**BHARAT HEAVY ELECTRICALS LIMITED**
**HEEP: HARDWAR-249 403 (UA)**
**Fax: 01334-223948/226462, Phone: 285291**
**E-mail: asanyal@bhelhwr.co.in**

**No. Cap/OT/06** **Date: 27th Jan.'07**

## OPEN TENDER (EXPRESSION OF INTEREST)

1. Sealed tenders (expression of interest) with the Tender No. and opening date clearly super scribed on the cover are invited from the manufacturers for the supply of the following items:-

2. Last date for taking tender documents and opening of tenders is indicated against each tender. Tenders will be received up to 1.45 P.M. on opening date and opened on the same day at 2.00 P.M. in the Tender Room.

3. Intending vendors must remit the tender fee of Rs. 2,000.00 for indigenous supplies (equivalent foreign currency $ 50.00 / € 40.00) from foreign vendors against each tender along with the requisite EMD in the form of bank draft while submitting the tender documents as detailed in "Instruction to Bidders", after down loading from this web site.

4. BHEL will not be responsible for any type of postal delay / incomplete information from vendor.

5. Other terms and conditions will be as per tender documents.

| Sl. No. | Tender No. | Description of Equipment | Qty. (Nos.) | Last date to get from BHEL | Opening date |
|---|---|---|---|---|---|
| 1. | C3991/6/6731T | CNC 5Axis Single Spindle Machining Cell (*as per enclosed specification)* | 03 | 14.03.07 | 15.03.07 |

**(A. Sanyal)**
**DGM (Capital Purchase)**

# BHARAT HEAVY ELECTRICALS LIMITED
# HEEP HARIDWAR INDIA-PIN 249403
# FAX NO: 0091 1334 226462/223948
# PHONE NO: 0091 1334 285291

**Enq. No.: C3991/6/6731T**

**Date of issue: 27th Jan.'07**
**Due Date: 15th March'07**

**M/S……**

**……**

**Sub: Tender Enquiry No. C3991/6/6731T.**

Dear Sir,

We are pleased to invite Expression of Interest., strictly as per enclosed terms and conditions and instruction to bidders, in sealed covers for the under mentioned equipment/systems.

| S.N. | Description | Qty. | Delivery Required | EMD (Earnest Money Deposit) |
|---|---|---|---|---|
| 1. | CNC 5Axis Single Spindle Machining Cell as per enclosed Specifications | 03 | 01.10.2007 | Rs. 1,00,000.00/- (One lac only or equivalent Foreign currency) |

Please submit your Techno-Commercial offer only for the above requirement subject to our terms and conditions. Your offer should reach us on or before the due date by 1.45 PM.

Bids shall be opened of those vendors **ONLY AFTER ENSURING PROOF OF EMD AND TENDER FEE (PLEASE SUBMIT SEPARATE DRAFTS FOR EMD AND TENDER FEE {drawn in favour of BHEL Hardwar} IN ANOTHER ENVELOPE SUPERSCRIBED WITH BOLD LETTERS "EMD & TENDER FEE")** at 2 PM on the due date in the presence of authorized representatives of the bidders who may like to be present. The authorized representative should bring authority letter from their parent company (Manufacturer) for attending the bid opening. All Govt. of India / PSU / State Govt. entities are exempted from submission of EMD. Purchase preference will be given to CPSE s as per GOI notification no. DPE/13(12) 2003-Fin. Dated 26th Oct'04.

KINDLY READ "INSTRUCTIONS TO BIDDERS", QUOTATION NOT IN ACCORDANCE WITH THE ABOVE INSTRUCTIONS ARE LIABLE TO BE DISQUALIFIED AND IGNORED.

Thanking You,
Yours Faithfully,
For & ON BEHALF OF BHEL, HARDWAR

**(A. Sanyal)**
**DGM (Purchase Capital)**

**INSTRUCTIONS TO BIDDERS FOR OPEN TENDER**
**(Expression of Interest)**

Only those bids will be opened which has been submitted with requisite EMD & tender fee.

1.0 The tenders shall be submitted as Techno -Commercial Bid along with vendor evaluation form as described below on or before the due date.

- **The Quotation should be from the Principal / Original Manufacturer, failing which the quotation is likely to be ignored**.
- Any corrections / amendments shall be properly & fully authenticated with signature.

1.1 TECHNO-COMMERCIAL BID shall comprise of following documents:

a) Complete Technical offer in TWO sets (one original + one copy).
b) Catalogue of the Equipment,
Complete reference of the past supply of equipment for the same or similar specification giving details of customer with Name of the contact person, Fax no, phone no, E-mail if available.
c) General Terms & Conditions as per **Annexure-A**
d) Acceptance of commercial terms by vendor as per **Annexure-B**.
e) Deviation with reference to specification to be laid down on separate sheet.
f) Validity of offer should be at least 180 days from tender opening.
g) Quality plan to be submitted on the prescribed format as per BHEL Quality requirements for approval, Quality plan should enclose vendor's own standard, test procedures, list of sub vendors for Bought out items cross-referred, if any.
h) Acceptance to submit Security Deposit and Performance Bank Guarantee as per enclosed format **Annexure-C**.
i) Warranty 24 months from commissioning of the equipment unless other wise specified in the technical specifications.
j) The rating of the company quoting for this tender from a third party (independent agency) preferably by M/S Dun and Bradstreet should be submitted. (DUN NUMBER), however this is not mandatory.
k) Any additional documents (please specify).
l) Consortium Bank List is at **Annexure-D**. Bank Guarantees necessarily to be submitted through any of them.

The VREF duly filled up will be assessed for manufacturing capability, quality systems being followed, organizational soundness and financial worthiness.

2.2 The techno-commercial part and part containing vendor Registration/ evaluation form will be opened on the date and time specified in the covering letter, in the presence of those tenderers who wish to attend.

2.3 BHEL reserves the right to open the price bid (part-II) along with the opening of techno-commercial offer at its option and in that case vendor will be informed accordingly.

The decision to go for reverse auctioning or processing through supplementary bid will be solely at the discretion of BHEL management

3.0 MARKING OF ENVELOPE:

3.1 The following shall be subscribed on the envelopes:

1. EMD AND TENDER FEE. : is enclosed
2. 1. TENDER NO. AND ITEMS DESCRIPTION.
   2. DUE DATE FOR OPENING.
   3. "TECHNO-COMMERCIAL BID"

**Note: No price bid to be submitted along with this offer**.

3.2 Envelopes not marked as above are liable to be ignored and will not be opened.

4.1 Tenders when finalized shall be in the name of the bidder only and change of name during tender evaluation (without certificate from registrar of company) and after submission of the tender is liable to make the offer ineligible for participation.

4.2 All test certificates / Guarantee certificates to be submitted in TRIPLICATE prior to despatch of materials for review and acceptance by BHEL.

IN CASE YOU ARE NOT MAKING AN OFFER AGAINST THIS ENQUIRY, THEN PLEASE ARRANGE TO SEND A LETTER OF REGRET IF YOU HAVE COLLECTED THE TENDER DOCUMENTS FROM BHEL / HAVE RECEIVED NIT AGAINST THIS TENDER.

Thanking You,

Yours faithfully,
For & on behalf of BHEL, Hardwar.

**(A. Sanyal)**
**DGM (Capital Purchase)**

**ANNEXURE-A**

## GENERAL TERMS AND CONDITIONS OF RA

Against this enquiry for the subject item /system with detailed scope of supply as per enquiry specifications, BHEL may resort to “REVERSE AUCTION PROCEDURE” i.e., ON LINE BIDDING ON INTERNET.

1. For the proposed reverse auction, technically and commercially acceptable bidders only shall be eligible to participate.

2. BHEL will engage the services of a service provider who will provide all necessary training and assistance before commencement of on line bidding on internet.

3. BHEL will inform the vendor in writing in case of reverse auction, the details of Service Provider to enable them to contact & get trained.

4. Business rules like event date, time, Start price, bid decrement, extensions etc. also will be communicated through service provider for compliance.

5. Vendors have to fax the Compliance form in the prescribed format (provided by Service provider) before start of Reverse auction. Without this, the vendor will not be eligible to Participate in the event.

6. BHEL will provide the calculation sheet (e.g., EXCEL sheet) which will help to arrive at “Total Cost to BHEL” like Packing & forwarding charges, Taxes and Duties, Freight charges, Insurance, Service Tax for Services 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.

7. Reverse auction will be conducted on scheduled date & time.

8. At the end of Reverse Auction event, the lowest bidder value will be known on the network.

9. The lowest bidder has to Fax the duly signed Filled-in prescribed format as provided on case-to-case basis to BHEL through Service provider within 24 hours of Auction without fail.

10. Any variation between the on-line bid value and the signed document will be considered as sabotaging the tender process and will invite disqualification of vendor to conduct business with BHEL as per prevailing procedure.

11. 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 be opened as per BHEL’s standard practice.

**Annexure-B**

| **TENDER NO.**<br>**SL. NO. DESCRIPITION** | **VENDOR'S CONFIRMATION** |
|---|---|
| **1) <u>Payment terms:</u>**<br>80% of the material cost to be paid against delivery / dispatch documents. Balance 20% of material cost and E&C and proving charges will be paid after satisfactory erection & Commissioning. (Through Bank for Indigenous & L/C in case of Import). | |
| **NOTE:** | |
| a) As per payment terms, minimum 20% will be released by BHEL after successful erection, commissioning and job proving.<br>b) Further this 20% will be released against submission of performance bank guarantee valid for entire warrantee period from the date of commissioning.<br>c) The security deposit is to be as per the tender condition. | |
| **Loading on payment terms if not agreed by vendor will be as follows:**<br><br>**Loading: Advance amount, if any (Amount – X)**<br><br>1.5% per month for the quoted delivery period for the amount 'X'<br><br>**Payment at the time of dispatch against shipping/dispatch documents (Amount Y):**<br><br>"1.5% per month for the amount X+Y exceeding 80% of contract value i.e. 1.5% of **(X+Y-0.8Z)** where Z is the contract value. As such loading of 6% will be done for imported and 3% for indigenous items." | |
| In case any bidder does not accept any of the condition at (a) to (c) above then, their offer is likely to be rejected by BHEL and technical bid will not be processed, and no correspondence in this regards will be entertained | |
| **1.2 <u>P.B.G. TERMS:</u>** Performance Bank Guarantee to be submitted on the prescribed format equal to the value of 10% of the total order value valid WARRANTY / GUARANTEE agreed period. This bank guarantee in the format to be prescribed by BHEL shall have to be submitted before release of last balance payment. | |
| **1.3 <u>CURRENCY OF PAYMENT:</u> (Euro / Dollar / CHF etc.)** | |
| **1.4** For indigenous supply the currency shall be Indian Rupees. | |

| | |
|---|---|
| 1.2 **SUPERVISION CHARGES**:<br>For Indian Suppliers: It should be quoted in Rupees.<br><br>For Foreign suppliers: If supervision is being carried out by persons residing in India, it should be quoted in Indian Rupees. | |
| **1.6 TAXES:**<br><br>All statutory taxes, if any, will be deducted at source & to be borne by the beneficiary. Tax deduction certificate shall be issued at the end of financial year if required. | |
| **2. Security Deposit:**<br><br>Vendor has to submit security equal to the amount of 5% of the total order value in the currency of order within one month of receipt of order in the form of Bank Guarantee in BHEL format valid for two months beyond shipment. | |
| **2.1 Submission of Bank Guarantee**:<br><br>All bank guarantee for security deposit as well as proforma bank guarantee should be from one of the BHEL consortium banks and the bank guarantee should be in the proforma as prescribed by BHEL. The performance bank guarantee as well as the list of consorti um banks is displayed at BHEL web-site www.bhelhwr.co,in however, in case the bank guarantee is not from BHEL consortium banks, then the vendor has to confirm bank guarantee on consortium bank and the bank charges are to be borne by the bidder. | |
| **3. Liquidated damages:**<br><br>L.D. shall be applicable for delayed delivery @ 0.5% per week and part thereof subject to a maximum of 10% for total P.O. value. If any vendor do not accept the LD @ of 0.5% per week and part thereof subject to a maximum of 5% of total PO value, their offer will be ignored. Vendors accepting LD terms different from the proposed terms of 0.5% maximum 10% will be loaded @ %age deviation from the range of 10% on their prices (FOB for imported and ex-factory for indigenous). If the vendor does not accept as above their offer is likely to be ignored and technical bid will not be processed. | |
| **4) Delivery of the equipment:**<br>***** Categorically indicate time period required for delivery of the equipment.<br><br>• Firm delivery period for the equipment to be stated w.e.f. date of LOI/ Order.<br><br>Commissioning & Handing over of complete system in weeks. | |

| | |
|---|---|
| **5) Settlement of Disputes:**<br><br>• Settlement of disputes through arbitration shall be in accordance with Arbitration Rules of Conciliation and Arbitration of the ICC, Paris. The venue of arbitration shall be Delhi. The courts of Delhi shall have exclusive jurisdiction.<br><br>• For Indigenous Source. The venue of arbitration shall be Haridwar Courts, which will have exclusive jurisdiction. | |
| **6) Authorization of pre-inspection:**<br><br>BHEL is authorized to pre inspect the material at your works. The material will be dispatched only after getting clearance form BHEL. | |
| **7) Drawing / Data approval:**<br>Any drawing / data approval required from BHE after placement of order shall be the responsibility of the vendor and any delay on account of the same shall be the responsibility of the vendor and have no bearing on the penalty applicable. | |
| **8) Drawing / design / information use:**<br>The vendor will have to give an undertaking that the drawing / design / information enclosed with the enquiry / proposed order will not be parted to any agency and will also not be used for manufacturing for any other customer. | |
| **9) Time period for Foundation / Erection & Commission:**<br>Vendor will have to ensure deputation of their people for erection & commissioning or for attending to any complaint during guarantee period within 7 days of intimation. In case of delay BHEL will be within their rights to get the job completed at the risk and cost of the supplier. | |
| **10) 5 Sets of O&M Manual:**<br>5 Sets of Operation & Maintenance Manual shall have to be supplied along with the equipment. Final payment will be released only after receipt of the required documentation. | |
| **11) Training:**<br>Vendor shall provide required training to BHEL personnel free of cost. | |
| **12) Purchasing of BOI items:**<br>Vendor shall purchase the BOUGHT OUT ITEMS only from vendors of repute and indicate the same to BHEL at the time of approval of GA drawing. BHEL reserves the right to visit / inspect the works of supplier and that of their sub contractors before or after placement of order. | |

| | |
|---|---|
| **13) <u>Spares, tooling, jigs and fixtures:</u>**<br>The equipment being new, above items shall be needed in bulk at a later stage. However two separate lists of spares, tooling, jigs and fixtures should be sent along with quotation.<br>1. Items which you recommend very necessary to be available along with the equipment.<br>**2.** Item which may be required at a later stage**. (The price validity of these items should be for a minimum period of two years from the date of commissioning of the equipment).** | |
| **14) Warranty/ Guarantee:** 24 months from the date of commissioning. | |
| **15)** Details of Contact person Name, Designation, Department complete postal, E-mail address & Fax no, phone, Mobile no. to be mentioned. | |
| **16)** Phyto sanitary Certificate essential for packages (Wooden). | |
| **17)** **Validity:** Validity of the offer should be 180 days from tender opening. | |
| **18)** **Bank Charges:** Bank Charges to be borne by vendor. | |
| **Note:** Attach separate sheet for additional information if necessary.<br>The above terms & condition supersedes the terms & conditions found contradictory written else where in the tender enquiry. | |

**NOTES :-**

a) Item wise breakup of the prices shall be as per TECH. SPECIFICATION / DISCUSSIONS; ELSE, THE BID IS LIABLE FOR REJECTION.

b) Bidder to note that total price indicated above SL 1.1-1.6 shall be considered for evaluation and hence should be complete in all respects for the full scope defined and considering all terms and conditions. Optionals as indicated in specification will not be taken for evaluation.

c) Any item not included in this price quoted above and shown separately will not be taken cognizance of and shall be ignored while evaluation.

