specs.)**

**6) Cabling distance between UCR and VMS panel in EER shall be approx 200m for each Unit.(Refer Cl. 2.10.3 of this specs.)**

**7) Key slot 30 mm (L) x 15 mm (W) x 3 mm (D) are provided on connecting Coupling.**

**8) KKS Tag Nos. for sensors/transducers will be provided during detailed Engineering.**

VIBRATION SENSOR ARRANGEMENT FOR BFP





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## 2.0 Analysis Requirements :

- 2.1 **Offer for Analysis & Diagnostics of Main TG vibration signals:** Vendor shall consider 31 nos. buffered raw vibration signal and 1 no. key phasor signal per Unit for analysis & diagnostics, from M/s Meggitt's VM600 monitoring system for TSS. Vendor shall include necessary hardware & software for interfacing & analysis / diagnostics of the raw buffered signals. List of buffered vibration signals for Main Turbine & Generator is enclosed at page 11 of 16 of this specification.
- 2.2 **Offer for Analysis & Diagnostics of BFP - Driven Turbine (DT) vibration signals:** Vendor shall consider 24 nos. buffered raw vibration signal and 2 nos. key phasor signal per Unit of BFP-DT for analysis & diagnostics, from M/s Shinkawa's VM-7 monitoring system for BFP-DT. Vendor shall include necessary hardware & software for interfacing & analysis / diagnostics of the raw buffered signals. Refer Annexure-III for detailed signal list. List of buffered vibration signals for BFP-DT is enclosed at page 12 of 16 of this specification.
- 2.3 Microprocessor/ Computer based Analysis Unit, with required software, is to be offered to achieve the following functions as minimum.
- Storage and comparative analysis of vibrations
  - Spectrums and Spectral Alarms
  - Generation / analysis of bode plot
  - Orbit plot & Polar plot
  - Time waveform
  - Nyquist plot
  - Shaft center line plot for TG
  - Cascade
  - Waterfall plots
  - Transient data ( during Start-up and Shut-down )

Vendor shall furnish the List of process signals required for further analyzing vibration data and include necessary hardware and software for accepting such signals from BHEL system.

- 2.4 The FFT analyzer units shall have a frequency range from 1Hz to 20 kHz, Spectrum resolution of 600 lines minimum. Provision for selecting high and low resolution display shall be provided. The scan rate shall be specified by vendor.
- 2.5 The FFT analyzer offered may be an independent unit or a part of Monitor rack/s housing input modules..etc. (discussed in Clauses 1.0 & 2.0 of this Specs.) and in-line with the manufacturer's practice.
- 2.6 The output from FFT analyzer unit and/or Monitor rack/s above shall be connected to a computer system to perform analysis of the Vibration data of the machine/s (discussed in Clauses 1.0 & 2.0 of this Specs.).
- 2.7 The **Computer for analyzer unit** shall consist at-least of following configuration.
- PC/server of reputed make (with 22" TFT monitor) and Latest model and version.
  - CPU of Intel Xeon / Quad Core Processor, shall be minimum 32 bit RISC based processor, suitable for real-time process application and support man machine interface equipment like CRTs, peripherals, bulk data storage and communication control and monitoring system
  - 22" colour TFT LCD Flat screen monitor of Latest model and version. CRT of minimum resolution 1280x1024 pixels. CRT shall display min. 80 no. of characters per line and min. 48 no. of lines per page; total 256 no. of graphic characters + ASSCII.
-



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- CRT display shall have min. 16 colours. Anti-reflection features shall be provided in the CRT. The CRT shall be desktop mounted. CRT shall be with digital eye feature.
- Minimum 6 GB RAM
  - Min 500 GB hard disc with mirroring type hard disc to ensure data integrity.
  - Combo Drive
  - Master Slave Card for Time synchronization
  - External Modem 56 k V.90
  - The Server PC shall have storage capability of bulk data for 5 years duration with facility for retrieval of the same
  - The system shall have facility to share all the data in the hard disk/ back up media and provide user friendly utilities to retrieve and analyse stored data
  - Network card.(2 Nos)
  - Necessary Cables with accessories for inter connecting and connecting to TSS / VMS Panels and DCS/ DAS Panel/s. Software CDs with License/s. User license for OS & all software shall be valid for entire life of power plant.
  - Anti-Virus Package to be included
- 2.8 An additional **User PC** shall be supplied, consist at-least of following configuration.
- Industrial grade PC with monitor, keyboard and mouse with multi window facility shall be provided
  - CPU shall be minimum 32 bit RISC based processor, suitable for real-time process application and support man machine interface equipment like CRTs, peripherals, bulk data storage and communication control and monitoring system
  - 22" colour TFT LCD Flat screen monitor of Latest model and version. CRT of minimum resolution 1280x1024 pixels. CRT shall display min. 80 no. of characters per line and min. 48 no. of lines per page; total 256 no. of graphic characters + ASCII. CRT display shall have min. 16 colours. Anti-reflection features shall be provided in the CRT. The CRT shall be desktop mounted. CRT shall be with digital eye feature.
  - Minimum 6 GB RAM
  - Min 50 GB hard disc.
  - DVD R/W drive 50X of capacity 8.5GB dual layer
  - DAT drive
  - Master Slave Card for Time synchronization
  - Necessary Cables with accessories for inter connecting and connecting to TSS / VMS Panels and DCS/ DAS Panel/s. Software CDs with License/s. User license for OS & all software shall be valid for entire life of power plant.
  - Anti-Virus Package to be included
- 2.9 A colour **Laser Jet A3 size Printer** shall be supplied, consist at-least of following configuration.
- Colour graphic printer of A3 size
  - Minimum 1 GB RAM
  - USB port compatibility.
  - Network printer.
  - Noise level shall not exceed 60dB at a distance of 1 meter from the printer

Vendor shall clearly bring out in his offer the configuration proposed. Vendor shall ensure that the capacity of the analyzer unit is sufficient to meet the specification requirements of the points being monitored. Also a spare capacity of 20% points of measurement, for future expansion shall be provided. Vendor shall specify the type of communication between the offered FFT unit and Analyzer unit. Vendor shall clearly bring out in their offer the Data Backup and Security procedures. Necessary no. of Ethernet hubs, cables, etc., shall be included in the offer. All items required to make the system complete shall be included in the offer.

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### 2.10 Configuration Requirements:

- 2.10.1 The offered Panels for VMS with FFT analyzer for Main TG, BFP-DT & VMS for Plant auxiliaries shall be located in Main Control equipment room (EER), separate for each Unit.
- 2.10.2 Offered Computer/ User PC/ Printer hardware shall be separate for each Unit and shall be located in separate Computer room(UCR) near Main Control equipment room of respective Units.
- 2.10.3 The distance between VMS Panels in Main Control equipment room (2.10.1) & Computer room (2.10.2) is about 200 meters. Vendor shall offer two (2) runs of FO Cable per unit (for redundant communication) and accessories for interconnection between Panel and Computer. Vendor shall include necessary networking components for redundant communication
- 2.10.4 For Analysis / Diagnostics of Vibration data of CW – Pumps, the FFT analyser unit shall be in the VMS panel of CW-Pump (ref. Clause 1.2 above). Cabling route length between this panel and VMS Panel for plant auxiliaries (Clause 2.10.1) located in main control equipment room will be 260 meter for Unit#1, 400 meter for Unit#2 and 550 meter for Unit#3. Vendor to indicate the type of Communication cable required and offer the same with necessary accessories.
- 2.10.5 Vendor to propose a detailed configuration diagram of the equipment to be supplied along with a list of equipment, which shall be approved by BHEL.

### 3.0 Diagnostics / Expert System Requirements:

Vendor shall utilize the Vibration data, Process information and Analysis data to provide Diagnosis and recommendations for machinery management, effectively. It shall be an extensive and accurate knowledge base to enable quick determination of the condition of a machine by providing alarm notification or advisories of the machinery malfunction. The offered system shall be able to specifically evaluate the available data while checking for the presence of the most frequently occurring machine malfunctions such as,

- High synchronous vibration
- Shaft bow / crack
- Fluid induced instability (Whirl and Whip)
- Radial pre-load forces (including misalignment)
- Vector change
- Rotor rub
- Loose rotating parts
- Electric motor non-uniform air gap
- Gear mesh problems, pump cavitations.

The vibration analysis & diagnostics system shall be able to provide guidance about predictive maintenance requirement of the machines. Predictive maintenance requirement guide shall also include the "Period of safe operation of machines available at any given point of time".

**Note:** Vendor to Consider Analysis and Diagnostic for Main Turbine and BFPDT Signals as listed at page 10 of 14 of this Purchase Specification. Necessary Hardware for interfacing these RAW Buffered Signals from M/s Meggitt's VM600 & M/s Shinkawa's VM-5 System shall be considered respectively.