3.0 Total weight -- /Gross / Net in Kg. Also package size essentially should be indicated if not exact then approximate.

4.0 Following details shall be provided in separate Annexure.

A) Unit prices for variable items.

B) Prices for any other OPTIONAL items.

5.0 **Excise duty:** Concession forms requirements etc. to be stated wherever applicable.

**NOTE:**

1. BHEL will evaluate the technical bids against essential criteria/requirements. BHEL may seek clarifications, if required, from the qualified bidders only. These clarifications will be communicated to the eligible vendors and they will be asked to attend techno-commercial discussions on specified dates. The bidders will be given 15 days notice to come prepared with the required documents/ clarifications. No extension will be given. **The offers of those bidders, who are unable to respond in this time frame, are likely to be ignored.**
2. The vendors found technically acceptable against their original technical offer and subsequent technical discussion BHEL will communicate equivalent scope of supply to the qualified bidders who will be required to submit their final bid in two parts. Un-priced technical part-I & price bid part-II **OR** vendor will be furnished a common scope and will be made to participate in the process of reverse auction if required.
   **It is clarified that no correspondence – technical or commercial – other than the above bids is permissible. In case any uncalled for correspondence – technical or commercial – is received, the same will be ignored and entire bid also may be ignored. It is also clarified that no commercial discount will be acceptable.**
3. All the bidders whose offers have been accepted by BHEL will be given one-week notice for opening price bid.

**Date**

**Signature**

**Name**

**Designation**

**Department**

**M/S**

**ANNEXURE-C**

## LIST OF CONSORTIUM BANK

1. **State Bank of India**
   **CAG Branch,**
   **10-th Floor, Vijaya Building,**
   **Barakhamba Road,**
   **New-Delhi-110001**

2. **Canara Bank**
   **74, Janpath,**
   **New-Delhi-110001**

3. **Punjab National Bank**
   **74, Janpath,**
   **New-delhi-110001**

4. **Bank of Baroda**
   **Corporate Banking Branch,**
   **11th Floor, BOB Building,**
   **Sansad Marg,**
   **New-Delhi-110001**

5. **Deutsche Bank**
   **Tolstoy Marg,**
   **New-Delhi-110001**

6. **State Bank of Hydrabad**
   **Surya Kiran Building,**
   **K. G. Marg,**
   **New-Delhi-110001**

7. **State Bank of Mysore**
   **Antriksh Bhawan,**
   **K. G. Marg,**
   **New-Delhi-110001**

8. **State Bank of Mysore**
   **Industrial Finance Branch,**
   **Ramanashree Arcade,**
   **MG Road,**
   **Bangalore-560001**

9. **State Bank of Travancore**
   **Travancore House,**
   **IF Branch, K G Marg,**
   **New-Delhi-110001**

10. **HDFC Bank Ltd**
    **5th Floor, HT House,**
    **K G Marg,**
    **New-Delhi-110001**

11. **CITI Bank N A**
    **Jeevan Vihar Building,**
    **Sansad Marg,**
    **New-Delhi-110001**

12. **Standard Chartered Bank**
    **H2 Block, Connaught place,**
    **New-Delhi-110001**

13. **ICIC Bank Ltd.**
    **ICIC Tower,**
    **Bisham Pitamah Marg,**
    **Pragati Vihar,**
    **New Delhi 110003**

14. **IDBI Bank Ltd.**
    **19, K G Marg,**
    **Surya Kiran Building,**
    **New-Delhi-110001**

15. **HSBC Ltd.**
    **ECE House,**
    **28 KG Marg,**
    **New-Delhi-110001**

**ANNEXURE-D**

***WAM-28***

# *Proforma for Bank Guarantee*

*In consideration of the Bharat Heavy Electrical Limited Siri fort N. Delhi through Division HEEP Hardwar (hereinafter called the Company') having agreed to exempt ---------- ---------- (hereinafter called 'the said Contractor' which term includes 'Suppliers' for the purpose of this Bond) from the demand under the terms and conditions of an Agreement date. ---------- Made between ----------and ---------- for (hereinafter called 'the said Agreement') of Security Deposit for the due fulfillment by the said Contractor of the terms and conditions contained in the said Agreement, on production of a Bank Guarantee for Rs. ---------- (Rupees----------only).*

1. *We, ---------- (Indicate the name of the Bank) (hereinafter referred to as 'the Bank') at the request of---------- ---------- (Contractor (s) do hereby undertake to pay to the Company an amount not exceeding Rs. ---------- against any loss or damage caused to or suffered or would be caused to or suffered by the Company by reason of any breach by the said Contractor (s) of any of the terms and conditions contained in the said Agreement.*

2. *We, ---------- do hereby undertake to pay the amounts due and (indicate the name of the Bank) payable under this guarantee without any demur, merely on a demand from the Company stating that the amount claimed is due by way of loss or damage caused to or would be caused to or suffered by the Company by reason of breach by the said Contractor(s), of any of the terms of conditions contained in the said Agreement or by reason of the contractor(s), failure to perform the said Agreement. Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee However, our liability under this guarantee shall be restricted to an amount not exceeding Rs.---- ---------- .*

3. *We undertake to pay to the Company any money so demanded notwithstanding any dispute or disputes raised by the Contractor(s) in any suit or proceeding pending before any court or Tribunal relating thereto our liability under this present being absolute and unequivocal.*

   *The payment so made by us under this bond shall be a valid discharge of our liability for payment there under and the Contractor(s) shall have no claim against us for making such payment.*

4. *We, ---------- further agree that the Guarantee herein contained (indicate the name of the Bank) shall remain in full force and effect during the period that would be taken for the performance of the said Agreement and that it shall continue to be enforceable till all the dues of the Company under or by virtue of the said Agreement have been fully paid and its claims satisfied or discharged or till ---------- Office / Department / Division of Bharat Heavy Electrical Limited certifies that the terms and conditions of the said Agreement have been fully and property carried out by the said contractor(s) and accordingly discharged this guarantee. Unless a demand or claim under this guarantee is made on us in writing on or before the ---------- we shall be discharged from all the liability under this guarantee thereafter.*

5. *We, ----------, further agree with the Company that the (indicate the name of the Bank) Company shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Agreement or to extend time of performance by the said contractor(s) form time to time or to postpone for any time or from time to time any of the power exercisable by the company against the said contractor(s) and to forbear or enforce any of the terms and conditions relating to the said Agreement and we shall not be relieved from our liability by any reason of any such variation or extension being granted to the said contractor(s) or for any forbearance, act or omission on the part of the company or any indulgence by the company to the said contractor(s) or by any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving us.*

6. *This guarantee will not be discharged due to the change in the constitution of the Bank or the contractor(s).*

7. *We,---------- lastly undertake not to revoke this guarantee during its (indicate the name of Bank) currency except with the previous consent of the Company in writing.*

*Date the ----------day of ----------*
*For ----------*
*(Indicate the name of the Bank)*

**Annexure -I**

Sample Report

## Measurement Report : Root & Shroud

Date: 07-02-06
Time: 11:31:35

**Blade Drg. No :** 0-10307-41004 (LP1R) 500 MW
**Serial No. of Blade:** 5 (entered by operator in some R parameter on the machine during machining)
**Machine:** CNC 5 Axes Machine (Model name/Layout number of machine)

**Box Nr :** 314263

**********
*** Note: '0' in Error denotes "Measured Values are within tolerance" ***
**********

| Description | Nom. Size | Measured Value | Dev.from Nom.Size | Tol. upper (+) | Tol. lower (-) | Error (Out-Tol) |
|---|---|---|---|---|---|---|
| ROOTWIDTH: | 40 | 40.0345 | 0.0345 | 0 | -0.05 | 0.0345 |
| ROOTNECKWIDTH: | 24.6 | 24.5548 | -0.0451 | 0 | -0.13 | 0 |
| SHROUDWIDTH: | 39 | 39.0755 | 0.0755 | 0.1 | -0.1 | 0 |
| --- | --- | --- | --- | --- | --- | --- |
| --- | --- | --- | --- | --- | --- | --- |
| --- | --- | --- | --- | --- | --- | --- |
| ROOT PITCH (Rmin): | 21.98 | 22.1065 | 0.1265 | 0.04 | -0.02 | 0.0865 |
| SHR TAPER ANGLE SS: | 1.475 | 1.4943 | 0.0193 | 0.05 | -0.05 | 0 |
| SHR PITCH (Rmax): | 34.847 | 34.9773 | 0.1303 | 0.04 | -0.02 | 0.0903 |

**Note:**

- The Nominal size means the nominal value as mentioned in the drawing/UEB file without application of any tolerance or any adjustment.
- The Tolerance values should be specified in Upper and Lower tolerance as mentioned in the drawing/UEB file and not in any other tolerance band after any adjustment.

**Annexure -II**

Sample Report

## Measurement Report : Profile

Date: 07-02-06
Time: 11:31:35

**Blade Drg. No :** 0-10307-41004 (LP1R) 500 MW
**Serial No. of Blade:** 5 (entered by operator in some R parameter on the machine
**Height of profile section :** Section No. 9/ 200mm from Hub Face)
**Machine:** CNC 5 Axes Machine (Model name/number of machine)

**Box Nr :** 314263

| Description | Deviation from Nominal value |
|---|---|
| POINT: 1 | 0.0688 |
| POINT: 2 | 0.0692 |
| POINT: 3 | 0.0756 |
| POINT: 4 | 0.0757 |
| POINT: 5 | 0.0731 |
| POINT: - | |
| POINT: - | |
| POINT: - | |
| POINT: - | |
| POINT: - | |
| POINT: 55 | 0.0633 |
| POINT: 56 | 0.0613 |
| POINT: 57 | 0.063 |
| POINT: 58 | 0.0652 |
| POINT: 59 | 0.0663 |
| POINT: 60 | 0.0637 |

**Annexure-III**

## Sample Project Master Page

**Project identification :**
Component Description :
Drawing Number : Revision Number display :

Path for storage of NC Programs output : (Selection by 'Browsing')

Input Definition: (Selection: Data type, Drawing type)
Blade Type: (Selection: TX, Twisted)
Blade Definition: (Selection: LH Moving, RH Moving, LH Guide, RH Guide)

Shroud Definition: (Selection: Rhomboidal, Z Shaped, Stepped)
Hub Definition: (Selection: Hook, T-Slot, Double T-Slot)

**Open Drawing**

(Manual entry of Hub and shroud data from drawings guided by sketches given as per Hub and Shroud type defined above - **only in case of 'Input Definition' – 'drawing type' if defined above**)

UEB data File: (Selection by 'Browsing' **in case of Input Definition – 'Data type' if defined above**)

Data definition Joint blade (only for guide blade)
Parameter 1 Parameter 2 Parameter 3

Profile data File: (Selection by 'Browsing')
Profile type: (Selection : xyz, STRAK, xyz without trailing edge)

Raw data File: (Selection by 'Browsing')

Template: (Manual selection of Template with simultaneous opening of selected template page for customised definition of operations suitable for this particular project).

Postprocessor selection: (list of available PPs for Selection)
(Multiple selection of PPs should be possible)

Fixture Translation (for each selected PP):
Fixture Rotation (for each selected PP):

ProfileReference :
Hub Reference Section :

**Optional Part**:
ProfileApprox :
ProfileEdens :
ProfileNRearr :
ProfileNSec :
ProfileSizeup :
ProfileSourceSec :

| Save | Cancel |
|---|---|

**Note :**

- **This is a sample Master project page and the vendor can modify or add new parameters as per their CAM software to fulfil the requirement of Automation system in totality as per point no. 2.22 of tender specifications.**
- **Provision and flexibility must be provided to create new operation templates as well as modify existing operation templates easily and it's method of storage at proper location.**
- **In case of further clarifications, the project master page can be finalized during technical discussion**

## Annexure-IV

# Sample Report of Operation Summary

**Component name:** Moving Blade HM4R 500MW

**Drawing Number:** 1-10102-41004

**Machine:** CNC 5-AXIS MACHINING CENTRE (Model name/Layout number)

**Operation list**

| Sl. Nr | Operation Description | Tool Id | Tool offset (D) No. | Tool desc. | Feed [mm/ min] | Speed [rpm] | Cutting time | Accum time |
|---|---|---|---|---|---|---|---|---|
| 1 | Roughing rhomboid LE | 101 | 1 | Face mill D50 Round insert r6 z5 | 2101 | 1401 | 00:00:54 | 00:00:54 |
| 2 | Roughing rhomboid PS | 101 | 1 | Face mill D50 Round insert r6 z5 | 2101 | 1401 | 00:00:44 | 00:01:38 |
| 3 | Roughing rhomboid TE | 101 | 1 | Face mill D50 Round insert r6 z5 | 2101 | 1401 | 00:00:51 | 00:02:29 |
| 4 | Roughing rhomboid SS | 101 | 1 | Face mill D50 Round insert r6 z5 | 2101 | 1401 | 00:00:44 | 00:03:13 |
| 5 | Roughing rooftop PS | 101 | 1 | Face mill D50 Round insert r6 z5 | 2101 | 1401 | 00:00:25 | 00:03:38 |
| 6 | Roughing rooftop SS1 | 101 | 1 | Face mill D50 Round insert r6 z5 | 2101 | 1401 | 00:00:26 | 00:04:04 |
| --- | ------ | --- | --- | ----- | ---- | ----- | --- | ---- |
| 12 | Finish Root LE | 205 | 2 | Finishing Face Mill cutter D80 r0.4 z7 | 384 | 915 | 00:00:20 | 00:05:20 |

| --- | ------ | --- | --- | ----- | ---- | ----- | --- | ---- |
|---|---|---|---|---|---|---|---|---|
| --- | ------ | --- | --- | ----- | ---- | ----- | --- | ---- |
| 67 | Measuring taper tip ps upper | 999 | 1 | Renishaw probe r3 | 531 | 531 | 00:00:07 | 00:52:01 |
| 68 | Measuring taper tip ss upper | 999 | 1 | Renishaw probe r3 | 531 | 531 | 00:00:08 | 00:52:09 |

## Cycle Time:

| | |
|---|---|
| **Cutting time:** | 00:52:09 |
| **Tool change time:** | 00:05:20 |
| **Additional probing time:** | 00:05:30 |
| **Part change time:** | 00:04:00 |
| **Machine cleaning time:** | 00:01:10 |
| **Total workpiece cycle time:** | 01:08:09 |

## Tool List:

| Tool desc. | Tool Id |
|---|---|
| Face mill D50 Round insert r6 z5 | 101 |
| Finishing Face Mill cutter D80 r0.4 z7 | 205 |
| Renishaw probe r3 | 999 |
| -------- | ---- |
| -------- | ---- |
| Indexable Ball nose cutter R8 z3 | 203 |
| Solid carbide Ball Nose cutter Dia 10,z=4 | 107 |
| Chamfering tool D10 z4 45deg. | 109 |

| | | | | |
|---|---|---|---|---|
| | **BHARAT HEAVY ELECTRICAL LIMITED** | | **Indent No. :** | **C /3991/ 6 / 6731T**<br>**Dated :** |
| | **UNIT'S ADDRESS:**<br>**HEEP, RANIPUR**<br>**HARIDWAR - 249403**<br>**UTTARANCHAL, INDIA** | | **Enquiry No. :**<br>**Due Date :** | |
| | | | **Supplier Qtn. No.:** | |
| | **CONTACT PERSON FROM PURCHASE DEPTT.:**<br>**NAME: MR. A.SANYAL**<br>**DESIGNATION: SENIOR MANAGER (PPX-CAP)**<br>**PHONE NO.: 0091 - 1334 - 285291**<br>**E-MAIL: asanyal@bhelhwr.co.in**<br>**FAX NO. : 0091 - 1334 - 226462** | | **Date :** | |

## TECHNICAL SPECIFICATION FOR CNC SINGLE SPINDLE 5 AXIS MACHINING CELL- Qty. 3 Nos.

**NOTE :-**

**1. Vendor must submit complete information against Qualifying Condition at clause at No. 5 . The offer complying this clause would only be considered.**
**2. The vendor should fill the "Offered" column in compliance to specified requirements and also " Deviation" column, where there is deviation from the specified requirement. Duly filled specification and compliance certificate should be submitted along with the offer. Inadequate, incomplete,ambiguous or unsustainable information against any of the clause of the specification/requirement shall be treated as non-compliance.**
**3. The Compliance and all documents enclosed with offer should be in English language only.**

**SCOPE:** **SUPPLY, ERECTION & COMMISSIONING OF SINGLE SPINDLE CNC 5 AXIS MACHINING CELL- 3 Nos. COMPLYING WITH SPECIFICATIONS AS BELOW.**

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---|---|---|---|---|---|
| **1.0** | **PURPOSE & WORKPIECE MATERIAL** | | | | |
| **1.1** | **Purpose:** The machine is required for complete finish machining of Steam Turbines Blades length 400 mm or more having intricate aerofoill shape from hot rolled/ forged rectangular bars. The machine should be capable of doing center hole drilling at root and tip ends of the bar necessary for clamping for complete machining in one set up.Achievable surface quality on finish blade should be about 0.63 µ Ra in optimized condition. | Vendor to accept and confirm | | | |
| **1.2** | **Work Piece Material:** Generally blade materials are high temperature & Creep Resistant alloys like X20Cr13, X22 Cr Mo V 12.2 1, X9CrMoVNbN11 etc. having Tensile Strength 1050 N/mm$^2$ & Hardness 350 BHN. However, the machine should be capable of machining still tougher material if requied. | Vendor to confirm | | | |
| **2.0** | **SPECIFICATIONS** | | | | |
| **2.1** | **TRAVERSES** | | | | |
| 2.1.1 | Longitudinal Axis X | 650 mm or more | | | |
| 2.1.2 | Vertical Axis Y | 600 mm or more | | | |
| 2.1.3 | Transverse Axis Z | 600 mm or more | | | |
| 2.1.4 | Rotational Axis A | 360 degree Continuous | | | |
| 2.1.5 | The machine's axis configuration should be suitably designed for most efficient 5-axis blade machining enabling least possible tool length for machining closer to the center of axis rotation. | Vendor to inform with details | | | |
| 2.1.6 | Table Pivot Axis B | Vendor to inform configuration | | | |
| **2.2** | **Axis Feeds & Rapid Traverses** | | | | |
| 2.2.1 | Linear X,Y &Z | 40 Meter /Min. or more | | | |
| 2.2.2 | Rotational Axis 'A' | 120 rpm or more | | | |
| 2.2.3 | Pivotal Axis 'B' | 30 rpm or more | | | |
| **2.3** | **MillingSpindle** | | | | |
| 2.3.1 | No. of Milling Spindle | 1 | | | |
| 2.3.2 | High Speed Milling Spindle with integrated vector controlled motor for roughing and finishing. | Vendor to confirm | | | |
| 2.3.3 | Spindle Position | Vendor to inform | | | |

(N Halder/DGM-WEX-Mech)

(A Mookherjee/DGM-TBM) (S K Shukla/SDGM-CNC-WEX) (D K Chawla,SM-NCT)

(T K Saha/Mgr-QC-B)