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LIST OF BUFFERED VIBRATION SIGNALS OF MAIN TURBINE & GENERATOR							
Sl. No.	Tag.No	Description	Signal range	Sensor Type	Sensor Order No.	Signal Conditioner Type	Signal Conditioner Order No.
1	MAD11CY021	ST BRG 1 CSG ABS VIB	0-20 mm/s	CA 202	144-202-000-205	IPC 704	A1-B03-C100-D77-E2-F5000-G0-H0-I0
2	MAD11CY022	ST BRG 1 CSG ABS VIB	0-20 mm/s	CA 202	144-202-000-205	IPC 704	A1-B03-C100-D77-E2-F5000-G0-H0-I0
3	MAD11CY041	ST BRG 1 CSG REL S VIB	0-250 µm	TQ 402	A1-B1-C165-D080-E050-F0-G000-H05	IQS 450	A1-B23-H05-I0
4	MAD11CY042	ST BRG 1 CSG REL S VIB	0-250 µm	TQ 402	A1-B1-C165-D080-E050-F0-G000-H05	IQS 450	A1-B23-H05-I0
5	MAD12CY011	ST AX BRG 2 S POSN	(-)1.5 to (+) 1.5 mm	TQ 402	A1-B1-C072-D000-E050-F0-G000-H05	IQS 450	A1-B23-H05-I0
6	MAD12CY012	ST AX BRG 2 S POSN	(-)1.5 to (+) 1.5 mm	TQ 402	A1-B1-C072-D000-E050-F0-G000-H05	IQS 450	A1-B23-H05-I0
7	MAD12CY013	ST AX BRG 2 S POSN	(-)1.5 to (+) 1.5 mm	TQ 402	A1-B1-C072-D000-E050-F0-G000-H05	IQS 450	A1-B23-H05-I0
8	MAD12CY021	ST BRG 2 CSG ABS VIB	0-20 mm/s	CA 202	144-202-000-205	IPC 704	A1-B03-C100-D77-E2-F5000-G0-H0-I0
9	MAD12CY022	ST BRG 2 CSG ABS VIB	0-20 mm/s	CA 202	144-202-000-205	IPC 704	A1-B03-C100-D77-E2-F5000-G0-H0-I0
10	MAD12CY041	ST BRG 2 CSG REL S VIB	0-250 µm	TQ 402	A1-B1-C165-D080-E050-F0-G000-H05	IQS 450	A1-B23-H05-I0
11	MAD12CY042	ST BRG 2 CSG REL S VIB	0-250 µm	TQ 402	A1-B1-C165-D080-E050-F0-G000-H05	IQS 450	A1-B23-H05-I0
12	MAD12CY045	ST BRG 2 KEY PH ANGLE		TQ 402	A1-B1-C072-D000-E050-F0-G000-H05	IQS 450	A1-B23-H05-I0
13	MAD13CY021	ST BRG 3 CSG ABS VIB	0-20 mm/s	CA 202	144-202-000-205	IPC 704	A1-B03-C100-D77-E2-F5000-G0-H0-I0
14	MAD13CY022	ST BRG 3 CSG ABS VIB	0-20 mm/s	CA 202	144-202-000-205	IPC 704	A1-B03-C100-D77-E2-F5000-G0-H0-I0
15	MAD13CY041	ST BRG 3 CSG REL S VIB	0-250 µm	TQ 402	A1-B1-C165-D080-E050-F0-G000-H05	IQS 450	A1-B23-H05-I0
16	MAD13CY042	ST BRG 3 CSG REL S VIB	0-250 µm	TQ 402	A1-B1-C165-D080-E050-F0-G000-H05	IQS 450	A1-B23-H05-I0
17	MAD14CY021	ST BRG 4 CSG ABS VIB	0-20 mm/s	CA 202	144-202-000-205	IPC 704	A1-B03-C100-D77-E2-F5000-G0-H0-I0
18	MAD14CY022	ST BRG 4 CSG ABS VIB	0-20 mm/s	CA 202	144-202-000-205	IPC 704	A1-B03-C100-D77-E2-F5000-G0-H0-I0
19	MAD14CY041	ST BRG 4 CSG REL S VIB	0-250 µm	TQ 402	A1-B1-C120-D035-E050-F0-G000-H05	IQS 450	A1-B23-H05-I0
20	MAD14CY042	ST BRG 4 CSG REL S VIB	0-250 µm	TQ 402	A1-B1-C120-D035-E050-F0-G000-H05	IQS 450	A1-B23-H05-I0
21	MKD11CY021	GEN BRG 1 CSG ABS VIB TE	0-20 mm/s	CA 202	144-202-000-205	IPC 704	A2-B03-C100-D25-E2-F5000-G0-H0-I0 (ATEX design for zone 1)
22	MKD11CY022	GEN BRG 1 CSG ABS VIB TE	0-20 mm/s	CA 202	144-202-000-205	IPC 704	A2-B03-C100-D25-E2-F5000-G0-H0-I0 (ATEX design for zone 1)
23	MKD11CY041	GEN BRG 1 CSG REL S VIB TE	0-600 MYM	TQ 402	A2-B1-C120-D002-E050-F2-G050-H05 (ATEX design for zone 1)	IQS 450	A2-B23-H05-I0 (ATEX design for zone1)
24	MKD11CY042	GEN BRG 1 CSG REL S VIB TE	0-600 MYM	TQ 402	A2-B1-C120-D002-E050-F2-G050-H05 (ATEX design for zone 1)	IQS 450	A2-B23-H05-I0 (ATEX design for zone1)
25	MKD12CY021	GEN BRG 2 CSG ABS VIB EE	0-20 mm/s	CA 202	144-202-000-205	IPC 704	A2-B03-C100-D25-E2-F5000-G0-H0-I0 (ATEX design for zone 1)
26	MKD12CY022	GEN BRG 2 CSG ABS VIB EE	0-20 mm/s	CA 202	144-202-000-205	IPC 704	A2-B03-C100-D25-E2-F5000-G0-H0-I0 (ATEX design for zone 1)
27	MKD12CY041	GEN BRG 2 CSG REL S VIB EE	0-600 MYM	TQ 402	A2-B1-C120-D002-E050-F2-G050-H05 (ATEX design for zone 1)	IQS 450	A2-B23-H05-I0 (ATEX design for zone1)
28	MKD12CY042	GEN BRG 2 CSG REL S VIB EE	0-600 MYM	TQ 402	A2-B1-C120-D002-E050-F2-G050-H05 (ATEX design for zone 1)	IQS 450	A2-B23-H05-I0 (ATEX design for zone1)
29	MKD21CY021	VIBRATION SENSOR FOR EXCITER BEARINGCASING, ABSOLUTE	0-20 mm/s	CA 202	144-202-000-205	IPC 704	A1-B03-C100-D77-E2-F5000-G0-H0-I0
30	MKD21CY022	VIBRATION SENSOR FOR EXCITER BEARINGCASING, ABSOLUTE	0-20 mm/s	CA 202	144-202-000-205	IPC 704	A1-B03-C100-D77-E2-F5000-G0-H0-I0
31	MKD21CY041	VIBRATION SENSOR FOR EXCITER SHAFT EE, RELATIVE	0-600 MYM	TQ 402	A1-B1-C072-D002-E050-F0-G000-H05	IQS 450	A1-B23-H05-I0
32	MKD21CY042	VIBRATION SENSOR FOR EXCITER SHAFT EE, RELATIVE	0-600 MYM	TQ 402	A1-B1-C072-D002-E050-F0-G000-H05	IQS 450	A1-B23-H05-I0

**Note:** 1. The above listed signals are for each unit.  
2. Sensors/Drivers/Monitors for above Main Turbine & Generator measurements are not part of this scope



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**LIST OF BUFFERED VIBRATION SIGNALS OF BFPDT**

Sl. No.	Tag.No	Description	Signal range	Sensor Type	Sensor Order No.	Signal Conditioner Order No.	Machine
1	XAD12CY032	PHASE MARKER		RS 050	RS-050A8R-2012	RD-05A1	B F P D T - A
2	XAD12CY041A	BFPDT-A TUR REL SHAFT VIB FJB	0-200 micron	VL 202	VL-202A08R-2012	VK-202A1	
3	XAD12CY041B	BFPDT-A TUR REL SHAFT VIB FJB	0-200 micron	VL 202	VL-202A08R-2012	VK-202A1	
4	XAD11CY042A	BFPDT-A TUR REL SHAFT VIB RJB	0-200 micron	VL 202	VL-202A08R-2012	VK-202A1	
5	XAD11CY042B	BFPDT-A TUR REL SHAFT VIB RJB	0-200 micron	VL 202	VL-202A08R-2012	VK-202A1	
6	XKD11CY041A	BFPDT-A GEAR BOX REL SHAFT VIB FJB	0-200 micron	VL 202	VL-202A08R-2012	VK-202A1	
7	XKD11CY041B	BFPDT-A GEAR BOX REL SHAFT VIB FJB	0-200 micron	VL 202	VL-202A08R-2012	VK-202A1	
8	XKD14CY042A	BFPDT-A GEAR BOX REL SHAFT VIB FJB	0-200 micron	VL 202	VL-202A08R-2012	VK-202A1	
9	XKD14CY042B	BFPDT-A GEAR BOX REL SHAFT VIB FJB	0-200 micron	VL 202	VL-202A08R-2012	VK-202A1	
10	XYA12CY021A	BFPDT-A HOUSING VIBRATION	0-25mm/s	CY 861	CY 861	FM CY EXTC 005	
11	XYA12CY021B	BFPDT-A HOUSING VIBRATION	0-25mm/s	CY 861	CY 861	FM CY EXTC 005	
12	XYA11CY021A	BFPDT-A HOUSING VIBRATION	0-25mm/s	CY 861	CY 861	FM CY EXTC 005	
13	XYA11CY021B	BFPDT-A HOUSING VIBRATION	0-25mm/s	CY 861	CY 861	FM CY EXTC 005	
14	XAD22CY032	PHASE MARKER		RS 050	RS-050A8R-2012	RD-05A1	B F P D T - B
15	XAD22CY041A	BFPDT-B TUR REL SHAFT VIB FJB	0-200 micron	VL 202	VL-202A08R-2012	VK-202A1	
16	XAD22CY041B	BFPDT-B TUR REL SHAFT VIB FJB	0-200 micron	VL 202	VL-202A08R-2012	VK-202A1	
17	XAD21CY042A	BFPDT-B TUR REL SHAFT VIB RJB	0-200 micron	VL 202	VL-202A08R-2012	VK-202A1	
18	XAD21CY042B	BFPDT-B TUR REL SHAFT VIB RJB	0-200 micron	VL 202	VL-202A08R-2012	VK-202A1	
19	XKD21CY041A	BFPDT-B GEAR BOX REL SHAFT VIB FJB	0-200 micron	VL 202	VL-202A08R-2012	VK-202A1	
20	XKD21CY041B	BFPDT-B GEAR BOX REL SHAFT VIB FJB	0-200 micron	VL 202	VL-202A08R-2012	VK-202A1	
21	XKD24CY042A	BFPDT-B GEAR BOX REL SHAFT VIB FJB	0-200 micron	VL 202	VL-202A08R-2012	VK-202A1	
22	XKD24CY042B	BFPDT-B GEAR BOX REL SHAFT VIB FJB	0-200 micron	VL 202	VL-202A08R-2012	VK-202A1	
23	XYA22CY021A	BFPDT-B HOUSING VIBRATION	0-25mm/s	CY 861	CY 861	FM CY EXTC 005	
24	XYA22CY021B	BFPDT-B HOUSING VIBRATION	0-25mm/s	CY 861	CY 861	FM CY EXTC 005	
25	XYA21CY021A	BFPDT-B HOUSING VIBRATION	0-25mm/s	CY 861	CY 861	FM CY EXTC 005	
26	XYA21CY021B	BFPDT-B HOUSING VIBRATION	0-25mm/s	CY 861	CY 861	FM CY EXTC 005	