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---|---|---|---|---|---|
| 2.3.4 | Spindle Speed | Min.15000 rpm | | | |
| 2.3.5 | Spindle Power | 19 kW at 100% Duty Cycle or more | | | |
| 2.3.6 | Spindle Torque | 160 NM or more at 100 % Duty Cycle | | | |
| | Vendor to submit Spindle-Power, Speed-Torque diagram with offer. | | | | |
| 2.3.7 | Spindle Taper | HSK A 63 | | | |
| 2.3.8 | Spindle Front Bearing Diameter | Vendor to inform | | | |
| 2.3.9 | Balancing Quality of Tool Holder | Vendor to inform | | | |
| 2.4 | Automatic Tool Changer | | | | |
| 2.4.1 | No. of Tool Deposit | 50 or more | | | |
| 2.4.2 | Tool Length | 350 mm or more | | | |
| 2.4.3 | Tool Diameter (with all pockets full) | 80 mm or more | | | |
| 2.4.4 | Tool Diameter (with adjacentpocket free) | 140 mm or more | | | |
| 2.4.5 | Tool Weight | 10 Kg. or more | | | |
| 2.4.6 | Tool Change Time (chip to chip) | Vendor to intimate with tool weight and tool diameter | | | |
| 2.4.7 | Manual operation of ATC should be possible. Vendor shall provide a separate hand pendant / custom built screen with proper safety interlocks for manual management of ATC. | Vendor to confirm | | | |
| 2.4.8 | Machine operation should be possible with or without referencing ATC | Vendor to confirm | | | |
| 2.4.9 | Automatic Tool Changer will have following features: | | | | |
| 2.4.9.1 | Provision of cleaning of spindle taper by compressed air blow during ATC cycle | Vendor to confirm | | | |
| 2.4.9.2 | Provision of compressed Air blow for cleaning spindle taper during manual tool change through pushbutton mounted at convenient location. | Vendor to confirm | | | |
| 2.4.9.3 | Provision of manual tool loading and unloading through push button mounted on Hand Held pendant or at convenient location. | Vendor to confirm | | | |
| 2.4.10 | Front/ Side access door for loading of tools in ATC. | Vendor to confirm | | | |
| **2.5** | **Automatic Part Changer** | | | | |
| 2.5.1 | For uninterrupted operation of the machine, automatic part changer shall consist of part magazine with hydraulically operated power chucks (pallets) for clamping the billet blanks without any pre-machining. Automatic Part Changer shall cyclically transport the chuck with blade blank from magazine to machining station and machined blade to magazine. In case, any vendor offers pick and place type(gantry type) part changer, this will also be acceptable and will be treated at par with hydraulic type part changer. Job clamping shall be as described at point no. 2.34 | Vendor to submit details | | | |
| 2.5.2 | No. of Pallet Station | 15 or more | | | |
| 2.5.3 | Pallet length | Vendor to inform | | | |
| 2.5.4 | Part Length including pallet | Vendor to inform | | | |
| 2.5.5 | Pallet weight with part | Vendor to inform | | | |
| 2.5.6 | Pallet weight without part | Vendor to inform | | | |
| 2.5.7 | Part change time | Vendor to inform | | | |
| 2.5.8 | In case any alignment device is required for part alignment, the same may be offered. | Vendor to inform | | | |
| **2.6** | **Workpiece Center Drilling** | | | | |
| 2.6.1 | Machine shall have feature of center drilling at tip end of clamped workpiece in the rotary station. Tail stock for this purpose shall be automatically adjustable. The clamping pressure on the workpiece at the tail stock end should be adjustable through program as well as manually with the provision of a suitable gauge located at convenient location for visualization of this clamping pressure. | Vendor to confirm & inform details | | | |
| 2.6.2 | Maximum blade length without pallet | 400 mm long finish blade length. | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---|---|---|---|---|---|
| **2.7** | **Coolant System** | | | | |
| 2.7.1 | Vacuum Rotary/ Turbo Coolant Filtration system comprising External system (nozzles around the spindle), an internal system (through the tool) and a work piece shower suspended from the ceiling shall be offered. It should have coolant collecting system at the base and recycling of coolant after proper filtration for which vacuum type coolant filtration unit comprising of coolant tank, vacuum rotational filter, filter drum (made of high quality steel net) vacuum pump, coolant pump, flushing pump,Oil separator etc. shall be offered. | Vendor to confirm | | | |
| 2.7.2 | Following parameters of coolant system to be furnished: | | | | |
| 2.7.2.1 | Coolant Tank Capacity | Vendor to intimate | | | |
| 2.7.2.2 | Discharge Rate for External Coolant supply | Vendor to intimate | | | |
| 2.7.2.3 | Pump pressure for external coolant supply | Vendor to intimate | | | |
| 2.7.2.4 | Discharge Rate for Internal Coolant supply through spindle | Vendor to intimate | | | |
| 2.7.2.5 | Pump pressure for internal coolant supply through spindle | Vendor to intimate | | | |
| 2.7.2.6 | Filtration purity | Vendor to intimate | | | |
| 2.7.3 | The External coolant system should be switchable through program(Mcode) as well as through pushbutton provided on the operator panel. However for the internal coolant system, if programmed, can then be switched OFF and ON through a push button on the operator panel. | Vendor to confirm | | | |
| **2.8** | **Chip Conveyor** | | | | |
| 2.8.1 | Elevated Scraper/ Screw type type chip conveyor integrated with coolant system located at back side of the machine shall be offered. | Vendor to confirm | | | |
| 2.8.2 | Following detailsof chip conveyor shall be be furnished with the offer : | | | | |
| 2.8.2.1 | Type of chip conveyor | Vendor to intimate | | | |
| 2.8.2.2 | Width of conveyor | Vendor to intimate | | | |
| 2.8.2.3 | Elevation of chip conveyor for chip bin | Vendor to intimate | | | |
| 2.8.2.4 | Material of chip conveyor should be rust and corrosion resistant | Vendor to confirm | | | |
| **2.9** | **Compressor Cooling System** | | | | |
| 2.9.1 | Closed loop compressor Cooling System for the milling spindle, servo-/torque motors , recirculating lubricating oil, hydraulic system oil etc. shall be offered , if required for working in centrally air conditioned environment having temperature of about 30 degree Celsius. Following details of compressor cooling system shall be submitted with the offer: | Vendor to confirm | | | |
| 2.9.1.1 | Type of Refrigerant | Vendor to intimate | | | |
| 2.9.1.2 | Refrigerating Capacity | Vendor to intimate | | | |
| 2.9.1.3 | Cooling Medium | Vendor to intimate | | | |
| **2.10** | **Machine Enclosure with Access Door** | | | | |
| 2.10.1 | Machine shall have sound dampening enclosure with interlocked doors in the tool and workpiece area and access door at operator's panel.Enclosure shall have large safety glass viewing window like ROTOCLEAR or equivalent for viewing the job and ongoing process. | Vendor to confirm | | | |
| **2.11** | **Machine Lights** | | | | |
| 2.11.1 | Machine light (Halogen light) for illumination of complete encapsulated working area for clear visibility. | Vendor to confirm | | | |
| 2.11.2 | Tube lights in electrical cabinets for maintenance purpose | Vendor to confirm | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---|---|---|---|---|---|
| 2.11.3 | 4 coloured signal light displaying operational ststus of the machine and visible from distance. | Vendor to confirm | | | |
| **2.13** | **Electrical Control Cabinet & Operator's Pendant** | | | | |
| 2.13.1 | Electrical Control Cabinet & Operator's Pendant shall be fitted with proper cooling arrangement for working in a centralized air-conditioned hall having temperature up to 30 degree Celsius.Electrical cabinet shall have provision for a 220V, 5 Amp socket for maintenance purpose. | Vendor to confirm | | | |
| **2.14** | **Hand Held Pendant** | | | | |
| 2.14.1 | A SIEMENS Hand Held Pendant B-MPI / BHG-MPI along with sufficient length of interfacing cable shall be offered. | Vendor to confirm | | | |
| **2.15** | **Mist/Flue Gas Extraction System** | | | | |
| 2.15.1 | Machine shall have Mist Extraction System/ Flue Gas Extraction System including all connection and installation at convinient location. Make and capacity of the system to be intimated with the offer. | Vendor to confirm | | | |
| **2.16** | **Other Technical Features** | | | | |
| 2.16.1 | Centralized Automatic Lubrication System for lubrication of all moving and rotating parts with alarm/interlocks incase of lubrication failure. | Vendor to confirm | | | |
| 2.16.2 | FLR & Air Dryer Unit of appropriate capacity to arrest moisture and other suspended particlesetc. In order to provide dry and clean air for machine operation. | Vendor to confirm | | | |
| 2.16.3 | Compressed Air point with provision of manually adjustable pressure valve, manually operated ON/OFF valve and sufficient length of flexible piping for cleaning of chips while changing/ indexing carbide inserts on operator's work area. | Vendor to confirm | | | |
| 2.16.4 | Coolant Flushing Gun with sufficient length of pipe for manual cleaning of workpiece. | Vendor to confirm | | | |
| 2.16.5 | Percentage type spindle load meter in the CNC Control | Vendor to confirm | | | |
| 2.16.6 | In cycle hour counter with reset facility. | Vendor to confirm | | | |
| 2.16.7 | Power Supply will be provided by BHEL at a single point near the machine, as per layout recommended by Vendor. All types of cables, connections, circuit breakers etc. required for connecting BHEL's power supply point to different parts of the machine, Voltage Stabilizer, Isolation Transformer, control cabinets etc. shall be supplied by the vendor. | Vendor to comply. | | | |
| 2.16.8 | One set of tools for service and maintenance of the machine shall be offered | Vendor to confirm | | | |
| 2.16.9 | Calibration mandrel/ gauge required, if any for high speed milling spindle and any special tools/ equipment required for geometrical accuracy test in long run shall be offered. | Vendor to confirm | | | |
| 2.16.10 | Lifting Yoke, if any for lifting the machine shall be offered. | Vendor to confirm | | | |
| **2.17** | **First Filling of Oils & Lubricants** | | | | |
| 2.17.1 | First filling of all required Oils , lubricants, & Grease etc. for the machine and auxilary system. to be supplied by vendor. Indigenous (Indian) source or Indian equivalant and specifications of all oils & greases are also to be provided by the vendor..The vendor shall also submit estimated annual consumption of all these items on 7000 hours per year working basis. | Vendor to confirm | | | |
| **2.18** | **CNC System** | | | | |
| 2.18.1 | The machine shall be equipped with latest Siemens SINUMERIK 840D CNC Control with latest Window XP (1.2 GHz or higher) based Operating system.The CNC control 840D will have PC version PCU50 & NCU 573.5 module or higher. It should consist of OP010/OP010C Operating Panel having 10.4 inches STN/TFTcolour display and 19"/MPC483C machine control Panel. It shall have MF-II PC Key board or the latest available successor with mouse on a folding/ sliding tray. | Vendor to confirm | | | |
| 2.18.2 | The CNC system should have following features: | | | | |
| 2.18.2.1 | Pentium III 933 MHz or of highest rating available with Siemens at the time of order. | Vendor to confirm | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---|---|---|---|---|---|
| 2.18.2.2 | Hard disk of 10GB (easily replaceable) or of highest rating available with Siemens at the time of order. | Vendor to confirm | | | |
| 2.18.2.3 | 512MB SDRAM or of highest rating available with Siemens at the time of order. | Vendor to confirm | | | |
| 2.18.2.4 | RS232-C interface for I/O device (Two Ports). | Vendor to confirm | | | |
| 2.18.2.5 | Floopy drive 3.5 inches with requisite interface / 1 GB Pen drive with USB Interface- 2 Nos. | Vendor to confirm | | | |
| 2.18.2.6 | Access lock on operator panel. | Vendor to confirm | | | |
| 2.18.2.7 | Co-ordinate system transformation. | Vendor to confirm | | | |
| 2.18.2.8 | Co-ordinate system rotation. | Vendor to confirm | | | |
| 2.18.2.9 | Look ahead of 70 blocks or more. | Vendor to confirm | | | |
| 2.18.2.10 | Helical/ Spline interpolation. | Vendor to confirm | | | |
| 2.18.2.11 | Scaling | Vendor to confirm | | | |
| 2.18.2.12 | Programmable mirror image matching. | Vendor to confirm | | | |
| 2.18.2.13 | Cylindrical interpolation. | Vendor to confirm | | | |
| 2.18.2.14 | Simulation. | Vendor to confirm | | | |
| 2.18.2.15 | Background editing. | Vendor to confirm | | | |
| 2.18.2.16 | Tool management. | Vendor to confirm | | | |
| 2.18.2.17 | SITOP power, DC-UPS Module 15 with AKKU module to ensure automatic unattended shutdown of the system in case of power failure or even in normal machine shutdown. | Vendor to confirm | | | |
| 2.18.2.18 | Display of PLC laddetr on 840D monitor. | Vendor to confirm | | | |
| 2.18.2.19 | Display on servo - wave forms on 840D monitor | Vendor to confirm | | | |
| 2.18.2.20 | Machine should have provision to switch from direct position feedback system (built in motor encoder) through PLC required for service purpose only. | Vendor to confirm | | | |
| 2.18.3 | The CNC system shall also have all other features required for: | | | | |
| 2.18.3.1 | Programming , machining & measurement of prove out components as mentioned at point no. 2.47 below. | Vendor to confirm | | | |
| 2.18.3.2 | Machine Networking at point no. 2.24 below. | Vendor to confirm | | | |
| 2.18.3.3 | System of Automatic generation of NC program generation mentioned at point no. 2.22 below. | Vendor to confirm | | | |
| 2.18.3.4 | In process / Post process Gauging & its customized report generation as mentioned at point no. 2.19 | Vendor to confirm | | | |
| 2.18.3.5 | Tool Monitoring as mentioned at point no. 2.20 below. | Vendor to confirm | | | |
| 2.18.3.6 | Machine Monitoring system as metioned at point no. 2.25 below. | Vendor to confirm | | | |
| 2.18.3.7 | The selected probing results file shall be sent by the operator from the CNC screen of the machine (after ensuring correct measurement result) to the printer via Automation PC through a single key command/soft Key.The file shall be also automatically stored in the Automation PC in respective machinewise folder (with file name as Drg. No. of blade along with serial no. of blade, which shall be entered by the operator on the machine in some R parameter or at predefined place, for eg. 01010241001_1) upon execution of above mentioned single key command/key. In this way files will not be overwritten and shall be deleted by the operator/supervisor from time to time as required. The printed as well as stored measured result file shall be in proper format as mentioned at point no. 2.19.2 c) with proper font sizes, spacing etc. so that it can be directly presented to inspection department. All necessary hardware & software including Automation PC, Hub (with possibility of 10 connections), Printer, all types of | Vendor to confirm | | | |
| | cables, communication software, CNC features required for above mentioned setup shall be provided by the party. A suitable enclosure for protection to Printer, Automation system with suitable facilities for this setup shall also be provided by the party. The system shall be completely demonstrated & established on all the supplied machines by the vendor during pre-acceptance at suppliers works as well as during commissioning of the machine at BHEL ,Hardwar | Vendor to confirm | | | |
| **2.19** | **In Process & Post process Gauging System:** | | | | |
| 2.19.1 | In process & post process gauging system comprising RENISHAW MP 10 / OMP60 probe system interfaced to CNC system. It should have following items/features: | Vendor to confirm | | | |
| 2.19.1.1 | RENISHAW probe MP10/OMP60 with Optical / IR signal transmission | | | | |
| 2.19.1.2 | Holder for probe with HSK63A taper suitable for the machine | Vendor to confirm | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---|---|---|---|---|---|
| 2.19.1.3 | Probe stylus . | Vendor to confirm | | | |
| 2.19.1.4 | Calibration master including the calibrating programm. | Vendor to confirm | | | |
| 2.19.1.5 | Required interface . | Vendor to confirm | | | |
| 2.19.1.6 | Receiver module . | Vendor to confirm | | | |
| 2.19.1.7 | Service Kit. | Vendor to confirm | | | |
| 2.19.2 | **Measurement** | | | | |
| a) | **For In Process measurement:**The In-process gauging shall be done for following features of blades with automatic correction of Tool/ work offsets.<br>**-- Blades with Rhomboidal shaped Hub and Shroud as well as TX blades**<br>i) Pitch width of Hub Face<br>ii) Pitch width of Shroud Face<br>iii) Neck width of Hub during Slot machining | Vendor to confirm | | | |
| | **-- Blades with Rhomboidal shaped Hub and Z shaped shroud**<br>i) Pitch width of Hub Face<br>ii) Probing of at least two important faces of Shroud with precise dimensions. (In case, the 10 faces of Z Shroud is being finished by more than one cutter, then probing to be done for each cutter)<br>iii) Neck width of Hub during Slot machining.<br>The pitch angle (wedge angle) for Hub and Shroud shall be measured to verify the correctness of the process. The measurement and correctness of pitch angle shall be tested during pre-acceptance at the works of the vendor. If found reliable, the same shall be incorporated as a part of in-process checking.. | Vendor to confirm | | | |
| b) | **For Post process measurement:**The post process gauging of the blade shall include measurements of following features of blade after complete machining.<br>**a) Blades with Rhomboidal shaped Hub and Shroud**<br>i) Half Hub Rhomboid width from center towards Leading edge<br>ii) Half Hub Rhomboid width from center towards Trailing edge<br>iii) Total Hub Rhomboidal width (addition of i & ii)<br>iv) Half Hub pitch width from center towards suction side at bottom radius Rmin (for moving blades) and at top radius Rmax (for Guide blade)<br>v) Half Hub pitch width from center towards pressure side at bottom radius (for moving blades) and at top radius (for Guide blade)<br>vi) Total Hub pitch width (addition of iv & v)<br>vii) Half Parallel distance from center for hub face facing pressure side at bottom radius Rmin (for moving blades) and at top radius Rmax (for Guide blade) | Vendor to confirm | | | |
| | viii) Total Parallel distance between two hub faces facing suction and pressure side at bottom radius Rmin (for moving blades) and at top radius Rmax (for Guide blade)<br>ix) Half Wedge Taper angle on Hub face towards suction side (to be established during pre-acceptance)<br>x) Half Wedge Taper angle on Hub face towards pressure side (to be established during pre-acceptance)<br>xi) Total Wedge Taper angle on two hub faces (addition of ix & x) - to be established during pre-acceptance<br>xii) Hub Slot Neck width (Neck left on Hub after slot m/cing) | | | | |