- Note:**
1. The above listed signals are for each unit.
  2. Sensors/Drivers/Monitors for above BFP-DT measurements are not part of this scope



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#### **4.0 Other Requirement ( common for VMS , Analysis / Diagnostic Systems )**

- 4.1 Name & registered address of the Indian branch office or Indian representative for support of Erection & Commissioning and after sales service.
- 4.2 Copy of agreement between Original Equipment manufacturer (OEM) & Indian representative for carrying out Erection & commissioning (E&C) by indian representatives
- 4.3 Experience record of E&C, for minimum 2 years for same Principal
- 4.4 Details of manufacturing, testing & inspection facility.
- 4.5 Vendor shall have facilities in India for Engineering activities, preparation of Documents etc., for offered system
- 4.6 After Technical acceptance of offer, the names of such Vendor shall be submitted to End User for acceptance. Commercial bids of only accepted Vendors shall be considered**

#### **5.0 Quality Requirements ( common for VMS , Analysis / Diagnostic Systems ) :**

5.1 Following minimum test requirements to be met :

- Calibration report of Sensors for the selected / approved Range with curves shall be furnished.
- For Vibration Sensors, Frequency response curves and for Proximity probes, Gap v/s voltage data to be furnished. Sample reports shall be included as a part of Quality plan.
- Calibration of Monitors for the approved Range shall be submitted.

**The above documents shall form part of Acceptance documentation.**

#### **5.2 TESTING & INSPECTION:**

- The equipment covered under this specification shall be subject to vendor's Quality Plan to be approved by M/s LPGCL before start of manufacture. To ensure that quality is in-built in each equipment the Quality Assurance System manual & Quality Plan indicating the system followed by the vendor shall be submitted to purchaser for his review along with the offer.
- The Testing shall include following Type test, in addition to the Routine Tests,

#### **5.3 TYPE TEST:**

The Vendor shall furnish the type test reports for the VMS & TSS System and the test requirement shall cover CMRR, NMRR Verification. Submission of type test results and certificate shall be acceptable provided ....

- i) The same has been carried out by the Vendor on exactly the same model / rating of equipment.
  - ii) There has been no change in the components from the offered equipment & tested equipment.
  - iii) **The test has been carried out as per the latest standards along with amendments as on the date of Bid opening and as indicated below**
-



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#### 5.4 SPECIAL REQUIREMENT FOR SOLID STATE EQUIPMENTS/ SYSTEMS

The minimum type test reports, 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/ IEC-255.4. 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/ IEC-255.4. 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 IEC-255-4 which is equivalent to ANS/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 IEC 801-2 or equivalent.
- vi) Radio frequency immunity test as per IEC 801-6 or equivalent.
- vii) Electromagnetic Field immunity as per 801-3 or equivalent.

Test listed at item no. v, vi, vii, above are applicable for electronic cards only.

#### 6.0 Documents :

- All documentation shall be in English language.
  - Following documents shall be supplied along with offer.
    - a) Mounting details of the sensors, mounting blocks/pads and local junction boxes.
    - b) Configuration diagram of the system offered.
    - c) Specification / data sheets of various devices offered.
    - d) General arrangement drawing of the cabinet showing mounting details and dimensions, maximum length between cabinets, cabinet to PC are to be indicated.
    - d) Reference list of users for fossil fired Turbine generator set of similar rating.
  - After award of contract, following documentation in no. of copies as mentioned below shall be supplied.
    - a) Quality plan
    - b) Storage instruction
    - c) Configuration diagram & Machine train diagram
    - d) Mounting details for sensors
    - e) Wiring and cabling diagrams for Cabinets & other devices  
BOM, GA drawing & Rack layout drg  
Loop scheme and cable schedule  
Mounting blocks and JB Drawings  
Datasheet and technical literatures
- 6 copies, within 2 weeks of placements of P.O
-



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- |  |   |   |
|--|---|---|
| f) Test certificate & test results   | } | 2 copies After completion of tests                    |
| g) Calibration results for sensors   |   |   |
| h) Test results for Cables   |   |   |
| i) Type test results   |   |   |
| j) Operation & maintenance manual for the system including wiring diagram, circuit diagrams, Sensor details, etc.. | } | 2 copies along with the equipment +<br>1 copy to BHEL |

Also one set of soft copy on CD ROM for all the datasheet/drawings/test reports are to be furnished to BHEL after placement of Purchase order.  
The drawings under (a),(c),(d),(e),(f) & (i) will be for approval & others are for information & records.

### 7.0 Training :

Vendor shall provide necessary training on the operation & application to BHEL / End-User. The training shall cover the basic aspects of Vibration monitoring, details of the System supplied, Analysis method, Operation and Maintenance.

### 8.0 Warranty :

The offered systems / equipments shall be Guaranteed for Satisfactory operation of 18 months from date of Commissioning or 24 months from date of supply, whichever is earlier.

### 9.0 Vendor to note that any Item / services required to complete the Equipment to meet the Specification requirement shall be taken care without any Cost implication to BHEL.

### 10.0 Erection & Commissioning ( E & C ) Scope :

#### 10.1 Vibration Monitoring System portion of offered system :

Vendor shall provide separate offers for Erection activity (as applicable), Supervision of Erection and total Commissioning of the offered Vibration Monitoring System as detailed below.

- Collection of material from stores
- Mounting of offered vibration sensors with its mounting block on the machine bearing and terminate the sensor cable to Local Junction box supplied.
- Mounting of Key-phasor sensor and its bracket shall be suitably installed by Vendor at site and terminate the sensor cable to Local Junction box supplied.
- Supervision of Erection of offered System
- Commissioning of offered System
- Handing Over the system to End-User
- Training the operation personnel on operation and maintenance aspects while carrying out the above E & C activities.
- **Relevant documentation for commissioning of this system inline with specification requirement.. such as signed protocol with end user to be furnished along with calibration data, as applicable.**

Note : The total responsibility of above activities on the offered system shall rest with the vendor.



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**10.2 For Analysis & Diagnostics of offered systems :**

Vendor shall provide separate offers for Erection activity (as applicable), Supervision of Erection and total Commissioning of the offered Analysis & Diagnostics system, as detailed below

- Termination of cables between cabinet and PC/Server
  - Carrying out pre-commissioning checks, energizing Cabinets & PC/Server.
  - Commissioning of individual services.
  - Installing various software packages on PC/Server & establishing the operation.
  - Checking for all functions of hardware and software when the plant is totally commissioned with all auxiliaries
  - Handing over the offered system/s to End-User.
  - Training the operation personnel on operation and maintenance aspects while carrying out the above E & C activities.
  - **Relevant documentation for commissioning of this system inline with specification requirement.. such as signed protocol with end user to be furnished along with calibration data, as applicable.**
-



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## SECTION - E

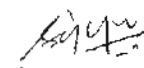
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# SPECIFICATION FOR TSS & VMS OF DVC-BOKARO PROJECT

Consultant : M/s DCPL, Kolkata

REVISION :

APPROVED

  
( SA / SKT )

PREPARED

ISSUED

DATE

  
(SA/DG)

409-416

27 /06/13



**Purchase Specification for  
Turbo Supervisory System (TSS) &  
Vibration Monitoring System (VMS)**

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**Project Synopsis in brief : DVC – BOKARO BTPS-A (1x500 MW)**

Location: New BTPS –A, 1x500 MW plant situated in Bokaro District of Jharkhand, India.

Access Road: The site is about 3 KM from District Road connecting Bermo with Bargura.

Nearest Railway station: Nearest broad gauge railway station is Bokaro close to the plant.

Nearest Airport: Ranchi and Netaji Subhash International Airport, Kolkata

Nearest Sea Port: Kolkata

**AA SCOPE:** Vendor shall offer Turbine Supervisory System (TSS) for Turbine-Generator Exciter and Vibration Monitoring System (VMS) for Plant Auxiliaries namely Boiler Feed Pump – BFPs & Motors, Cond. Extr. Pump – CEPs & Motors, DMCW Pumps & Motors, ACW Pumps & Motors, Cooling Water Pump – CWP & Motors, Mill Motors, ID Fans & Motors, FD Fans & Motors, PA Fans & Motors alongwith **Analysis and Diagnostics** for all these Machines covered under TSS and Plant Auxiliaries (VMS) for **DVC Bokaro – 1 x 500 MW** Power plant. **Technical requirements for the above machines are as per Cl. BB of this Purchase specification.** Scope of Supply shall include Engineering, Testing, Erection & Commissioning activities as per this specification.

**BB Technical Requirements:**

**1.0 Turbine Supervisory System ( TSS ) :**

**Measurement required for TSS shall be as per Table-1**

Vendor to indicate the IP class to which the sensors are complied.

**1.1 Absolute Bearing Vibration Measurement:**

For measurement of Vibration, Piezo-Velocity type sensor complete with connecting leads, terminal connectors are to be provided at all bearing as per Annexure-1. The sensors shall meet at least following specifications: -

- Freq.range : 5 Hz to 5 KHz
  - Operating temp. : 0 – 120 Deg . C
  - Environmental Protection : Hermetically sealed
  - Sensitivity : 100mV /inch/sec, ± 5%
- M6 Mounting Stud to be supplied

The Mounting Blocks / Pads required to fix these sensors on Generator Bearings are also to be included in the Offer. Vendor to mention Quantity of such Mounting Blocks/Pads required to be supplied. The mounting arrangement for Turbine & Exciter Bearings shall be in line with the Diagram as per Annexure – 2. (This mounting arrangement for Bearing 1,2,3,4 and 7 is supplied by BHEL NOT in Vendor's scope. The Mounting arrangement for Generator i.e bearing 5,6 to be supplied by Vendor as per typical drawing in a Annexure-3. Vendor shall make the exact drawing based on Visit to site). The length of the cable from Sensor up to nearest local junction box (JB also included in the scope of vendor) shall be equal to or more than 9 meters.

The Sensor integral cable and the extension cable shall be Teflon insulated and to meet the high operating temperature > 205<sup>0</sup> C requirement of the respective sensor.

**1.2 Relative Shaft Vibration Measurement :**

For measurement of Relative Shaft Vibration, Non-contact type sensors with connecting leads and terminal connectors are to be provided at all bearing as per Annexure-1.



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The sensors shall meet at least the following specifications: -

- Location of the sensor : Inside Bearing Casing
- Temp. range : 0 – 177<sup>0</sup> C
- Environmental protection : Encapsulated/ Hermetically sealed
- Frequency Range : 10 Hz to 10 KHz.
- Sensitivity : 8 mV/ $\mu$ m,  $\pm$  5%

Reverse mount sensors: For Turbine & Exciter Bearings (Brg 1, 2,3, 4 & 7)

Forward mount sensors: For Generator Bearings (Brg 5 & 6).

Typical Dimension of Sensor: Thread Size M10 x 1  
Threaded Length : 30 mm  
Sensor Tip Diameter: 8 MM

The sensors shall be capable of operation in an atmosphere of oil fumes. The casing of the sensor shall be made of stainless steel and the measurement shall not be affected by the presence of oil in the air gap.

The Sensor integral cable and the extension cable shall be teflon insulated and to meet the high operating temperature >205<sup>0</sup> C requirement of the respective sensor.

The Mounting Blocks / Pads required to fix these sensors on Generator Bearings are also to be included in the Offer. Vendor to mention Quantity of such Mounting Blocks/Pads required to be supplied. The mounting arrangement at Turbine & Exciter Bearings shall be in line with the Diagram as per Annexure – 2. (The mounting arrangement NOT in Vendor's scope). The length of the cable from Sensor up to nearest local junction box (JB also included in the scope of vendor) shall be equal to or more than 9 meters.

### 1.3 Absolute Shaft Vibration Measurement :

The necessary Computation Circuitry for the calculation of the Absolute Shaft Vibration with the Absolute Bearing Vibration and Relative Shaft Vibration at each location is to be provided. The Details of such computation is to be furnished.

### 1.4 Rotor Expansion HPT & IPT :

- Type : Non-contact eddy current
- Temp. Range : 0 – 177<sup>0</sup>C.
- Environmental protection : Encapsulated/ Hermetically sealed
- Location of the sensor : Inside the bearing casing.
- Sensitivity : 0.4 V/mm +/-5%
- Calibration Matrl : JIS SCM440(AISI4140 Steel) Flat Surface or VCL140Steel

Typical dimension of Sensor shall be as follows

- Thread Size : M24 x1.5
- Threaded Length : 30 MM
- Sensor tip Diameter : 8 MM
- Overall Body Length (Threaded + Unthreaded + Sensor tip etc.) not to exceed 125 MM for Sensor

The sensors shall be capable of operation in an atmosphere of oil fumes. The casing of the sensor shall be made of stainless steel and the measurement shall not be affected by the presence of oil in the air gap. The Sensor integral cable and the extension cable shall be teflon insulated and to meet the high operating temperature > 205<sup>0</sup> C requirement of the respective sensor.



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Mounting Bracket required shall be in scope of Vendor. Due to Space Limitation, only one sensor measurement is possible for HPT and for IPT two coil measurement is possible.

**1.5 Overall expansion HPT and IPT:**

Type	:	LVDT.
Temp. Range	:	0 – 120 <sup>0</sup> C.
Environmental protection	:	Weatherproof Enclosure.
Location of the sensor	:	Outside the bearing casing.

The mounting bracket required shall be included in the scope of vendor. The Sensor integral cable and the extension cable shall be Teflon insulated and to meet the high operating temperature >205<sup>0</sup>C requirement of the respective sensor. Computation circuitry for the calculation of the HPDE with Rotor Expansion and Over-all expansion to be included.

**1.6 Differential Expansion HPT , IPT and LPT :**

Type	:	Non-contact eddy current.
Temp. Range	:	0 – 177 <sup>0</sup> C.
Environmental protection	:	Encapsulated/ Hermetically sealed
Location of the sensor	:	Inside the bearing casing.
Sensitivity	:	0.4 V/mm +/-5%
Calibration Material	:	JIS SCM440(AISI4140 Steel) Flat Surface or VCL140Steel
Typical dimension of sensor	:	Thread size M30 x 1.5 Thread Length 40 MM Tip Diameter 25 MM

Overall body length of sensor shall not exceed 110 MM

The sensors shall be capable of operation in an atmosphere of oil fumes. The casing of the sensor shall be made of stainless steel and the measurement shall not be affected by the presence of oil in the air gap. The Sensor integral cable and the extension cable shall be teflon insulated and to meet the high operating temperature (>205 <sup>0</sup>C) requirement of the respective sensor.

Mounting bracket for LPDE shall be in scope of Vendor. Computation circuitry for the calculation of the HPDE and IPDE with rotor expansion and overall expansion to be included.

**1.7 Axial Shift :**

Type	:	Non-contact eddy current.
Temp. Range	:	0 – 177 <sup>0</sup> C.
Environmental protection	:	Encapsulated
Location of the sensor	:	Inside the bearing casing.
Sensitivity	:	04mV/microns +/- 5%
Calibration Matrl	:	JIS SCM440(AISI4140 Steel) Flat Surface or VCL140Steel
Typical Dimension of snesor	:	Thread Size M14 x 1.5 Thread Length 25 MM Tip Diameter : 11.3 MM

Overall Body length of, sensor shall not exceed 110 MM



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The sensors shall be capable of operation in an atmosphere of oil fumes. The casing of the sensor shall be made of stainless steel and the measurement shall not be affected by the presence of oil in the air gap. The mounting bracket required shall be included in the scope of vendor. The Sensor integral cable and the extension cable shall be teflon insulated and to meet the high operating temperature  $>205^{\circ}\text{C}$  requirement of the respective sensor.

All three sensors to be mounted in one bracket. Three different modules to be used for monitoring and different cables to be used from JB to cabinet.

**1.8 Reference Phase Measurement :**

For phase reference measurement, one Non-contact eddy current type sensor and matching converter shall be supplied. The converter will be located near the TG set. The sensor will be mounted in bearing No 2 of the turbine. A key phasor slot of 2mm-depth and 26 mm width is made on a collar provided in bearing No 2. The sensors shall be capable of operation in an atmosphere of oil fumes. The casing of the sensor shall be made of stainless steel and the measurement shall not be affected by the presence of oil in the air gap. The exact sensor mounting arrangement will be finalised after award of contract. The mounting bracket required shall be included in the scope of vendor.

**LIST OF MEASUREMENT FOR TSS : TABLE-1**

Sl No	Measurement	Type	No. of Measurements	Range of Measurement	Remarks
01	Absolute Bearing Vibration (X & Y)	Seismic/velocity	14	0-200 $\mu$ peak to peak	
02	Absolute & Relative Shaft Vibration(X & Y)	Non-contact	14	0-800 $\mu$ peak to peak	
03	Rotor Expansion HPT	Non-contact	1*	0 – 25 mm	Sensor single coil
04	Overall Expansion-HP Casing	LVDT	1*	0 -30 mm	
05	Rotor Expansion IPT	Non-contact	1*	0 - 21 mm	Sensor Two Coil
06	Overall Expansion – IP Casing	LVDT	1*	0 -20 mm	
07	HP diff expansion	Computed	-	-8/0/+12 mm	
08	IP diff expansion	Computed	-	-8/0/+12 mm	
09	LP Differential Expansion	Inductive/ Non contact	1 **	-15/0/+48 mm	Sensor two coil
10	Axial Shift	Non contact	3***	-1.5/0/+1.5 mm	

\* The signals of Overall Expansion and Rotor Expansion to be used to Compute the Differential Expansion of HPT and IPT which will have the Measuring Range of -8/0/+12 mm.