| | xiii) Hub Slot Size (checking for both slots)<br>xiv) Hub Rhomboidal Angle<br>xv) Half Shroud Rhomboid width from center towards Leading edge<br>xvi) Half Shroud Rhomboid width from center towards Trailing edge<br>xvii) Total Shroud Rhomboidal width (addition of xv & xvi)<br>xviii) Half Shroud pitch width from center towards suction side at top radius Rmax (for moving blades)<br>xix) Half Shroud pitch width towards pressure side at top radius Rmax (for moving blades)<br>xx) Total Shroud pitch width (addition of xviii & xix)<br>xxi) Half Parallel distance from center for shroud face facing pressure side at top radius Rmax (for moving blades) and at bottom radius Rmin (for Guide blade)<br>xxii) Total Parallel distance between two Shroud faces facing suction and pressure side at top radius Rmax (for moving blades) and at bottom radius Rmin (for Guide blade)<br>xxiii) Half Wedge Taper angle on Shroud face towards suction side (to be established during pre-acceptance)<br>xxiv) Half Wedge Taper angle on Shroud face towards pressure side (to be established during pre-acceptance)<br>xxv) Total Wedge Taper angle on two shroud faces (addition of xxiii & xxiiv) - to be<br>xxvi) Shroud Rhomboidal Angle | | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---|---|---|---|---|---|
| | **b) Blades with Rhomboidal shaped Hub and Z shaped Shroud**<br>i) Half Hub Rhomboid width from center towards Leading edge<br>ii) Half Hub Rhomboid width from center towards Trailing edge<br>iii) Total Hub Rhomboidal width (addition of i & ii)<br>iv) Half Hub pitch width from center towards suction side at bottom radius Rmin (for moving blades) and at top radius Rmax (for Guide blade)<br>v) Half Hub pitch width from center towards pressure side at bottom radius (for moving blades) and at top radius (for Guide blade)<br>vi) Total Hub pitch width (addition of iv & v)<br>vii) Half Parallel distance from center for hub face facing pressure side at bottom radius Rmin (for moving blades) and at top radius Rmax (for Guide blade)<br>viii) Total Parallel distance between two hub faces facing suction and pressure side at bottom radius Rmin (for moving blades) and at top radius Rmax (for Guide blade)<br>ix) Half Wedge Taper angle on Hub face towards suction side<br>x) Half Wedge Taper angle on Hub face towards pressure side<br>xi) Total Wedge Taper angle on two hub faces (addition of ix & x) | | | | |
| | xii) Hub Slot Neck width (Neck left on Hub after slot m/cing)<br>xiii) Hub Slot Size (checking for both slots)<br>xiv) Hub Rhomboidal Angle<br>xv) Half Shroud Rhomboid width from center towards Leading edge<br>xvi) Half Shroud Rhomboid width from center towards Trailing edge<br>xvii) Total Shroud Rhomboidal width (addition of xv& xvi)<br>xviii) Half Wedge Taper angle on Shroud face towards suction side (to be established during pre-acceptance)<br>xix) Half Wedge Taper angle on Shroud face towards pressure side (to be established during pre-acceptance)<br>xx) Total Wedge Taper angle on two shroud faces (addition of xviii & xix) - to be established during pre-acceptance<br>xxi) For other dimensions of shroud to be probed refer to sketch enclosed at Annexure-C<br>**c) TX Blades**<br>i) Similar checking for TX Blades as under (a) "Blades with Rhomboidal shaped Hub and Shroud". | | | | |
| c) | The measured result file shall be genarated on the machine only ( not dependent on any external software/PC) & shall contain all relevant information such as nominal values, measured values, tolerances along with project details & serial no./Box no. of measured blade as per format at Annexure-I. Further , all the measurements done on the blade except the profile shall appear in a single file in the above format so that it can be prensented to the inspection department directly. The measured result of the Blade Profile shall be stored in a different file with deviation values ( in normal direction) of the measured points only with project details , serial no. of measured blade & the drawing location / section where profile was measured as per format at Annexure -II. The printing of the file and other details shall be as per point no. 2.18.3.7 | Vendor to confirm | | | |
| 2.19.3 | All programs / software including customization required for In-process gauging & Post-process measurement of complete blade (Hub, shroud, & profile ) after machining & its report genaration on the machine as per above mentioned format shall be supplied along with the machine. | Vendor to confirm | | | |
| 2.19.4 | The probing system shall be completely demonstrated & established on all supplied machines during pre- acceptance at supplier's works as well as during commissioning of the machines at BHEL, Hardwar by using it for In-process measurements with automatic correction of tool/ work offsets & measurement of complete prove out blades after machining. (All important dimensions of Hub ,Shroud & profile portion as per point no. 2.19.2). | Vendor to confirm | | | |
| 2.19.5 | The backup of all programs for the above probing system shall be supplied on CDs. | Vendor to confirm | | | |
| 2.19.6 | The calibration procedure shall be completely demonstrated & established on all the supplied machines by the vendor during pre-acceptance at suplier's works as well as during commissioning of the machines at BHEL ,Hardwar. | Vendor to confirm | | | |
| 2.19.7 | Complete trials & test shall be conducted at BHEL,Hardwar on all the machine by the vendor to demonstrate & establish full capability of the probing system during comisioning of machine . | Vendor to confirm | | | |
| 2.19.8 | Complete technical support for its smooth usage during the warranty period of the machines shall be provided by the vendor. | Vendor to confirm | | | |
| **2.20** | **Tool Life Monitoring ;** | | | | |
| 2.20.1 | The system should be capable of folowing features : | | | | |
| 2.20.1.1 | The expected tool life entered for the tool is monitored | Vendor to confirm | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
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| 2.20.1.2 | When the end life of tool is nearing , the machine shall finish cycle in progress & then change tool by bringing in the sister tool from the magazine . | Vendor to confirm | | | |
| 2.20.2 | Blum Laser system for tool setting & tool breakage detection | Vendor to confirm | | | |
| | The system shall be capable of measuring tool length , tool radius & load these values into tool offfset memory of the machine. The system shall also have following capability/ features: | Vendor to confirm | | | |
| 2.20.2.2 | Tool breakage detection. | Vendor to confirm | | | |
| 2.20.2.3 | Cutting edge monitoring at straight & round edes . | Vendor to confirm | | | |
| 2.20.2.4 | The vendor shall provide a suitable user friendly program in the machine for automatic checking (picking of tool from magazine, measurement of tool length, radius & loading of these values into offset memory of the machine) for all the tools at a time or some of the tools as specified by operator in that program for the offered Laser system. The program must run the measurement cycle 3 or 4 times (as required) for each tool with automatic adjustment of offset values till the values are within specified tolerance mentioned in the program. The operator shall only enter once the approximate length and radius values for each tool (after every physical change of tool) at appropriate location of length offset in the machine and load the tool back in the magazine. | Vendor to confirm | | | |
| 2.20.2.5 | All programs / software required to run the system shall be supplied & established on all the supplied machines by the vendor. The backup for all programs shall supplied on CDs. | Vendor to confirm | | | |
| 2.20.2.6 | The party shall conduct complete trials & test during pre- acceptance at supplier's works as well as during commissioning of the machines at BHEL,Hardwar on all the machines to demonstrate & establish full capabilities of the system. | Vendor to confirm | | | |
| 2.20.2.7 | The system shall be supplied with the complete calibration system including calibration master , calibration program. The calibration procedure shall be completely demonstrated & established on all the supplied machines by the vendor during pre-acceptance at supplier's works as well as during commissioning of machines at BHEL, Hardwar. | Vendor to confirm | | | |
| 2.20.2.8 | Complete technical support for its smooth usage during the warranty period of the machines shall be provided by the vendor. | Vendor to confirm | | | |
| **2.21** | **CAM SOFTWARE:** | | | | |
| | A dedicated Blade machining PC based CAM Software working on Windows XP Operating system shall be offered with complete details (Detailed brochers,writeup). | | | | |
| 2.21.1 | A dedicated PC based CAM software capable of Blade Geometry definition and generation of tool path of complete turbine blade, simulation along with integrated customised post processor to generate the NC program for the machining and measurement of complete blade ( Profile , Hub & Shroud) shall be offered suitable for the offered machines. | Vendor to confirm | | | |
| 2.21.2 | The software should be capable of accepting the profile data of the blade in the following ways for modelling and generation of tool path & part progrram. | Vendor to confirm | | | |
| 2.21.2.1 | BHEL supplied STRAK data format. | Vendor to confirm | | | |
| 2.21.2.2 | IGES format from leading CAD systemsuch as IDEAS , Pro-Engineer, Unigraphics, AUTOCAD etc. | Vendor to confirm | | | |
| 2.21.2.3 | Provision for accepting profile coordinates in simple & suitable ASCII (Text ) file. | Vendor to confirm | | | |
| 2.21.3 | The software should be capable of accepting the Hub (Root) & Shroud data of the blade in the following ways for modelling and generation of Tool path/Part Program. | Vendor to confirm | | | |
| 2.21.3.1 | BHEL Suplied Hub & Shroud Data in UEB data format. | Vendor to confirm | | | |
| 2.21.3.2 | Provision of manual definition of complete Hub & Shroud portion of the blade in the software itself. | Vendor to confirm | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
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| 2.21.4 | The STRAK-UEB interface of the CAM software shall be capable of Automatic input of geomatrical data of blades using BHEL Supplied data (in STRAK & UEB format) for following types of blades | Vendor to confirm | | | |
| | -Moving blade with Rhomboidal shaped HUB & SHROUD with T-Slot / Double T-Slot in Hub (Left & Right Hand) | | | | |
| | - Guide Blade with Rhomboidal shaped HUB & SHROUD with T-Slot / Hook slot in Hub (Left & Right Hand). | | | | |
| | - Moving & Guide Blade with Rhomboidal shaped HUB & Z shaped SHROUD (Left & Right Hand). | | | | |
| | - Moving & Guide Blade with Rhombiodal shaped HUB & Stepped SHROUD ( Left & Right Hand). | | | | |
| | Further , the correctness of the STRAK-UEB interface shall be demonstrated by the vendor through input of all the above mentioned Blade geometry in their offered CAM software ( using BHEL supplied data ) during pre-acceptance at vendor's works as well as BHEL, Hardwar during commissioning of machine. | Vendor to confirm | | | |
| 2.21.5 | The CAM software shall be capable of manual definition of complete blade geometry as well as generation of the NC programs for machining of following types of blades from blade & profile drawings. | Vendor to confirm | | | |
| | Moving and Guide blades (left & right hand) with rhomboidal shaped HUB and rhomboidal / Z shaped SHROUD. | | | | |
| | Moving and Guide Blades of all types of TX Profile Blades | | | | |
| | - Locking and Joint blade (left & right hand) with rhomboidal shaped HUB and rhomboidal / Z shaped SHROUD. | | | | |
| | Further , this capability of the CAM software shall be demonstrated by the vendor through preparation of program (one no. for each type) from sample blade & profile drawings of BHEL during training period at vendors work as well as at BHEL, Hardwar during commissioning of machine. | Vendor to confirm | | | |
| 2.21.6 | The software should include graphical display of blade profile & simulation of tool path on screen. | Vendor to confirm | | | |
| 2.21.7 | The software should be capable of generating program for measurement of individual surface points over the profile along a section, different Hub & Shroud dimensions of the blade by means of probing system provided on the machine. | Vendor to confirm | | | |
| 2.21.8 | The software shall be instaled on two separate PCs to be made available by BHEL having matching hardware requirements for the offered software to generate the programs. | Vendor to confirm | | | |
| 2.21.9 | In case of breakdown of any PCs on which the CAM software shall be loaded , the supplier shall provide help to facilitate loading of the software from supplier's server on another PC after intimation of IP address of the new PC if required by M/s BHEL. | Vendor to confirm | | | |
| 2.21.10 | All necessary modules of the CAM software required to meet the above capabilities of CAM software & for generation of part programs for machining & measurement of all varieties of blades mentioned at point no. 2.21.4, 2.21.5, proveout blades mentioned at point no. 2.47 as well as Automatic generation of NC Programs at point no. 2.22 shall be supplied along with the machine. | Vendor to confirm | | | |
| 2.21.11 | The party shall provide full technical support & Upgradation of the offered CAM software during the warranty period. The technical support shall include trouble shooting through telephone , E-mails & visit of their experts if required. | Vendor to confirm | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
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| 2.21.12 | The backup of the software shall be provided on CDs. | Vendor to confirm | | | |
| **2.22** | **SYSTEM OF AUTOMATIC ACCESS , GENERATION , STORAGE & RETREIVAL OF NC PROGRAMS:** | | | | |
| | The vendor shall supply a complete full proof system of Automatic access of Geometrical data of blade from Network, Automatic generation of NC programs without programer intervention , Automatic Storage of NC programs on the Network & its retreival by the operator from the machine. | | | | |
| | It shall have following features: | | | | |
| 2.22.1 | **1. Project Master Page:**<br>For each blade which should be calculated with the Automatic system, project master page shall be defined with all necessary information for calculating the NC Data, whose sample page is attached at Annexure-I. The project master page will be identified by the drawing number and the status of the calculated NC Data can be checked by the revision number. The project master pages will be stored in a database. In case of further clarification, the project master page can be finalized with the vendor during technical discussions. | Vendor to confirm | | | |
| | **2. Geometry Input Data:**<br>The blade types mentioned at point 2.21.4/5 of the scope of supply will be supported by the system. The Geometry data can be defined through the STRAK – UEB definition or manually from drawings using geometrical sketches as mentioned at point no. B (ii). The Blank shall be defined in a special file format provided by the vendor. | Vendor to confirm | | | |
| | **a)** Input through STRAK – UEB Interface (2.21.4) : The STRAK & UEB file name along with path will be defined in full length by BHEL on the Project Master page. The blades with input definition as "data type" will be automatically converted into model internally based on the Strak &Ueb files. At the pre-defined folder, there has to be also a file named "1.rev", which defines the actual version of the geometry data and has to be increased manual by every change in the geometry data. The content of this file is not relevant for the automatic system. The corresponding Revision number on the project page will be updated after processing the project with the new geometry data. | | | | |
| | **b)** Manual Input from Drawing (2.21.5) : The blades with input definition as "drawing type " will be defined here. The blade profile with its name & full path shall be defined by BHEL. The profile data file (manually keyed in from drawing) shall be in a user friendly format, which will be mutually decided, and then automatically converted internally into CAM Format. The Hub and Shroud data shall be defined manually from drawings, guided by a parametric drawing/sketches to be provided by the vendor. Only those parameter of the drawing will be used which are necessary for CAM system. | | | | |
| | **c)** Raw material definition (2.21.4/5) : The file name along with path will be defined by BHEL on the project master page. The blank geometry can be defined through length, width, height and the asymmetric parameters. The rotation of the blank will be calculated by the system. The file format will be defined by the vendor and it will accept varying number of spaces between keywords and parameters. The blank will not be checked for any revision number changes. If there is any changes in the blank geometry, BHEL shall be responsible for recalculating the project. | | | | |
| | **d)** Locking and Joint blades :<br>The data for Joint blade (only for Guide blades) and Locking blade (only in case of moving blade) shall be entered via the project master page if required. | | | | |
| | **3. Tool library:**<br>There will be a tool library, initially containing all tools supplied by the vendor. The tool library can be updated by BHEL through addition of new tools as well as modification of existing one. The spindle speed and feed rate for each tool shall be defined in the tool library, corresponding to the CAM technology parameter. Provision shall be provided for generating program with different cutting parameters to be used for every reginded solid carbide tools. | Vendor to confirm | | | |
| | **4. Operation Templates:**<br>Different templates for defining the milling process will be defined by the vendor and proved during the machine acceptance at BHEL, Haridwar as per point no. 2.22.1 para 9(c) of this scope of supply. The templates shall be stored in a defined folder. The templates for a blade will be defined in the project master page. There could be more than one set of templates for one blade type depending on the range of the blade size. The tools which has to be used for each blade will be selected automatically from the tool library, based on corner radii, fillet radii and other things as defined. | Vendor to confirm | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
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| | **5. Post processor :**<br>It shall be possible to select different machine post processors (more than one machine for a particular blade) with provision of entering Fixture rotation and fixture translation for each machine to generate NC output suitable for the selected machines. The methodology of incorporating this feature in master page shall be decided by the vendor. | Vendor to confirm | | | |