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\*\* A Conical Collar with Dual Ramp measuring surface at an angle of 14.3 Deg to Horizontal is provided.

\*\*\*The three signals of Axial Shift measurement shall be connected to three different monitors. Three different cable shall be used for interconnection of these sensors from JB to Panel.

Apart from Table-1 above Vendor to Consider Analysis and Diagnostic for BFPDT Signals as listed in Table-2 of this Purchase Spec. Necessary Hardware for interfacing these RAW Buffered Signals from M/s Shinkawa VM-5 System shall be considered

**Table-2**

<b>BFPDT VIBRATION SIGNALS TO BE CONSIDERED FOR ANALYSIS AND DIAGNOSTICS FOR BFPDT-A</b>		
<b>KKS</b>	<b>DESCRIPTION</b>	<b>RANGE</b>
XKD14CY042A	GEAR BOX O/P VIBRN(LO SPD)	0-200 microns
XKD14CY042B	GEAR BOX O/P VIBRN(LO SPD)	0-200 microns
XKD11CY041A	GEAR BOX(HI SPD) VIBRN(FJB)	0-200 microns
XKD11CY041B	GEAR BOX (HI SPD) VIBRN(FJB)	0-200 microns
XAD12CY041A	TURBINE FJB REL SFT VIBRN	0-200 microns
XAD12CY041B	TURBINE FJB REL SFT VIBRN	0-200 microns
XAD12CY042A	TURBINE RJB REL SFT VIBRN	0-200 microns
XAD12CY042B	TURBINE RJB REL SFT VIBRN	0-200 microns
XAD12CY021	Key Phasor	
<b>BFPDT VIBRATION SIGNALS TO BE CONSIDERED FOR ANALYSIS AND DIAGNOSTICS FOR BFPDT-B</b>		
<b>KKS</b>	<b>DESCRIPTION</b>	<b>RANGE</b>
XKD24CY042A	GEAR BOX O/P VIBRN(LO SPD)	0-200 microns
XKD24CY042B	GEAR BOX O/P VIBRN(LO SPD)	0-200 microns
XKD21CY041A	GEAR BOX(HI SPD) VIBRN(FJB)	0-200 microns
XKD21CY041B	GEAR BOX (HI SPD) VIBRN(FJB)	0-200 microns
XAD22CY041A	TURBINE FJB REL SFT VIBRN	0-200 microns
XAD22CY041B	TURBINE FJB REL SFT VIBRN	0-200 microns
XAD22CY042A	TURBINE RJB REL SFT VIBRN	0-200 microns
XAD22CY042B	TURBINE RJB REL SFT VIBRN	0-200 microns
XAD22CY021	Key Phasor	

**Note: Sensors/Drivers/Monitors for above BFPDT measurements are not part of this scope**

**1.9 Other items :**

Following shall be offered: Sensor Mounting blocks, Fasteners, Junction box with terminals, flexible conduits...etc..



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**1.9.1 Measuring Attachment (TRANSDUCER):**

The Measuring Attachment Unit shall be suitable for mounting near the turbine. The operating temperature range shall be 0 to 85 °C and environment protection class of IP 55 or better.

The connection between the sensor and measuring attachment will be made with a cable, which forms an integral part of the sensor. The length of such a cable shall be at least 9 meters (1 meter Integral+8 meter extension). Suitable protection for the cable like Protective hose/ Armouring to be provided the size of which shall meet the cable seal Requirements as per Cl 1.9.10. The connectors to be protected from the Environment & Electrical isolation.

**1.9.2 Local Junction Box (Metal):**

Required No. of Local JB's made of sheet steel , 3mm thick CRCA sheet are to be included in the scope of supply. The JB's shall be of Standard Design of Vendor and conform to IP 65 class of protection and shall be provided with adequate No. of cable glands and Terminal Blocks. Separate JB for each of the Bearing shall be provided. The JB arrangement drg is to be furnished. JB color shall be Exterior = RAL 7032, Interior = Brilliant White. Type Test for IP-65 to be included.

**1.9.3 Electronic Racks:**

- (i) The Electronic Transmitter modules, to drive the various sensors as detailed in Table-1 above shall be housed in adequate No of 19" Instrument racks. The hardware design shall allow online replacement of monitors without isolation/disconnection of input/output cable connections. The Instrument racks and necessary power supply modules shall be installed in a freestanding cabinet as per Cl. 1.9.11. BHEL reserves the rights to choose either Rack based TSS or Din rail based TSS, as per End user requirement.
- (ii) Power Supply:  
The equipment shall work with 240V AC +/-10%, 50Hz single phase uninterrupted supply. The Common Power Supply to electronic rack shall be Redundant such that on failure of one power supply(Power Supply modules in each rack shall be redundant), the other power supply shall cater to the requirement of the equipment. All the components required to achieve this shall be supplied, mounted and necessary wiring to be done. Any deviation/ alternate scheme proposed to be clearly brought out in the offer.
- (iii) The Microprocessor based Electronic Transmitter modules shall not have more than 4 Channels per module. The Transmitter modules shall receive the sensor signals and give buffered 4 - 20mA signal FOR EACH CHANNEL AND COMPUTATION CHANNEL. One 4-20 mA output signals shall be provided from each channel and computing channel of modules for hardwired link to DCS

Transmitter module shall have in built indication to show at least

- Alarm indication
- Module Healthy / Fault indication.
- The transmitter module shall have facility to set the Measuring Range
- No separate alarm contacts are envisaged for individual measurement.
- One no each potential free contacts to be provided for system failure,(rack wise or system wise as per manufactures standard practice) power supply OK/failure for hooking up the status to DDCMIS. The rating of the contact shall be 60V DC, 3 Watts.
- Vendor to indicate the available feature in their system for indication of measured values on rack/module.
- 4-20 mA signal output shall be less than 4 mA for related sensor failure.
- Separate monitor to be allotted for each bearing measurement.



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**1.9.4 Calibration/ Configuration Equipment:**

One set of Calibration Kit and Portable Shaker table for both the units shall be included in the offer.

**1.9.5 Link to DDC/DAS:**

All the measured signals and the other Related Parameters shall be hooked up to the DAS to be supplied by BHEL through redundant RS 232 MODBUS link. Necessary Hardware and Software Interface required to be included in the offer and the details of Signal Transfer Protocol to be furnished.

**1.9.6** The Instrument rack shall have 10% of Rack Space free for any future expansion.

**1.9.7** Spare 10% or 2 nos (whichever is more) channels of each variety of module shall be provided in the TSS.

**1.9.8** All the signals coming from field & going to other instruments shall be terminated on cage clamp type terminal blocks.

**1.9.9 Cables:**

All Instrumentation Cables (0.5 sq.mm) shall be Annealed Tinned Copper conductor provided with Individual Pair Shielding in addition to Overall Shielding and armored. The Cables shall be FRLS type twisted multi-pair cables or triad/multi-triad cables supplied in Drum lengths of 500mtr(+/-5%). All Instrumentation Cables shall be suitable for Continuous operation at 70 Deg.C and shall at least meet the following specifications:

Mutual Capacitance at 0.8KHz	:	120 nF/Km
Conductor resistance(max)	:	73.4 ohm/Km
Insulation resistance	:	100 M Ohm/Km
Cross-talk at 0.8 KHz	:	60 dB
Characteristic impedance (max)	:	320 Ohms at 1 KHz
Attenuation at 1 KHz	:	1.2 dB/Km
Voltage Grade	:	225V
Colour Code	:	As per VDE0815 STD

Cables between local JB'S to System racks, heat resistant hose, converters and extender cables are in Vendor's scope. Vendor to consider about 150 meter Route length between local JB to system rack. Vendor to furnish full details of the cable being offered. All the cables shall have PVC insulation for conductor and PVC with FRLS properties for both inner and outer sheaths. Vendor to consider 20% of extra length of Cables.

**1.9.10 Cable Seals:**

Necessary Cable seals meeting suitable environment conditions of medium, temperature and pressure (at least 25 psi) shall be included for Routing the cables from inside the bearing to outside. The Seals shall be suitable for M12x1.5 tapped hole of length 25 mm provided on the Bearing Casing. Also any other items required to complete the equipment /system shall be included by the vendor. This item is required for following measurements.

- Key Phase
- Axial Shift
- Rotor expansion of HPT & LPT
- LPDE



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**1.9.11 Panel : TSS Panel will be supplied by Vendor and Monitors with Rack will be mounted at Site by Vendor.**

**Panel features will be as follow:**

- Panel shall be of typical size 800 mm X 800 mm X 2300 mm, approx.
- Panel shall be made up of 2 mm thick CRCA steel sheet.
- Anti - Vibration pad of about 15 mm shall be provided.
- Panel Protection class will be **IP-42 as per IS:13947.**
- Permissible ambient conditions
  - a) Room temperature - Operation : 0°C to 60°C  
Storage : -25°C to 80°C
  - b) Relative humidity – Average : 65%  
Short Duration : 95% Max(One day)
- Paint (Epoxy based, powder coated)  
Doors, Canopy & Plain end covers :- Off White to RAL:9002 Semi – Glossy (Both interior & exterior)  
Folded End Covers : Exterior :- Blue to shade RAL:5012.
- Panel painting shall be powder coated to 80 to 100 microns thick.
- Door shall be provided in the front and rear sides, shall be of 2 mm thick CRCA steel sheet.
- Louvres with mess shall be provided at the bottom of doors for ventilation
- Front door of the panel shall be provided with a suitable Glass window.
- 3 Point locking system.
- Door swing : 375 mm maximum.
- Cutout shall be provided on the bottom of the panel for cabling.
- Suitable Lifting Hooks shall be provided on the panel.
- Provision shall be made in the panel to accept two power supply feeders with required MCB's.
- Terminals shall be cage clamp type for cable termination. 20% spare terminals shall be offered.
- M8 bolts shall be provided for cubicle earthing.
- Illumination shall be provided in the panel.
- Door switch shall be provided for door open status on OWS.
- Top Canopy to cater for second digit (2) of IP Class.
- One switch & Socket shall be provided per suite of panel.

**1.9.12 Teflon insulated SS flexible conduit to be used from sensor to JB routing.**

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**2.0 Vibration Monitoring System ( VMS ) for Auxiliaries :**

**2.1 Requirement for VMS Hardware :**

- (i) Microprocessor based Vibration Monitoring System shall be offered for Monitoring the Vibration levels of various Machines or Plant auxiliaries of a Power plant. The Machines to be monitored for Vibration levels are Pumps (BFP, CEP, DMCWP, ACWP and CWP), Fans (ID, FD and PA), Motors (of Fans, Pumps and Mills) detailed in Machine Data ref. CE/416/BOKARO/VMS-D / Page 15 of 22 of this specification.
  - (ii) The measurement of Vibration levels shall be carried out on the Bearing housings of the above machinery in both Horizontal & Vertical planes ( X – Y planes ).
  - (iii) The offered Vibration Monitoring System shall as a minimum consists of Vibration Sensors & Phase measurement sensors with low noise cables of 10 meters length in SS flexible conduits, Local terminal box / Junction boxes, necessary per-amplifier/ electronics mounted in local weather –proof boxes, Vibration monitors, Monitor Racks, Power supplies, integrating units, Relay modules, Interface module, Communication modules, Signal conditioning devices, sensor-mounting accessories, interconnecting cables, calibration equipment, Panel/s ..etc..
  - (iv) Sensors shall be Velometer type & selected based on the service requirement / parameters w.r.t machine Speed and the Vibration ranges, for each of the Machine. The Project-specific details of various machines have been provided at Machine Data ref. CE/416/BOKARO/VMS-D / Page 15 of 22 of this specification. Offered sensor shall be with sensitivity of  $\pm 5\%$ .
  - (v) The offered Sensors with mounting accessories shall be mounted on Bearing housing of the Machine, in Horizontal and Vertical directions. Weatherproof housing shall be provided for these sensors and shall be suitable for field conditions of the Power plant. Vendor to note that the Cables from Sensor-Local Junction box in field to Vibration monitoring System Panel/s in Main control room shall be provided by BHEL which is 4Pair x 0.5 Sq. mm – PVC, FRLS, Individual & Overall shielded Pair Copper Cable. Maximum cabling distance from the Machine to Panel/s will be 400 meters. 2Triad x 0.5 Sq.mm Individual & Overall shielded Pair Copper Cable will be provided by BHEL for Phase measurement sensors.
  - (vi) The offered Vibration Monitors shall be 2 to 4 channel with 4-20 mA output per channel. Independent potential free contacts shall be made available for high alarm & trip purposes for each channel being monitored. Critical alarm & trip relay output shall be configured in 2 of 3 voting or 1 of 2 voting logic as required for the machine criticality. For 1 of 2 and 2 of 3 voting philosophy each trip channel shall be configured in separate cards. The Power supply in the Rack shall be Redundant power supply modules in each rack such that on failure of a single power supply, the power supply shall cater to the requirement of offered equipment. The output of each channel shall be in Velocity units and field programmable to Displacement units MODBUS / TCP IP output shall be provided from TSS & VMS as soft link to DCS.
  - (vii) The front of the offered monitors shall have digital bar graph display for the measured Vibration levels and also have facility to connect another device to analyse the Vibration, of each channel. The front face of these monitors shall
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have status indications for healthy conditions for Sensor circuit, monitor circuit and power supply. Set point indication with set point adjustment facility for setting Alarm and Trip levels shall be provided. Offered monitors shall be modular in construction, plug-in type and suitable for mounting in 19" Rack. A facility shall be available from front of mounting rack for functional checking of monitors with inhibition of alarm & trip contact outputs during test. Alarm inhibition shall also be provided during start-up. If in case the offered monitors does not have digital bar graph display, then Panel PC / Panel LCD display of minimum 15 inch display size shall be offered per Unit wise for digital bar graph display of the measured vibration levels.

- (viii) Interface module shall be capable of connecting external Condition Monitoring Server for configuration of monitoring modules, relay modules and communication. This shall also provide link with the server to monitor static & dynamic data. Display unit shall be provided at rack for monitoring. Hard key shall be provided at rack to prevent unauthorized soft link access to the system configuration.
  - (ix) No failure of a single component shall lead to the trip of the machine. The system shall be capable enough to store Sequence of Event even in worst data condition. Sequence of Events shall not be lost in case of total power failure & system restart. Non volatile memory shall be used for the same.
  - (x) A communication processor shall be provided to interface Machine Condition Monitoring server. Data shall be transferred with high integrity and without any loss of data.
  - (xi) Communication processor shall be capable of collecting data better than once per second.
  - (xii) System shall be time synchronized with the GPS clock.
  - (xiii) Removal & replacement of module shall be possible to carry out in system power on condition.
  - (xiv) In addition to machine transducer data Process variable monitors shall have the capability to receive 4-20mA DC process data.
  - (xv) Relay modules shall be programmable or hardwired connected to perform Boolean operation.
  - (xvi) It shall be possible to test all the monitors in the rack. The trip and alarm relay shall be automatically bypassed during testing to prevent alarm and trip.
  - (xvii) The system shall be supplied with necessary configuration & MMI software for configuring & downloading of the program from machine condition monitoring server. In case the server does not support for the same, a separate portable Laptop computer shall be provided.
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- (xviii) System shall be capable of operating from 0 to 50°C and at 95% non-condensing moisture.
- (xix) Specific details of vibration monitor shall be as follows:
- Sensitivity: 100 mV/mil or better
  - Frequency Response: User programmable
  - Accuracy:  $\pm 0.5\%$  of full scale
  - Transducer Supply Voltage: -24 VDC (Typical)
  - Alarm Adjustment: Digitally adjustable over full scale for alert and danger set-points.
- (xx) Specific details of phase reference monitor shall be as follows:
- Input signal: Two proximity probes, one for eccentricity and one for key-phasor
  - Frequency Response: 0 to 10Hz
  - Accuracy:  $\pm 0.5\%$  of full scale
- (xxi) The mounting racks for all equipment shall be designed for flush mounting through the front face of upright panels.
- (xxii) The front of each mounting rack shall house a monitor test-switch, test condition indicating lamp and power on indication lamp.
- (xxiii) Panel shall be provided with necessary isolation transformer, MCBs, switch etc. Power and signal cable shall be routed in separate tray.
- (xxiv) Panel shall have the provision for protective and DC system ground.
- (xxv) Each vibration monitor and mounting rack shall have nameplate engraved to indicate the main equipment to which the module is catering and the bearing details.
- (xxvi) Offered Vibration monitoring equipment shall be functionally tested for circuit continuity and output response. All the components & interconnection cables shall be tested to ensure compliance with the specification requirement & all other applicable codes & standards.
- (xxvii) For Analysis & Diagnostic package along with VMS, Sensors and related Electronics shall be offered for measurement of Phase angle / speed of the Machine. A Key-slot of dimension "30 mms x 15 mms x 3 mms" typically, is provided on the Machine-Shaft / Coupling. Suitable mounting brackets for these sensors shall also be offered.
- (xxviii) Vibration Monitors shall be offered / grouped / assigned in such a way that the channels being monitored for Vibration for a machine will not be in same monitor. Eg..BFP DE – X & Y and BFP NDE – X & Y channels, will be in different vibration monitor...etc..
- (xxix) Vendor to note again that the sensors & monitors offered finally shall be as per Machine Data ref. CE/416/BOKARO/VMS-D / Page 15 of 22 of this specification. Spare 10% channels of each variety wired in the rack shall be provided in the VMS. 10% empty slots to be kept in the rack. Any revision in selected / offered models of sensors & monitors during detailed Engineering shall be done without any Commercial implications.
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**2.2 Panel for above equipment :**

Vendor shall supply the panel for VMS as per below specification:

- Panel shall be of size 800 mm X 800 mm X 2415 mm H ( including top canopy- 60 mm + Bottom frame 50 mm + Antivibration pad 15mm ) in mm
- Panel shall be made up of 2mm thick CRCA steel sheet.
- Anti-vibration pad of about 15 mm shall be provided.
- Panel protection class shall be IP – 32; Panel height shall be 2415 mms.
- Door shall be provided in the front & rear sides, shall be of 2 mm thick CRCA steel sheet.
- 3 point locking system
- Paint shade/s shall be :
  - Exterior (front & rear door) = Grey to Shade No RAL 9002, Semi-Glossy
  - Exterior (side cover) = Blue to Shade RAL 5012, Semi-Glossy
  - Interior = Brilliant White to Shade No 9-102 SP:1650 Glossy
- Panel painting shall be powder coated 100 microns thick or more.
- Cutout with cable-gland plates shall be provided on the bottom of the Panel, for Cabling.
- Suitable Lifting Hooks shall be provided on the Panel.
- Provision shall be made in the Panel to accept two power supply feeders with required MCB's.
- Terminals shall be Clip-on type for cable termination. 20 % spare terminals shall be offered.
- Illumination shall be provided in the panel.