| | **6. Running the Automation NC Programming system:**<br>The Automation system will run regularly under a defined schedule, which shall be defined by BHEL (e.g. every morning 8:00, every Monday….). All projects which have a mismatch between the revision file number and the revision number on the project master page will be recalculated and the new NC output data will be stored at the predefined path. | Vendor to confirm | | | |
| | The starting screen of Automation NC Programming System will have following Options:<br>• Add a new project master page<br>• Modify existing project master page<br>• Show Model<br>• Execute selected projects<br>• Execute All (All projects are recalculated without checking the revision number)<br>• Define schedule<br>• Exit After executing if errors have occurred, the errors will be displayed in a log file with information about the type of error and which can be saved/retained. Some of the possible errors are for eg. files not available because a PC is switched of or there is a wrong input in the master project page. The master project page can then be opened for modifications and re-executed manually. | | | | |
| | **7. Storage of Data:**<br>The created NC Data will be stored in a predefined folder to be defined by BHEL in the project master page. For each blade, there will be three different types of NC Data valid for different type of machines (one for new cutters, one with regrinded cutters and another for Locking/Joint blades). For the regrinded tools, the additional regrinded cutting parameters defined in the tool library shall be used. The initial cutting parameters for regrinded cutters will be defined by the vendor (for eg. reduction of 30%) which can then be modified by BHEL as per actual shop practice. The NC data files for different blades and different machines shall be generated and stored as per following structure: | Vendor to confirm | | | |
| | -----Machine 1 ---------Drawing number_N NC<br>---------Summary<br>---------Drawing number_R NC<br>Drg. number - ---------Summary<br>---------Drawing number_JT NC<br>---------Summary<br>------Machine 2 --------Drawing number_N NC<br>--------Summary<br>--------Drawing number_R NC<br>--------Summary<br>--------Drawing number_JT NC<br>--------Summary<br>. | | | | |
| | The Summary folder will contain an operation summary file containing operation and few other details, whose sample file is attached at Annexure-4. | Vendor to confirm | | | |
| | **8. Measuring Program:**<br>The NC measuring programs (post process measurement of blade) will be included in the regular NC Data file at the end for every blade prog with a M0 command separating the main prog and measuring prog or can be also switched on by an R-Parameter on the machine by the operator. By default it, the R parameter will be switched off. | Vendor to confirm | | | |
| | **9. General :**<br>**a)** For the Double T-Slot Hub and the Stepped Shroud, only the geometric modelling (from UEB file and manually from Drawing) will be fulfilled in automation system as there are no examples for programming the operation templates and prove them by machining. The templates will only be a copy of other Hub / Shroud templates and the correct operation order will be defined later on by BHEL. | Vendor to confirm | | | |
| | **b)** All blades to be machined during pre-acceptance and during prove out at BHEL, Haridwar shall use NC programs generated through the Automation system of NC programme generation. | Vendor to confirm | | | |
| | **c)** A detailed writeup/user manual about the Automation system shall be provided having details about installation procedure of the software, it's setup, description of various parameters used in project master page, model creator, operation template creator, directory structure and other details which will help in understanding and using the system. | | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
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| 2.22.2 | The machine operator shall download these NC programs stored at predefined path in the Automation PC or on the network (all the programs in the drawing no. wise folder) to the specified folder in the work piece directory of the machine in CNC mode after specifying the drawing no. of the blade. | | | | |
| 2.22.3 | The party shall conduct complete trials during pre- acceptance at supplier's works as well as during commissioning of machines at BHEL,Hardwar on all machines to demonstrate successsful implementation of full capabilities of the supplied Automation system. | | | | |
| 2.22.4 | The vendor shall carry out complete customization, prepare all the required operation templates, provide all necessary logics so that the access of geometrical data, successsful conversion , processing & generation of NC programs suitable for machining , programs storage is carried out automatically without human intervention as mentioned above at point no. 2.22 | | | | |
| 2.22.5 | The backup of the software shall be provided on CDs. | | | | |
| **2.23** | **Integration of CAM software with existing simulation software"VERICUT"** | | | | |
| | The party shall completely integrate their offered CAM software with the simulation software"VERICUT" version already available with BHEL or provide their own suitable version of VERICUT. The following features shall be provided: | Vendor to confirm & offer | | | |
| 2.23.1 | Complete 3D model of the offered machine (working area) shall be built accurately for simulation software "VERICUT"& the same shall be loaded on BHEL PCs. | Vendor to confirm & offer | | | |
| 2.23.2 | Complete model of all tools with their adapters being supplied in the 'Tooling Package' shall be built for simulation software"VERICUT"& shall be loaded on PCs at BHEL Haridwar. | Vendor to confirm & offer | | | |
| 2.23.3 | All necessary customization needed either in offered CAM softwatre or in "Vericut" for smooth & error free 3D simulation of the NCs programs (generated from the offered CAM software) shall be done by the vendor . The complete 3D simulation of tool path / NC program on the blank blade model shall be completely demonstrated during pre-acceptance (for pass-off blades) at vendor's works as well as at BHEL,Hardwar (for proveout blades) during commissioning of the machine showing clearly the avoidence of collision / interferance of tools with machine components. | Vendor to confirm & offer | | | |
| 2.23.4 | The complete 3D simulation of tool path /NC program generated from the offered CAM system on the blank blade model shall be completely established on BHEL's PC loaded with "VERICUT" software . | Vendor to confirm & offer | | | |
| 2.23.5 | The party shall provide full technical support for the above integration of simulation software "VERICUT" during the warranty period of the machine. | Vendor to confirm | | | |
| 2.23.6 | The back up of the above data shall be provided on CDs. | Vendor to confirm & offer | | | |
| | NOTE:The simulation software "VERICUT" available with BHEL has following modules : Version:5.2 | | | | |
| | Vericut base product , 3 axes Mill& Drill , Multi axes Mill & Drill , Special cutters & holders , Machine simulation. | | | | |
| **2.24** | **MACHINE NETWORKING:** | | | | |
| 2.24.1 | Machine control should have necessary hardware & software so that it is ready for interfacing with gigbit Ethernet Local Area Network with 100MB/ sec. Speed available on machine on UTP cables for NC program & other related DATA transfer . This network to be connected to Wide Area Network / Internet.It should cover following features: | Vendor to confirm & offer | | | |
| 2.24.1.1 | The machine should appear as a node just as any other PC in the entire network (Network Neighbourhood). | Vendor to confirm & offer | | | |
| 2.24.1.2 | The program transfer should be simple copy & paste method just as it is done in case of PCs. | Vendor to confirm & offer | | | |
| 2.24.1.3 | The networking should be capable to transfer programs from/to machine across the network in CNC mode. | Vendor to confirm & offer | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
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| 2.24.1.5 | All necessary Anti-Virus measures shall be incorporated. | Vendor to confirm & offer | | | |
| 2.24.1.6 | The above Networking features shall be completely demonstrated and established on all the supplied machines by the vendor during pre-acceptance at vendor's works as well as at BHEL, Haridwar during commissioning of the machines. | Vendor to confirm & offer | | | |
| | | | | | |
| **2.25** | **MACHINE MONITORING SYSTEM(MMS) SIGNALS** | | | | |
| 2.25.1 | Following MMS signals would be made available on a specifically earmarked terminal strip . These MMS signals would be sourced from a SIMATIC S-7 PLC output card seperately. | Vendor to confirm & offer | | | |
| 2.25.1.1 | Control ON | Vendor to confirm & offer | | | |
| 2.25.1.2 | Cycle ON | Vendor to confirm & offer | | | |
| 2.25.1.3 | Spindle running (in all modes ) | Vendor to confirm & offer | | | |
| 2.25.1.4 | Feed Active (Any of the axes running in all modes) | Vendor to confirm & offer | | | |
| 2.25.1.5 | M30 Program Stop. | Vendor to confirm & offer | | | |
| **2.26** | **SIGNALS FOR AREA MANAGER SYSTEM** | | | | |
| 2.26.1 | The PLC on each machine (SIMATIC S7-300 ) shall have one additional 24 Input +24 Output card for tapping of signals for Area Manager System. | Vendor to confirm & offer | | | |
| **2.27** | **FAULT DIAGNOSTIC SYSTEM** | | | | |
| 2.27.1 | TELE DIAGNOSTIC SERVICE | | | | |
| | Tele-diagnostic service should be provided through International telephone lines along with required Hardware / Software for the supplied CNC system to access both CNC and PLC. This should be provided free of charge for the guarantee period. Terms and conditions for the service after guarantee period should be informed by vendor. Help guide should be provided for use of the system/service. | Vendor to confirm & offer | | | |
| 2.27.2 | FAULT DIAGNOSTIC SYSTEM | | | | |
| | Supplier's own diagnostic system with required hardware and software should be supplied and installed on the CNC system. This should include customized auto-diagnostic system with supporting hardware and software which shows detailed cause and remedy for the faults on the display with full video diagnostic help for faults related to mechanical/hydraulic and electrical/electronic maintenance. Help guide should be provided for use of the system. | Vendor to confirm & offer | | | |
| | Provision of suitable note book as diagnostics aid with PCMCIA CARD / ADAPTOR for MPI Port , necessary cables, S7 . software ( Licensed copy) , S7. Graph ( if usedin the machine) for display of PLC user programme on Notebook. Note book must be loaded with soft copies of Electrical circuit diagram, wiring diagram, hydraulic diagram, machine layout, PLC software, machine operation & maintenance manuals and diagnostic & help text etc. | Vendor to confirm & offer | | | |
| | Screen (pages) displaying the status of all inputs of ATC and AWC manually for service personnel only. | Vendor to confirm & offer | | | |
| **2.28** | **SERVO VOLTAGE STABILIZER** | | | | |
| 2.28.1 | Oil / Air Cooled Servo Controlled Voltage Stabilizer (of reputed Indian make) suitable for complete machine, its drives, controls, PLC etc. for unbalanced load & supply conditions considering specified power supply & ambient conditions. | | | | |
| 2.28.2 | Make | Vendor to intimate | | | |
| 2.28.3 | Model, Rating & Input/Output Voltage etc. | Vendor to intimate | | | |
| 2.28.4 | Monitoring device with cutoff facility for under/over output voltage, Devices for load current measurement, MCCB at input for overload/short circuit protection. | Vendor to offer | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
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| 2.28.5 | Spares Package for Servo Voltage Stabilizer, with item-wise breakup, are to be recommended and offered by the vendor in sufficient quantity for 2 years of trouble free operation considering three shifts continuous running of the machine. Detailed list is to be submitted. Price of unit quantity of each item is to be quoted. | Vendor to offer | | | |
| **2.29** | **ULTRA ISOLATION TRANSFORMER** | | | | |
| 2.29.1 | Ultra Isolation Transformer (of reputed Indian make) suitable for complete machine , its drives, controls, PLC etc. for unbalanced load & supply conditions considering specified power supply & ambient conditions. | Vendor to confirm & offer | | | |
| 2.29.2 | Make | Vendor to intimate | | | |
| 2.29.3 | Model, Rating & Input/Output Voltage etc. | Vendor to intimate | | | |
| 2.29.4 | Monitoring device with cutoff facility for under/over output voltage, Devices for load current measurement, MCCB at input for overload/short circuit protection. | Vendor to offer | | | |
| **2.30** | **SPARES** | | | | |
| 2.30.1 | Following Mechanical, Hydraulic and Pneumatic spares used on the machine, with item-wise price breakup, are to offered by the vendor. Price of unit quantity of each item is to be quoted. In case vendor feels any other item not listed below are essential to be maintained as spare, same shall also be offered. | Vendor to offer | | | |
| 2.30.1.1 | Hydraulic Spares: | | | | |
| | 1 No. for each machine of - Hydraulic Pumps (all types), Lubrication Pump (all types), Solenoid valves (all types), Pressure Switch (all types), Hydraulic Cylinder, Pressure Reducing valve, accumulator. 10 Nos. of each type of Hydraulic Hoses, all types of oil seals & O-rings, all types of filter elements | Vendor to offer and inform total numbers of each item offered | | | |
| 2.30.1.2 | Pneumatic Spares: | | | | |
| | 1 No. for each machine of - Solenoid Valves (all types), Check valves (all types), Pressure reducing valve (all types), Ball Valve (all types), Silencer, Filters (all types), Pressure Switch (all types) , Cylinder. 10 Nos. of each type of Coiled Flexible Air Pipes. | Vendor to offer and inform total numbers of each item offered | | | |
| 2.30.1.3 | Spares for Lubrication System | | | | |
| | Pump all types - 1 No. for each machine, Measuring Valve all types- 1 No. for each machine, Connector (all types)- 1 No. for each machine Seals (all types) 10 Nos., O-Ring (all types)- 10 Nos., Hose (all types)- 10 Nos, Pressure Switch (all types) and Float Switch- 2 Nos. | Vendor to offer and inform total numbers of each item offered | | | |
| 2.30.1.4 | Spares of Coolant Filtration System | | | | |
| | Pump (all types) - 1 No. for each machine, Filters (all types)- 1 No. for each machine, Solenoid valves (all types)- 1 No. for each machine, Pressure Switches (all types)- 1 No. for each machine, Float Switches (all types)- 1 No. for each machine, Vacuum Filter element- 1 No. for each machine, Seals (all types), Pump Seals- 10 Nos. each | Vendor to offer and inform total numbers of each item offered | | | |
| 2.30.1.5 | Spare Spindle- 1 No. for each machine | Vendor to offer | | | |
| 2.30.1.6 | Belts all types- 5 Nos. each | Vendor to offer | | | |
| 2.30.1.7 | Flexible Bellow Cover - 1 set | Vendor to offer | | | |
| 2.30.1.8 | Bearings all types - 1 No. each | Vendor to offer | | | |
| 2.30.1.9 | Coolant Gun- 2 Nos for each machine | Vendor to offer | | | |
| 2.30.1.10 | Ball Screw + Nut (X,Y & Z Axis)- 1 No. each | Vendor to offer | | | |
| 2.30.1.11 | Flex track (Conduit) and connecting part- 1 set | Vendor to offer | | | |
| 2.30.1.12 | Probe, Pneumatic Unit and Pressure valve for Tool Monitoring System - 1 set | Vendor to offer | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---|---|---|---|---|---|
| 2.30.1.13 | Filter for Mist Extraction System- 1 set | Vendor to offer | | | |
| 2.30.1.14 | Special Oil and Grease- For one year operation of each machine. | Vendor to offer | | | |
| 2.30.2 | Following spare parts of electrical/electronics and CNC system shall be offered itemwise per machine: | | | | |
| 2.30.2.1 | PCU-50 with system software and hard disk- 1 No. | Vendor to offer | | | |
| 2.30.2.2 | Operator panel with OP010 / OP010C, 10.4" colour flat screen- 1 No. | Vendor to offer | | | |
| 2.30.2.3 | Diskette unit for PCU-50 with connecting cable- 1 No. | Vendor to offer | | | |
| 2.30.2.4 | NCU Box + NCU 573.5- 1 No. | Vendor to offer | | | |
| 2.30.2.5 | PLC input and output cards-Digital & Analogue- 1 No. of each type | Vendor to offer with identification/ordering number and total nos. offered | | | |
| 2.30.2.6 | 19" Machine Control Panel- 1No. | Vendor to offer | | | |
| 2.30.2.7 | I/R Module - 1 No, Power Module for Main Spindle - 1No., Drive Power Modules Modules - 1No each type | Vendor to offer with identification/ordering number and total nos. offered | | | |
| 2.30.2.8 | Measuring System Linear & Rotary - 1 No each type | Vendor to offer with identification/ordering number and total nos. offered | | | |
| 2.30.2.9 | DC-USV - 1 No. and Battery Module - 1 No. | Vendor to offer with identification/ordering number | | | |
| 2.30.2.10 | Controller Cards - 1 No. each type | Vendor to offer with identification/ordering number and total nos. offered | | | |
| 2.30.2.11 | Filter and Choke Module - 1 No. | Vendor to offer with identification/ordering number | | | |
| 2.30.2.12 | Proximity Switches All types 2 Nos. each | Vendor to offer with identification/ordering number and total nos. offered | | | |
| 2.30.2.13 | Set of Push Buttons- 20 Nos | Vendor to offer with identification/ordering number and total nos. offered | | | |
| 2.30.2.14 | Set of Indicating Lamp- 50 Nos | Vendor to offer with identification/ordering number and total nos. offered | | | |
| 2.30.2.15 | Main Switch - 1 No.+ Relay - 1No.each type + Time Relay - 1No.each type | Vendor to offer with identification/ordering number and total nos. offered | | | |
| 2.30.2.16 | Power Contactors All Types and 1 No. Each | Vendor to offer with identification/ordering number and total nos. offered | | | |
| 2.30.2.17 | Complete Laser System - 1 No. | Vendor to offer with identification/ordering number | | | |
| 2.30.2.18 | Spare hard disc of PCU-50 loaded with all Siemens and OEM Software | Vendor to offer with identification/ordering number | | | |
| Note | All types of spares for total machine and accessories should be available for atleast ten years after supply of the machine. If machine or control is likely to become obsolete in this period, the vendor should inform BHEL sufficiently in advance and provide drawings of parts / details of spares & suppliers to enable BHEL to procure these in advance, if required | Vendor to confirm | | | |