**2.3 Other items :**

Following shall be offered:

- Vibration-Sensor Mounting blocks,
- Phase-angle measurement-Sensor with Mounting brackets, required Fasteners,
- Field Junction box with Terminals, as per below specification:
  - Type of Enclosure: IP-65, Dust tight, Weatherproof and Water proof
  - Material: 16 SWG sheet hot-dip galvanized / Cast aluminium LM6.
  - Type of cover: Solid unhinged with retention chain
  - No. of Paint: One base + two finish coatings of anti-corrosive epoxy
  - Mounting: Surface
  - Cable Entry: Conduit Knockout/ Threaded Hub
  - Gasket: Neoprene
  - Grounding: Brass earth lug with green screw head; External – 2 nos., Internal – 1 No M6
  - No. of Drain Holes: Two at bottom capped
  - Tag Plate: a) JB Number  
b) Cable Number on top  
c) Cable numbers with ferrules (sides)
  - Accessories: a) Rail mounted Terminal blocks with makers  
b) Cable gland
- Cable Gland
  - Type: Double compression
  - Entry Thread: ET
  - Material: Brass
  - Finish: Cadmium Plated
  - Protection: IP – 54 or better
  - Accessories: Neoprene gasket, locknuts, reducers etc.



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- One (1 no.) Portable Data Collector shall be offered, common for both Units. Instrument shall be capable for machine condition monitoring and analyzing the data. Instrument shall be microprocessor based and ready for use in harsh environment. Integral LCD display shall provide the necessary display of readings & spectral data. Minimum 02 channels along with additional input for phase reference measurement shall be available with the instrument. Instrument shall include necessary accelerometers and other devices with accessories for collection of machine parameters. A long life Ni-Cd battery pack shall be offered. Replacement of battery shall not lead to loss of stored data.
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**Machine Data for Auxiliaries**

Machine Data of BOKARO (1x 500 MW) TPS:					Ref.: CE/416/BOKARO /VMS-D					
Sl. No.	Machine	Machine Qty.	No. of Bearings for monitoring vibration (in X & Y direction)	Installation (Horizontal/ Vertical )	Machine RPM	Alarm Level (mm/sec - Peak)	Trip Level (mm/sec - Peak)	Mounting Details	NO. OF VIBRATION SENSORS	NO. OF PHASE MARKER SENSOR
1	Turbine Driven Boiler Feed Pump - TDBFP	2	2	Horizontal	00-650	11 **	18 **	C	8	2
2	MDBFP	1	2	Horizontal	800-6500	11 **	18 **	C	4	1
3	MDBFP - Motor	1	2	Horizontal	1500	4.5	7.1 #	B	4	1
4	Condensate Extrn. Pump - CEP	3	1	Vertical	1485	11**	18 **	A	6	3
5	CEP - Motor	3	2	Vertical	1500	4.5 #	7.1 #	B	12	
6	CWP	4	2	Vertical	490	11 **	18 **	A	16	4
7	CWP - Motor	4	2	Vertical	429	4.5 #	7.1 #	B	16	
8	DMCW (TG) Pump	3	2	Horizontal	1500	10 #	15 #	A	12	3
9	DMCWP (TG) - Motor	3	2	Horizontal	1500	7 #	12 #	A	12	
10	DMCW (SG) Pump	2	2	Horizontal	1500	10 #	15 #	A	8	2
11	DMCWP (SG) - Motor	2	2	Horizontal	1500	7 #	12 #	A	8	
12	ACWP	2	1	Vertical	1485	10 #	15 #	A	4	2
13	ACWP - Motor	2	2	Vertical	1500	7 #	12 #	A	8	
14	Mill Motor	8	2	Horizontal	1000	4.5 #	7.1 #	B	32	8
15	ID Fan	2	2	Horizontal	120-580	6.3 #	12.6 #	E1	8	2
16	IDF - Motor	2	2	Horizontal	600	4.5 #	7.1 #	B	8	
17	FD Fan	2	1	Horizontal	990	6.3 #	12.6 #	E	4	2
18	FDF - Motor	2	2	Horizontal	1000	4.5 #	7.1 #	B	8	
19	PA Fan	2	1	Horizontal	1490	6.3 #	12.6 #	E	4	2
20	PAF - Motor	2	2	Horizontal	1500	4.5 #	7.1 #	B	8	
<b>GRAND TOTAL</b>		<b>52</b>							<b>190</b>	<b>32</b>

**Note:**  
1) Mounting Details:  
A: 60 x 60 x 10 mm pad on bearing housing  
B: 60 mm cube vibration pad welded on both end shields  
C: 40 x 100 mm machined surface provided on DE & NDE bearing housing  
E / E1: 80 x 80 mm / 70 x 80 mm machined pads screwed with bearing housing respectively.  
2) \*\* 'mm/sec - rms' ; # 'mm/sec - peak'  
3) KKS Tag Nos. for transducers will be provided during detailed Engineering.  
4) VMS Racks for CWP & ACWP machines shall be located in common panel which will be located in CW Pump House Control Room.



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### 3.0 Analysis Requirements :

**3.1** Microprocessor/ Computer based Analysis Unit, with required software, is to be offered to achieve the following functions as minimum.

- Bar graph and point display indicating the setpoints.
- Graphical plant and machine area representation with location of sensors and the current values.
- Diagnostics of the system and sensors. Alarm to be retransmitted to DCS.
- Current and history trend with resolution of 10 msec.
- Spectral band and waveform plotting.
- Multiple trends display including process value for data correlation.
- Storage and comparative analysis of vibrations
- Spectrums and Spectral Alarms
- Generation / analysis of bode plot
- Orbit plot & Polar plot
- Time waveform
- Nyquist plot
- Shaft center line plot for TG
- Cascade
- Waterfall plots
- Transient data ( during Start-up and Shut-down )
- Date & Time stamped alarm list.
- Log & Report generation
- Provision for beeping icon in case of appearance of alarm
- Export & import of DCS data. Both way redundant communication link with the DCS shall be provided.
- Electronic documentation.

Vendor shall furnish the List of process signals required for further analyzing vibration data and include necessary hardware and software for accepting such signals from BHEL system.

**3.2** The FFT analyzer units shall have a frequency range from 1Hz to 20 kHz, Spectrum resolution of 600 lines minimum. Provision for selecting high and low resolution display shall be provided. The scan rate shall be specified by vendor.

**3.3** The FFT analyzer offered may be an independent unit or a part of Monitor rack/s housing input modules ..etc. ( discussed in Clauses 1.0 & 2.0 of this Specs. ) and in-line with the manufacturer's practice.

**3.4** The output from FFT analyzer unit and/or Monitor rack/s above shall be connected to a computer system to perform analysis of the Vibration data of the machine/s ( discussed in Clauses 1.0 & 2.0 of this Specs. ).

**3.5** Machine Condition Monitoring server shall be capable of running several software on single platform like Windows NT / Windows 2000 and interfacing with multiple machinery protection racks using Ethernet / Token passing communication link, switches and network cable etc. Configuration and downloading of programs for different modules in Machine protection system such as monitoring modules, relay modules etc. shall be executable from this server with at least two levels password protection.

**3.6** Data collected in the system will also be accessed by Maintenance Management System resident on the plant wide area network for condition based maintenance.

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- 3.7** The Computer for analyzer unit shall consist at-least of following configuration.
- PC/server of reputed make (with 22" TFT monitor) and Latest model and version.
  - Intel Xeon /Quad Core Processor
  - Minimum 4 GB RAM
  - Min 500 GB hard disc with mirroring type hard disc to ensure data integrity.
  - Combo Drive
  - Master Slave Card for Time synchronization
  - Colour Laser printer upto A4 printing. Ref Models (XEROX Phaser 6500 & equivalent or better)
  - Network card.(2 No;s)
  - Necessary Cables with accessories for inter connecting and connecting to TSS / VMS Panels and DCS/ DAS Panel/s. Software CDs with License/s.
  - Anti-Virus Package to be included

Vendor shall clearly bring out in his offer the configuration proposed. Vendor shall ensure that the capacity of the analyzer unit is sufficient to meet the specification requirements of the points being monitored. Also a spare capacity of 20% points of measurement, for future expansion shall be provided. Vendor shall specify the type of communication between the offered FFT unit and Analyzer unit. Vendor shall clearly bring out in their offer the Data Backup and Security procedures. Necessary no. of Ethernet hubs, cables, etc., shall be included in the offer. All items required to make the system complete shall be included in the offer.

**3.8 Configuration Requirements:**

- 3.8.1** The offered Panels for TSS of TG, VMS for auxiliaries with FFT analyzer for TSS of TG, VMS for auxiliaries shall be located in Main Control equipment room.
- 3.8.2** Offered Computer hardware shall be located in Computer room near Main Control equipment room.
- 3.8.3** The distance between Panels in Main Control equipment room (3.8.1) & Computer room (3.8.2) is about 50 meters. Vendor shall offer FO Cable and accessories for interconnection between Panel and Computer.
- 3.8.4** All racks shall be connected in a network and racks for CWP & ACWP machines shall be located in common CWP/ACWP VMS Panel at remote location at CW pump house area. Cabling distance from CWP/ACWP VMS Panel to Main VMS Panel in Main Control Equipment Room (3.8.1) shall be 400 meters. Vendor to indicate the type of Communication cable required and offer the same with necessary accessories. Networking shall be made through OFC/ Ethernet data highway cable.
- 3.8.5** Vendor to propose a detailed configuration diagram of the equipment to be supplied along with a list of equipment, which shall be approved by BHEL.



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**4.0 Diagnostics / Expert System Requirements:**

Vendor shall utilize the Vibration data, Process information and Analysis data to provide Diagnosis and recommendations for machinery management, effectively. It shall be an extensive and accurate knowledge base to enable quick determination of the condition of a machine by providing alarm notification or advisories of the machinery malfunction. The offered system shall be able to specifically evaluate the available data while checking for the presence of the most frequently occurring machine malfunctions such as,

- High synchronous vibration
- Shaft bow / crack
- Fluid induced instability (Whirl and Whip)
- Radial pre-load forces (including misalignment)
- Vector change
- Rotor rub
- Loose rotating parts
- Electric motor non-uniform air gap
- Gear mesh problems, pump cavitations (as applicable)
- Location of fault
- Type of fault
- Severity of fault
- Time of occurrence
- Recommended action

The system shall also allow to generate easy to use custom rules. The system shall be developed with automated advisory capability of the system. Rule generator shall reject any rule, which is not syntactically correct.

Bidder shall supply all licensed version of all the applicable software in run & edit mode for his system and for integration of his system with third party device.

**5.0 Following Vendors for the items listed , are approved by Enduser/Customer:**

- |      |   |   |
|------|---|---|
| i)   | <b>Cabinet / Panel (for TSS &amp; VMS )</b>             | <b>- Rittal / Pyrotech</b>  |
| ii)  | <b>PC/Server &amp; TFT Monitor (for TSS &amp; VMS )</b> | <b>- DELL/HP</b>  |
| iii) | <b>Fiber Optic Cable (for TSS &amp; VMS )</b>           | <b>- Akash Fiber, Birla Ericsson<br/>and Finolex.</b>   |
| iv)  | <b>FRLS Cables<br/>-armoured (for TSS)</b>              | <b>- Advance Cable technologies, Bangalore<br/>Polycab, Daman<br/>Nicco , Kolkata<br/>Habia Cables, Sweden<br/>Delton, Faridabad<br/>KEI Industries Ltd, Chennai<br/>Universal Cables, Satna<br/>Kerpen Cables, Germany<br/>Lapp Cables, Germany<br/>Thermo Cables, Hyderabad<br/>Thermo Electric, Netherland/USA</b> |

**Note : Anyother vendors other than above, shall be accepted subject to approval by Enduser/Customer.**



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## **6.0 Quality Requirements ( common for TSS & VMS , Analysis / Diagnostic Systems ) :**

### **6.1 Following minimum test requirements to be met :**

- Calibration report of Sensors for the selected / approved Range with curves shall be furnished.
- For Vibration Sensors, Frequency response curves and for Proximity probes, Gap v/s voltage data to be furnished. Sample reports shall be included as a part of Quality plan.
- Callibration report for LVDT Sensors to be furnished
- Calibration of Monitors for the approved Range shall be submitted.

**The above documents shall form part of Acceptance documentation.**

### **6.2 TESTING & INSPECTION:**

- The equipment covered under this specification shall be subject to vendor's Quality Plan to be approved by M/s DVC before start of manufacture. To ensure that quality is in-built in each equipment the Quality Assurance System manual & Quality Plan indicating the system followed by the vendor shall be submitted to purchaser for his review along with the offer.
- The Testing shall include following Type test, in addition to the Routine Tests,

### **6.3 TYPE TEST:**

The Vendor shall furnish the type test reports for the VMS & TSS System and the test requirement shall cover CMRR, NMRR Verification. Submission of type test results and certificate shall be acceptable provided ...

- i) The same has been carried out by the Vendor on exactly the same model / rating of equipment.
- ii) There has been no change in the components from the offered equipment & tested equipment.
- iii) **The test has been carried out as per the latest standards along with amendments as on the date of Bid opening and as indicated below**

### **6.4 SPECIAL REQUIREMENT FOR SOLID STATE EQUIPMENTS/ SYSTEMS**

The minimum type lest reports, 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/ IEC-255.4.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/ IEC-255.4. 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

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IEC-255-4 which is equivalent to ANS/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 IEC 801-2or equivalent.
- vi) Radio frequency immunity test as per IEC 801-6 or equivalent.
- vii) Electromagnetic Field immunity as per 801-3 or equivalent.

Test listed at item no. v, vi, vii, above are applicable for electronic cards only.

**7.0 Documents :**

- All documentation shall be in English language.
  - Following documents shall be supplied along with offer.
    - a) Mounting details of the sensors, mounting blocks/pads and local junction boxes.
    - b) Configuration diagram of the system offered.
    - c) Specification / data sheets of various devices offered.
    - d) General arrangement drawing of the cabinet showing mounting details and dimensions, maximum length between cabinets, cabinet to PC are to be indicated.
    - d) Reference list of users for fossil fired Turbine generator set of similar rating.
  - After award of contract, following documentation in no. of copies as mentioned below shall be supplied.
    - a) Quality plan
    - b) Storage instruction
    - c) Configuration diagram & Machine train diagram
    - d) Mounting details for sensors
    - e) Wiring and cabling diagrams for Cabinets & other devices  
BOM, GA drawing & Rack layout drg  
Loop scheme and cable schedule  
Mounting blocks and JB Drawings  
Datasheet and technical literatures

6 copies, within 2 weeks of placements of P.O
  - f) Test certificate & test results
  - g) Calibration results for sensors
  - h) Test results for Cables
  - i) Type test results
- 2 copies After completion of tests
- j) Operation & maintenance manual for the system including wiring diagram, circuit diagrams, Sensor details, etc..
- 2 copies along with the equipment +  
1 copy to BHEL

Also one set of soft copy on CD ROM for all the datasheet/drawings/test reports are to be furnished to BHEL after placement of Purchase order.



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The drawings under (a),(c),(d),(e),(f) & (i) will be for approval & others are for information & records.

**8.0 Training :**

Vendor shall provide necessary training on the operation & application to BHEL / End-User. The training shall cover the basic aspects of Vibration monitoring, details of the System supplied, Analysis method, Operation and Maintenance.

Training courses shall be conducted by experienced personnel of the bidder. Course participants shall receive individual copies of technical manuals at the time the course is conducted. Upon completion of each course, training manuals shall be property of Owner. Bidder shall supply all changes and revisions to the manuals.

Training shall be provided to operating, programming and maintenance personnel.

Bidder shall include in his (class-room lecture, audio-visual presentation, hands-on). If bidder conducts Owner's training on regular periodic basis, a printed brochure of such program may be enclosed for reference.

Bidder shall provide all additional training deemed necessary by Owner, if there are modifications to Bidder's system and software after completion of the regular training period.

**9.0 Warranty :**

The offered systems / equipments shall be Guaranteed for Satisfactory operation of 18 months from date of Commissioning or 24 months from date of supply, whichever is earlier.

**10.0 Vendor to note that any Item / services required to complete the Equipment to meet the Specification requirement shall be taken care without any Cost implication to BHEL.**

**11.0 Erection & Commissioning ( E & C ) Scope :**

**11.1 Turbo Supervisory System portion :**

11.1.1 Vendor shall give a separate offer for erection and commissioning of the complete Turbine Supervisory system covered in this specification.

11.1.2. The total responsibility of erection and commissioning of the system supplied shall rest with the vendor. The important events are listed below:

- Collection of material from stores.
- Preparation of mounting surface and mounting arrangement to suit the surface of the machine
- Mounting of Sensors on the Machine/s
- Mounting of local JB's and termination of cables between sensor to local JB.
- Laying of cable between Local JB and Control Panels , is by BHEL
- Termination of cables between local JB's to cabinet
- Termination of cables between cabinet and PC ( as applicable )
- Carrying out pre-commissioning checks,energizing Cabinets & PC (as applicable)
- Commissioning of individual services.
- Installing various software packages on PC & establishing the operation.
- Checking for all functions of hardware and software when the plant is totally commissioned with all auxiliaries
- Handing over the system to End-User.



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- Training the operation personnel on operation and maintenance aspects.
  - **Relevant documentation for commissioning of this system inline with specification requirement, such as signed protocol with end user to be furnished along with calibration data.**

### 11.2 Vibration Monitoring System portion :

Vendor shall provide separate offers for Erection activity (as applicable), Supervision of Erection and total Commissioning of the offered Vibration Monitoring System as detailed below.

- Collection of material from stores
- Mounting of offered sensors with its mounting block on the machine bearing and terminate the sensor cable to Local Junction box supplied.
- Mounting of Key-phasor sensor and its bracket shall be suitably installed by Vendor at site and terminate the sensor cable to Local Junction box supplied.
- Supervision of Erection of offered System
- Commissioning of offered System
- Handing Over the system to End-User
- Training the operation personnel on operation and maintenance aspects while carrying out the above E & C activities.
- **Relevant documentation for commissioning of this system inline with specification requirement.. such as signed protocol with end user to be furnished along with calibration data.**

Note: The total responsibility of above activities on the offered system shall rest with the vendor.

### 11.3 For Analysis & Diagnostics systems :

Vendor shall provide separate offers for Erection activity (as applicable), Supervision of Erection and total Commissioning of the offered Analysis & / or Diagnostics system, as detailed below

- Termination of cables between cabinet and PC/Server
  - Carrying out pre-commissioning checks, energizing Cabinets & PC/Server.
  - Commissioning of individual services.
  - Installing various software packages on PC/Server & establishing the operation.
  - Checking for all functions of hardware and software when the plant is totally commissioned with all auxiliaries
  - Handing over the offered system/s to End-User.
  - Training the operation personnel on operation and maintenance aspects while carrying out the above E & C activities.
  - **Relevant documentation for commissioning of this system inline with specification requirement.. such as signed protocol with end user to be furnished along with calibration data.**
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