(N Halder/DGM-WEX-Mech)

(A Mookherjee/DGM-TBM) (S K Shukla/SDGM-CNC-WEX) (D K Chawla,SM-NCT)



(T K Saha/Mgr-QC-B)

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---|---|---|---|---|---|
| 2.30.3 | Vendor to confirm that complete list of spares for machine and accessories, along with specification / type / model, and name & address of the spare supplier shall be furnished along with documentation to be supplied with the machine | Vendor to confirm | | | |
| **2.31** | **DOCUMENTATION** | | | | |
| | Four sets of following documents (Hard copies) in English language should be supplied along with the machine. | | | | |
| 2.31.1 | Operating manuals of Machine & CNC system | Vendor to confirm | | | |
| 2.31.2 | Programming Manuals (Advance & Standard) of Machine & CNC system | Vendor to confirm | | | |
| 2.31.3 | Detailed Maintenance manual of machine with all drawings (preferably laminated) of machine assemblies/sub-assemblies/parts including Electrical / Pneumatic/ Coolant / Hydraulic circuit diagrams, electrical schematic diagram, wiring diagram and detailed drawing of machine Spindle. | Vendor to confirm | | | |
| 2.31.4 | Maintenance, Interface & commissioning manuals for CNC system, spindle & feed drives (applicable for machine and Part Loading System). | Vendor to confirm | | | |
| 2.31.4.1 | Operator's Guide (HMI Advance) | 6FC5298-6AF00-0BP3 or equivalent 3 sets | | | |
| 2.31.4.2 | Diagnostics Guide | 6FC5298-6AA20-0BP3 or equivalant 3 sets | | | |
| 2.31.4.3 | Programming Guide (Fundamentals) | 6FC5298-6AB00-0BP2 or equivavalt 3 sets | | | |
| 2.31.4.4 | Programming Guide (Advanced) | 6FC5298-6AB10-0BP2 or equivavant 3 sets | | | |
| 2.31.4.5 | Programming Guide (Cycles) | 6FC5298-6AB40-0BP2 or equivavalant 3 sets | | | |
| 2.31.4.6 | User and Manufacturer Documentation on CD ROM, with help tool | 6FC5298-7CA00-0BG2 or equivalent 1 CD | | | |
| 2.31.4.7 | Brief Guide Operation | 6FC5298-6AA10-0BP0 or equivalent 3 sets. | | | |
| 2.31.4.8 | Manual NCU 571 /572/573 Planning SINUMERIK 840 D | 6FC5297-6AC10-0BP3 or equivalen 3 setst. | | | |
| 2.31.4.9 | Manual Operator Components SINUMERIK FM-NC / 810 D / 840D | 6FC5297-6AA50-0BP3 or equivalent 3 sets. | | | |
| 2.31.4.10 | Description of Functions SINUMERIC FM-NC / 810D / 840D Basic Machine | 6FC5297-7AC20-0BP1 or equivalent 3 sets. | | | |
| 2.31.4.11 | Description of Functions SINUMERIC / 810D / 840D Tool Management | 6FC5297-6AC60-0BP1 or equivalen 3 sets. | | | |
| 2.31.4.12 | Description of Functions SIMODRIVE 611 Digital/ 810D Drive Functions SINUMERIC 840D & Simodrive 611D | 6SN1197-0AA80-1BP2 or equivalent 3 sets. | | | |
| 2.31.4.13 | Installation Guide Lists | 6FC5297-7AB70-0BP1 or equivalen 3 setst. | | | |
| 2.31.4.14 | Planning Guide SIMODRIVE 611 | 6SN1197-0AA00-0BP7 or equivalent 3 sets. | | | |
| 2.31.4.15 | Planning Guide Servo Motor 1FT6 | 6SN1197-0AD02-0BP0 or equivalent 3 sets. | | | |
| 2.31.4.16 | User and Manufacturer Documentation on CD ROM, with help tool | 6FC5298-7CA00-0BG2 or equivalent 2 CDs. | | | |
| 2.31.5 | Manufacturing drawings for all supplied tool holders, cassettes, adapters, sleeves, fixtures, coolant connections, tailstock center, etc. | Vendor to confirm | | | |
| | Catalogues, Drawings and Operation & Maintenance Manuals of all bought out items, wherever applicable. | Vendor to confirm | | | |
| 2.31.6 | Detailed specification of all rubber items and hydraulic/lube fittings. | Vendor to confirm | | | |
| 2.31.7 | All relevant documentations for Refrigerant systems including circuit diagram. | Vendor to confirm | | | |
| 2.31.8 | Operating and User Manuals, Maintenance Manuals & Catalogues for supplied Tool Monitoring System , LASER System for Tool Breakage Detection, In-process & Post process Gauging System, Voltage Stabilizer, Isolation Transformer, Job Loader, Tool Changer etc. | Vendor to confirm | | | |
| 2.31.9 | Help guides for tele-diagnostic service and diagnostic systems | Vendor to confirm | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---|---|---|---|---|---|
| | Three sets of following documents in English language should be supplied along with the machine. | Vendor to confirm | | | |
| | Final PLC program on CD, NC data & PLC data on floppy. | Vendor to confirm | | | |
| 2.31.9.1 | Hard copy of PLC program along with comments in English of machine and Job Loading System(if applicable) | Vendor to confirm | | | |
| 2.31.9.2 | Complete back-up of hard disk on GHOST CD and clear written Instructions to take back-up and reloading of a new hard disk. Also ghost image of 810 D system on CD as backup (if applicable) | Vendor to confirm | | | |
| 2.31.9.3 | Complete Operating Guide, User and Programming manual of offered PC windows based CAM Software for Blade machining. | Vendor to confirm | | | |
| 2.31.9.4 | Complete Operating Guide and User manual of In-process & Post process Gauging of blades as per point no. 2.19 | Vendor to confirm | | | |
| 2.31.9.5 | Complete Operating Guide, User manual of Automatic NC Program Generation system as per point no. 2.22 | Vendor to confirm | | | |
| 2.31.9.6 | Complete write up regarding integration of CAM Software with Simulation Software VERICUT. | Vendor to confirm | | | |
| 2.31.9.7 | Complete backup of installed software including CNC features on 3.5" floppy disks or on CD for re-installation as and when required. Set of instructions /Help guide for re-installation should also be provided. | Vendor to confirm | | | |
| 2.31.10 | One additional set of all the above documentation/machine drawings/machine manuals on CD ROM, wherever possible. | Vendor to confirm | | | |
| 2.31.11 | One complete set of documents in best available condition shall be supplied one month prior to start of training date for study by BHEL engineers. | Vendor to confirm | | | |
| **2.32** | **TOOLING PACKAGE** | | | | |
| a) | The tooling package shall consist of all toolings including consumables, tool holders for machining following blades on each machine with sister tooling concept. The tooling package shoud be sufficient to machine the quantity of blades mentioned against each type of blade on each machine. | Vendor to offer | | | |
| 2.32.1 | Drawing No. 11030641006- Qty. 120 Nos. | | | | |
| 2.32.2 | Drawing No. 11010241001- Qty. 80 Nos. | | | | |
| 2.32.3 | Drawing No. 11051841008- Qty. 110 Nos. | | | | |
| 2.32.4 | Drawing No. 21010241012-Qty. 80 Nos. (TX Blade) | | | | |
| 2.32.5 | Drawing No. 21051841012- Qty. 100 Nos (TX Blade) | | | | |
| b) | The tooling package shall consist of 2 Nos. of tool holders for all varieties of cutting tools used for machining the above mentioned blades considering sister tooling concept so that changing time of toolholders is eliminated. The other consumable toolings like solid carbide cutters, inserts, screw, coolant nozzles etc. shall be for machining requisite quantities of blades (drawing number wise) as mentioned at clause no 2.32.1 to 2.32.5 of scope of supply. No resharpening or recoating should be considered in the tooling package for machining above mentioned blades. | Vendor to confirm | | | |
| c) | The tooling package shall also consist of any additional toolings & tool holders (with sister tooling concept) required to machine 5 nos. of Locking blade for each variety of moving blade and 5 nos. of Joint blades for each variety of Guide blades mentioned above at point no. 2.32 a) of tender specification. | Vendor to confirm | | | |
| **2.33** | **TIME CYCLE** | | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---|---|---|---|---|---|
| 2.33.1 | Vendor to indicate time cycle for machining the blades mentioned at 2.32.1 to 2.32.5. The time cycle should include all components of time viz. job change time, tool probing time through Laser checking, tool change time, machining time, In-process and post process job probing time etc. Time cycle for machining with new tools and resharpened tools be indicated separately. Vendor has to prove the offered timing during final acceptance of the machine at BHEL Hardwar. | Vendor to intimate | | | |
| **2.34** | Job Clamping shall be possible directly in the rotary station of the machine by means of a 2 jaw chuck. The jaws shall be suitable for all bar sizes ranging from 60 X 30 mm to 100 X 70 mm. .Separate jaws, if required, for clamping the bars of above range shall be offered. A schematic drawing indicating holding arrangement with dimensional requirement shall be furnished with the offer. | Vendor to confirm | | | |
| **2.35** | **TROPICALISATION** | | | | |
| 2.35.1 | All electrical / electronic equipment shall be tropicalized to work in mentioned operating condition. | Vendor to confirm | | | |
| 2.35.2 | All electrical & electronic control cabinets & panels should be dust and vermin proof. | Vendor to confirm | | | |
| 2.35.3 | All electrical components in the cabinets should be mounted on DIN Rail. | Vendor to confirm | | | |
| 2.35.4 | All electrical / electronic panels shall be provided with suitablelocks. Illumination and points for of 220Volts, 5/15 Amp AC with on/off switch shall be provided inside the electrical cabinet. | Vendor to confirm | | | |
| 2.35.5 | All motors shall conform to CE standard. | Vendor to confirm | | | |
| 2.35.6 | All cables moving with traversing axes should be installed in caterpillar / Drag chain. Additionally, all the cable trays/chains etc. required for laying of cables should be included in the offer. | Vendor to confirm | | | |
| 2.35.7 | Vendor should ensure the proper earthing for the machine and its peripherals/accessories. Any material requirement for the same should be informed with foundation design/drawings. The vendor can take earthing connection from the nearest available location of the production shop. | Vendor to confirm | | | |
| **2.36** | **OPERATING CONDITIONS** | | | | |
| 2.36.1 | Total machine including all supplied items should work trouble free and efficiently under following operating conditions and should give specified accuracies.<br>**Power Supply (AC):**<br>Voltage = 415 V +10% / -15%<br>Frequency = 50 Hz +3% / -3%<br>No. of phases = 3 (3 wire system without neutral)<br>**Ambient Conditions:**<br>Temperature up to 30 degree Celsius in Air Conditioned Hall<br>Relative Humidity About 70% | Vendor to ensure that offered Voltage Stabilizer and Isolation Transformer meet this requirement. | | | |
| **2.37** | **SAFETY ARRANGEMENTS** | | | | |
| 2.37.1 | Following safety features in addition to other standard safety features should be provided on the machine: | Vendor to confirm | | | |
| 2.37.1.1 | Machine should have adequate and reliable safety interlocks / devices to avoid damage to the machine, workpiece and the operator due to the malfunctioning or mistakes. Machine functions should be continuously monitored and alarm / warning indications through lights/ alarm number with messages (on CNC display) should be available. | Vendor to intimate | | | |
| 2.37.1.2 | All the pipes, cables etc. on the machine should be well supported and protected. These should not create any hindrance to machine operator's movement for effective use of machine. | Vendor to intimate | | | |
| 2.37.1.3 | All the rotating parts used on machine should be statically & dynamically balanced to avoid undue vibrations & noise. | Vendor to intimate | | | |
| 2.37.1.4 | Emergency Switches at suitable locations as per International Norms should be provided. | Vendor to intimate | | | |
| 2.37.1.5 | Oil & water pipe lines should not run with electrical cable in the same trench. | Vendor to intimate | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---|---|---|---|---|---|
| **2.38** | **ENVIRONMENTAL PERFORMANCE OF THE MACHINE** | | | | |
| 2.38.1 | The Machine should conform to following factors related to environment : | Vendor to intimate | | | |
| 2.38.1.1 | Maximum noise level shall be 85 dB (A) at 1 meter away from the machine with correction factor for back ground noise, if necessary. This will be measured as per international standards like DIN 45635-16. Supplier to demonstrate compliance to noise level, if asked for during commissioning and necessary measurement equipment will be arranged by BHEL at Hardwar. | Vendor to intimate | | | |
| 2.38.1.2 | There shall not be any emissions from the machine after installation of offered mist extraction syste. | Vendor to intimate | | | |
| 2.38.1.3 | There should not be any effluent from the machine. In case there are any effluents from the machine, requisite effluent treatment plant or pollution control device should be built into the machine by the supplier. | Vendor to intimate | | | |
| 2.38.1.4 | No hazardous chemicals shall be required to be used in the machine. | Vendor to intimate | | | |
| 2.38.1.5 | Machine should be built in line with international safety and environmental protection standard. A copy of confirmation certificte shall be given during pre-dispatch inspection. | Vendor to intimate | | | |
| 2.38.1.6 | Paint of the machine should be oil / coolant resistant and should not get peeled off and mixed up with coolant. | Vendor to intimate | | | |
| **2.39** | **GEOMETRICAL ACCURACIES** | | | | |
| 2.39.1 | Geometrical Accuracy Tests shall be in accordance with relevant & prevailing international standards viz. ISO 1708 or equivalent applicable standard. Detailed Test Charts for the same, clearly showing the accuracies to be achieved on the machine, shall also be submitted with the offer. | Vendor to confirm and submit. | | | |
| 2.39.2 | All the Geometrical accuracies including test pieces machining etc. should be demonstrated to BHEL engineers during pre-acceptance at Supplier's works.In case due to some unforeseen reasons it becomes imperative to repeat test of the geometrical accuracies at BHEL Hardwar, the same shall have to be arranged by the vendor. Test pieces including toolings for test piece machining shall be supplied by vendor.Drawing of test piece to be submitted along with the offer. | Vendor to confirm and submit. | | | |
| **2.40** | **POSITIONING & REPEATABILITY ACCURACIES** | | | | |
| 2.40.1 | **Positioning & repeatability accuracies shall** be measured as per VDI/DGQ 3441 ( Latest Revision). CHECKING BY USING LASER INTERFEROMETER. | | | | |
| 2.40.1.1 | Positioning uncertainty over entire X axis (P) | Vendor to intimate | | | |
| 2.40.1.2 | Positioning uncertainty over entire Y axis (P) | Vendor to intimate | | | |
| 2.40.1.3 | Positioning uncertainty over entire Z axis (P) | Vendor to intimate | | | |
| 2.40.1.4 | Positioning uncertainty over entire Aaxis (P) | Vendor to intimate | | | |
| 2.40.1.5 | Positioning uncertainty over entire B axis (P) | Vendor to intimate | | | |
| 2.40.1.6 | Positioning Scatter over entire traverse in Xaxis (Ps) | Vendor to intimate | | | |
| 2.40.1.7 | Positioning Scatter over entire traverse in Y axis (Ps) | Vendor to intimate | | | |
| 2.40.1.8 | Positioning Scatter over entire traverse in Zaxis (Ps) | Vendor to intimate | | | |
| 2.40.19 | Positioning Scatter over entire traverse in A axis (Ps) | Vendor to intimate | | | |
| 2.40.1.10 | Positioning Scatter over entire traverse in B axis (Ps) | Vendor to intimate | | | |
| 2.40.2 | All the Positioning and Repeatability accuracies should be demonstrated to BHEL engineers during pre-acceptance at Suppliers works and again during Erection & Commissioning at BHEL Works. | Vendor to confirm | | | |
| **2.41** | **LEVELING & ANCHORING SYSTEM** | | | | |
| 2.41.1 | Complete set of anchoring materials including foundation bolts, nuts, washers, fixators, leveling shoes etc for alignment and fixing of the machine on the floor should be supplied. Details to be submitted. | Vendor to confirm | | | |
| **2.42** | **TOOLS FOR ERECTION, OPERATION & MAINTENANCE** | | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---|---|---|---|---|---|
| 2.42.1 | Tools and Equipment required for erection of the machine shall be brought by the vendor. Necessary tools like Torque Wrench, Spanners, Keys, grease guns etc. required for operation and maintenance of the machine should also be supplied by the vendor. List of such tools should be submitted with offer. | Vendor to confirm | | | |
| 2.42.2 | Set of Test Mandrels/Special Gauge for checking spindle run-out & alignment of headstock/tailstock etc. should be brought by the vendo, if not quoted. | Vendor to confirm | | | |
| **2.43** | **FOUNDATION** | | | | |
| 2.43.1 | Vendor to confirm that floor details submitted along with tender enquiry is fit to install the machine. Vendor shall submit the preliminary layout drawing for getting BHEL's approval within one month from the date of Purchase Order. In case additional foundation is required, complete foundation design including details viz. static / dynamic load details etc. and final layout drawings shall be submitted by the supplier within three months after getting BHEL's approval for Preliminary layout Drgs. The layout should consist of all reqirements pertaining to complete machine including space requirement for Voltage Stabilizer, Isolation Transformer, Air dryer, Chip Bin & all other accessories/offered items. BHEL shall construct complete foundation for the machine under supervision of supplier and at supplier's responsibility. Vendor should arrange equipments required for the testing of foundation, if required by the vendor. The vendor shall also indicate detailed specifications of grouting compound and grouting procedure etc. for foundation bolts of the machine. | Vendor to offer | | | |
| 2.43.2 | Soil condition at BHEL, Haridwar is mentioned below :<br>(a) Soil strata : Silty sand up to 2.5 meter depth<br>(b) Average density of soil = 1.8 $T/m^3$<br>(c) Angle of internal friction = 35° (up to 3.0 m depth)<br>(d) Coefficient of elastic uniform compression "Cu" = 3.0 $Kg/cm^3$<br>(at 7m depth for 10$m^2$ base area and 1.0 $Kg/cm^2$ confining pressure)<br>(e) Bearing capacity at 1.5 meter depth = 10$T/m^2$<br>(f) Water table = 25 meter below ground level | For vendor's information. | | | |
| **2.44** | **TRAINING** | | | | |
| 2.44.1 | Training of BHEL Engineers in the following field for the following period shall be provided :<br>(a) CAM Software, Automation System, Integration of Simulation software 'Vericut', In-Process & Post Process Measurement & Pre-acceptance machining of blades - 5 Weeks<br>(b) Electrical, Electronic & CNC maintenance for machine & other supplied equipments - 3 Weeks<br>(c) Mechanical & Hydraulic maintenance of the machine & other supplied equipments - 3 Weeks<br>(d) Operation of the machine & other supplied equipment - 3 Weeks<br>(e) Training of Electronics Engineer at the CNC System Manufacturer's works in India for advanced features and specialized training - 1 week. Training charges, if any, shall be indicated per week basis for each disclipine. | | | | |
| 2.44.2 | The training shall be imparted at the time of Machine Pre-acceptance tests at vendor's works and suitable nos. of competent, english speaking experts for each area shall be pre-arranged by vendor to cover complete training as well as pre-acceptance during the stipulated period. | | | | |
| 2.44.3 | Air-fare, boarding & lodging for the trainees shall be borne by BHEL. | | | | |
| **2.45** | **MACHINE PRE-ACCEPTANCE AT VENDOR'S WORKS** | | | | |
| 2.45.1 | BHEL persons deputed for training will be doing pre-acceptance at vendor's works and give dispatch clearance after satisfaction from all angles. During pre-acceptance, all accuracy tests mentioned at point number 2.39 and 2.40 shall be witnessed by the team. Also during pre-acceptance, vendor shall machine 2 types of blades (10 numbers each) per machine from the list of drawings mentioned at 2.32 a) in the presence of BHEL representatives and submit 3D Co-ordinate Measuring Machine reports for machined blades. The proving will essentially contain one type of blade at clause 2.32.1 and one type of blade among drawings at clause 2.32.4 or 2.32.5.Vendor shall demonstrate achivement of time quoted for machining the two types of blades. | Vendor to confirm | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---|---|---|---|---|---|
| 2.45.2 | All the blades to be machined during pre-acceptance shall use NC programs generated through the Automation system being supplied as per point no. 2.22 of scope of supply. | Vendor to confirm | | | |
| 2.45.3 | Raw material (blank) and toolings required for machining the blades for pre-acceptance shall be arranged by the vendor. | Vendor to confirm | | | |
| 2.45.4 | Demonstration of In-process and post process measurement of job, it's report generation as well as it's printing as per point no. 2.19 to the satisfaction of BHEL for efficient and smooth usage | Vendor to confirm | | | |
| 2.45.5 | Demonstration of System of Automatic access, generation, storage & retrieval of NC programs as per point no. 2.22 to the satisfaction of BHEL for efficient and smooth usage. | Vendor to confirm | | | |
| 2.45.6 | Demonstration of Integration of offered CAM software with Simulation software "Vericut" as per point no. 2.23 | Vendor to confirm | | | |
| **2.46** | **ERECTION & COMMISSIONING** | | | | |
| 2.46.1 | Supplier to take full responsibility for carrying out the erection, start up, testing of machine, it's control & all types of other supplied equipment/accessories, machining of test pieces etc. Service requirement like power, air & water shall be provided by BHEL at only one point to be indicated by supplier in their foundation/layout drawings. Other requirements like crane(capacity of 5 Ton only) and helping personnel shall also be provided by BHEL. Details of these requirements should be informed/discussed by vendor and agreed with BHEL in advance.**In case crane of higher capacity is required, representative of vendor to hire mobile crane from local sources.** | Vendor to confirm | | | |
| 2.46.2 | Erection & Commissioning of Voltage stabilizer, Isolation Transformer , Air Dryer and other accessories with all electrical & mechanical connections shall also be responsibility of the vendor. | Vendor to confirm | | | |
| 2.46.3 | Successful proving of BHEL components by the supplier shall be considered as part of commissioning. All tests, as mentioned at Sl. No. 2.39 and 2.40 and testing/demonstration of tele-diagnostic service, Machine Networking etc.shall also be part of the commissioning activity. | Vendor to confirm | | | |
| 2.46.4 | Tools, Tackels, Test Mandrels, instruments and other necessary equipment (including Laser equipment, if required) required to carry out all erection & commissioning activities should be arranged and brought by the supplier. | Vendor to confirm | | | |
| 2.46.5 | Commissioning spares, required for commissioning of the machine within stipulated time, shall be brought by the supplier on returnable basis. | Vendor to confirm | | | |
| 2.46.6 | Broad Schedule of Erection and Commissioning shall be submitted within three months of order. | Vendor to confirm | | | |
| 2.46.7 | Charges, duration, terms & conditions for Erection & Commissioning should be furnished in detail separately by vendor along with offer. | Vendor to confirm | | | |
| 2.46.8 | Portion, if any, of the machine, accessories and other supplied items where paint got rubbed or peeled off during transit or erection should be repainted and matched with the original adjoining paint by the vendor. For this purpose, the vendor should supply sufficient quantity of touch-up paint of various colours/shades of paints used. The vendor shall ensure performing touching after commissioning but before final acceptance. | Vendor to confirm | | | |
| **2.47** | **PROVE OUT OF BHEL COMPONENTS** | | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---|---|---|---|---|---|
| 2.47.1 | Complete and successful machining of proveout component, to the specified design accuracy and surface finish, shall be done by the vendor after erection & startup of the machine at BHEL works using tools, equipment and CNC programs etc. supplied by the vendor. Representative of vendor shall have to machine the blades as per drawing numbers and quantity mentioned against clause "Tooling package" at point number 2.32 a) and time study submitted as per point number 2.33 shall have to be adhered. Further, 5 Nos. of Locking blades for each variety of Moving blades & 5 Nos. of Joint blades for each variety of Guide blades shall also be machined to specified design accuracy and surface finish as a part of proveout at BHEL, Haridwar. Raw material (blanks) for all the prove out components shall be provided by BHEL. | Vendor to confirm | | | |
| 2.47.2 | In case, BHEL decides to order as per vendor's offer submitted (drawing no. wise) at point no. 5.1 under optional items, the vendor shall have to machine 2 good blades (dimensionally correct) as a part of proveout of operation templates of the Automation system | Vendor to confirm | | | |
| 2.47.3 | All the blades to be machined during proveout at BHEL, Haridwar shall use NC programs generated through the Automation system being supplied as per point no. 2.22 of scope of supply. | Vendor to confirm | | | |
| 2.47.4 | The vendor shall provide one week of exclusive training to BHEL's operators during commissioning of the machine at BHEL, Haridwar. | Vendor to confirm | | | |
| 2.47.6 | Vendor shall be fully responsible for machining of proveout components as per drawing accuracies and other requirements specified at various clauses in this tender specifications. | Vendor to confirm | | | |
| 2.47.7 | Vendor shall be responsible for any deviation/rejection in proveout components due to wrong machining or malfunctioning of the machine during proveout and also for the delay in machining due to improper recommended tooling etc. Any change in tooling during proveout shall be at the responsibility and cost of the vendor and the same shall be supplied sufficient for the quantity of blades as mentioned under the heading 'Tooling Package' at clause no. 2.32. | Vendor to confirm | | | |
| **2.48** | **FINAL MACHINE ACCEPTANCE** | | | | |
| 2.48.1 | Final acceptance shall be made by BHEL after completion of following activities at BHEL Haridwar: | Vendor to confirm | | | |
| 2.48.1.1 | Demonstration of specified/offered Geometrical accuracies as per test chart/standard after machine commissioning | Vendor to confirm | | | |
| 2.48.1.2 | Demonstration of specified/offered Positioning accuracies as per VDI-DGQ/3441 and specified values after machine commissioning | Vendor to confirm | | | |
| 2.48.1.3 | Demonstration of all features of the machine, control system & accessories to the satisfaction of BHEL for efficient and effective use of the machine. | Vendor to confirm | | | |
| 2.48.1.4 | Machining of test piece as submiited in the offer and agreed. Vendor shall supply test pieces as well as tooling required for machining. | Vendor to confirm | | | |
| 2.48.1.5 | Training of BHEL machine engineers in operation of complete machine, software & accessories etc by the supplier's experts / engineers before & during proveout at BHEL works. | Vendor to confirm | | | |
| 2.48.1.6 | Prove out of BHEL components as per point no. 2.47. | Vendor to confirm | | | |
| 2.48.1.7 | Demonstration and establishment of In-process and post Process measurement of job, it's report generation as well as it's printing as per point no. 2.19 to the satisfaction of BHEL for efficient and smooth usage | Vendor to confirm | | | |
| 2.48.1.8 | Demonstration and establishment of System of Automatic access, generation, storage & retrieval of NC program as per point no. 2.22 to the satisfaction of BHEL for efficient and smooth usage. During proveout, vendor shall provide a minimum of 2 weeks support (12 working days) by their Automation expert for machining few varieties of blades by BHEL through Automation system for establishing the correctness of supplied Automation system. | Vendor to confirm | | | |
| 2.48.1.9 | Demonstration and establishment of Integration of offered CAM software with Simulation software "Vericut" as per point no. 2.23 | Vendor to confirm | | | |
| **2.49** | **PACKING** | | | | |
| 2.49.1 | Sea worthy & rigid packing for machine, control and other supplied items to avoid any damage/loss in transit. | Vendor to confirm | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---|---|---|---|---|---|
| **2.50** | **GUARANTEE** | | | | |
| 2.50.1 | Guarantee for complete machine,CNC Control, softwares and all supplied accessories/equipments for 24 months from the date of final acceptance of the machine. Any spare required during commissioning period (before final acceptance of the machine) shall have to be arranged by the vendor free of cost and duty levied have to be borne by the vendor. | Vendor to confirm | | | |
| **2.51** | **COLOUR OF THE MACHINE** | | | | |
| 2.51.1 | Painting of Machine including accessories like electrical panels, chip conveyor, coolant system, work piece handling system etc. shall be : RAL 6011 Apple Green ( Polyurethane Paint ) | Vendor to confirm | | | |
| **3.0** | **ADDITIONAL INFORMATION** | | | | |
| 3.1 | Following information shall be supplied with the offer: | | | | |
| 3.1.1 | Machine Model No. | Vendor to inform | | | |
| 3.1.2 | Total connected load (KVA) | Vendor to inform | | | |
| 3.1.3 | Space required (Length, Width, Height) for complete machine & accessories | Vendor to inform | | | |
| 3.1.4 | Catalogue of the machine | Vendor to submit | | | |
| 3.1.5 | Total weight of the machine | Vendor to inform | | | |
| 3.1.6 | Weight of heaviest part of machine | Vendor to inform | | | |
| 3.1.7 | Weight of the heaviest assembly of the Machine | Vendor to inform | | | |
| 3.1.8 | Dimensions of largest part of the machine | Vendor to inform | | | |
| 4.00 | **QUALIFYING CONDITIONS** | | | | |
| 4.1.0 | Only those vendors should quote who have supplied and commissioned at least one no. CNC 5 Axis Milling Machine, with automatic job changer, of size suitable for machining of turbine blades of length up to 400 mm in one set up directly from raw material and for similar application, in the past 10 years and such machines is presently working satisfactorily for more than one year after commissioning. However, if such machine has / had been supplied to BHEL, then such machine should be presently working satisfactorily for more than six months after its commissioning and acceptance in BHEL. | Vendor to submit | | | |
| | The vendor must certify that they have the capability to supply dedicated 5 Axes CAM software for blade machining and measurement as mentioned at point no. 2.19 and 2.21 of the tender specifications. Further, the vendor will certify that referred machine for the qualification against the tender is capable to manufacture all types of blades stated at point no 2.21.4 using STRAK-UEB interface of CAM Software and 2.21.5 of the tender specifications. | | | | |
| | If BHEL desires, to demonstrate capability for supplying the aforesaid machine with capability of relevant CAM software as mentioned above, the vendor will have to supply one type of sample blades duly machined using BHEL supplied UEB & STRAK data on the offered CAM software, within a period of 4 months from opening date of the Tender. The sample blade should have been machined on the offered/ similar machine available with them or supplied to any of their customer(s). The vendor also to supply (both 3D CMM results as well as few post process probing results of Hub, Shroud and one section of profile done on the machine) measured data of the sample blades. BHEL will revalidate the measured values of the offered blade as per the drawing/data supplied with the tender. | | | | |
| | In the event of compliance to the above, BHEL reserves the right to verify the vendor's claim by deputing a team at BHEL's expenses to see performance of the machine on which these blades have been machined and vendor will arrange demonstration of preparation of program on CAM software, machining and measurement/probing of blades on the machine as per BHEL drawing requirement (supplied with the tender document). Vendor will have to give certificate that they will arrange the visit of BHEL's team to witness the demonstration of machine capabilities if so desired. | | | | |

(N Halder/DGM-WEX-Mech)

(A Mookherjee/DGM-TBM) (S K Shukla/SDGM-CNC-WEX) (D K Chawla,SM-NCT)



(T K Saha/Mgr-QC-B)

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---|---|---|---|---|---|
| | For the drawings and data available along with the tender documents and or given at any point of time during tender processing, vendor to give an undertaking that they will not use this information directly or indirectly in any way detrimental to the interest of BHEL. | | | | |
| | Other terms and conditions:<br><br>The qualification of the vendor as per above mentioned conditions and tender evaluation shall be carried out concurrently and BHEL will not bear any cost for expenses incurred by the vendors during course of qualification and tender evaluation by way of replying to BHEL queries, visit to BHEL for technical discussions, manufacture and supply of sample blades as per BHEL drawings /data and / or any other expenses not specifically mentioned herein.<br><br>Price bids of only those vendors will be opened who qualify as per above conditions and whose offers are technically acceptable. | | | | |
| 4.1.1 | Name & complete address of the customer / company, where such machine(s) is(are) installed. | Vendor to submit | | | |
| 4.1.2 | Year of Commissioning of the supplied machine. | Vendor to submit | | | |
| 4.1.3 | Broad specifications of the supplied machine i.e. Model, Blade machining length, accessories supplied, features of Software supplied etc. | Vendor to submit | | | |
| 4.1.4 | Application for which the machine has been supplied. Vendor to also confirm that the supplied machine is also being used for manufacture of finished steam turbine blades with pallet changing and software as mentioned at clause 2.21. | Vendor to submit | | | |
| 4.1.5 | Performance certificate (with specific mention of model of the machine , availability of pallet type job changer & Software as per BHEL requirement ) from the customer(s) regarding satisfactory performance of the machine supplied to them (original certificate or through e-mail directly from the customer). The performance certificate can be returned after verification by BHEL, if required. | Vendor to submit | | | |
| 4.1.6 | Name, designation, address, Phone no., FAX no. and email address of the issuer of the Performance Certificate/ contact person of the customer. | Vendor to submit | | | |
| **5.00** | **OPTIONAL ITEM:** | | | | |
| 5.1 | To prove the operation templates being provided for Automation system as per point no. 2.22, the vendor shall submit an optional offer (drawing no. wise ) for machining 2 good blades (dimensionally correct) each for following blades as mentioned below. All the blanks required for machining shall be supplied by BHEL. However, any additional tooling required other than the ordered tooling package shall be included in this offer<br><br>i) Drg. No. 11030641003 (Moving blade Left Hand – Z shape shroud)<br>ii) Drg. No. 11010241016 (Moving blade Right hand)<br>iii) Drg. No. 11020246006 (Moving blade Left Hand))<br>iv) Drg. No. 11051841016 (Guide blade Right hand)<br>v) Drg. No. 11061646004 (Guide blade Left hand)<br>vi) Drg.No. 21020241004 (TX – Moving blade – Left Hand)<br>vii) Drg. No. 21074741003 (T4 – Guide blade – Left Hand)<br>viii) Drg. No. 21061641013 (TX – Moving blade – Right hand)<br>ix) Drg. No. 21051841009 (TX – Guide blade – Right hand) | Vendor to submit offer | | | |
| 5.2 | Repair service contract with supplier of CNC system for service & spares for motor drives, CNC Unit and Milling Spindle should also be offered by the vendor with price validity of 2 years from the date of commissioning of the machines. | Vendor to offer and submit details | | | |
| | | | | | |
| | | | | | |

(N Halder/DGM-WEX-Mech)

(D K Chawla,SM-NCT)

(A Mookherjee/DGM-TBM)

(S K Shukla/SDGM-CNC-WEX)



(T K Saha/Mgr-QC-B)

# QUALITY PLAN FOR CAPITAL MACHINE TOOLS

| | | |
|---|---|---|
| BHEL<br>QC-178 | NAME OF SUPPLIER----------NAME OF EQUIPMENT----------<br>-<br>Q.P NO.---------- REV NO.----------INDENT NO----------<br>SPECIFICATION NO.----------REV NO.---------- | SHEET----------OF----------<br>*<br>P- PERFORMANCE 1.BHEL REP<br>W-WITNESSED BY 2.VENDOR<br>V-VERIFIED BY 3.SUB - VENDOR<br>FINALLY TO BE REVIEWED BY BHEL HARDWAR |

| SL. NO. | MAJOR COMPONENTS / SUB ASSEMBLIES | DETAILS OF COMPONENTS GOING IN THE ASSLY 'COL-2' | CLASSIFICATION MATERIAL GRADES | TYPE OF CHECKS (SEE DETAILS AT ANNEX-I) | QUANTUM OF TEST REFERENCE DOCUMENT FOR TESTING | REFERENCE DOCUMENT FOR TESTING | ACCEPTENCE NORMS | FORMAT OF RECORDS | AGENCY FOR TESTING (TO BE PROPOSED BY VENDOR)* | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** |
| | | | | | | | | | | | | |

**Prepared by:**
**(Signature and seal of the Head of Quality Management Of Supplier's works)**
**NOTE: Annexure-I is enclosed herewith**

**Approved by:**
**BHEL Hardwar**
**(Signature & Seal of Approving Authority)**

# TYPE OF CHECK FOR COL. NO. 5

| Code | Description | Code | Description |
|---|---|---|---|
| 1. | Visual | 17. | No Load / Free running Test |
| 2. | Dimensional | 18. | Load / Over Load Test |
| 3. | Fitment and alignment | 19. | Measurement of speed / RPM |
| 4. | Physical Test (Sample) | 20. | Surface Finishing |
| 5. | Chemical Test (Sample) | 21. | Manufacturing Test Certificate for Bought Out Items (BOIs) |
| 6. | Ultrasonic Test (UT) | | |
| 7. | Magnetic Particle Test (MPI) | 22. | Internal Inspection Report by Contractor |
| 8. | Radiography Test (RT) | 23. | Hardness Test |
| 9. | Dye Penetration Test (DPT) | 24. | Acoustical Test |
| 10. | Welder's Qualification Test | 25. | High Voltage (HV) Test |
| 11. | Heat Treatment | 26. | Megger Test |
| 12. | Pressure Test Leakage Test Balancing | 27. | Circuit / Continuity Check |
| 13. | Leakage | 28. | Simulation Checking |
| 14. | balancing | 29. | Any other relevant tests to Assure the performance of the Equipment |
| 15. | Vibration Test | | |
| 16. | Performance | 30. | Proof Testing at BHEL Hardwar |