

NOTE:
PORTABLE CMM FOR FIR-TREE BLADE

The technical specifications for indent no. C/3991/2012/4820T PORTABLE CMM FOR FIR-TREE BLADE have been revised to ensure more clarity about BHEL requirements to vendors.

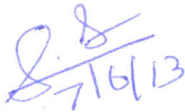
The following clauses of the technical specifications have been revised

| Clause No. | Original Text | Revised Text |
|------------|---|--|
| 1.10 | Purpose: This PORTABLE Computerised Coordinate Measuring machine is mainly intended for checking turbine blades profiles and precision components. The turbine blade checking includes complete dimensional and geometrical checking of blade profile, shroud & tip in line with drawing requirements of 210/250/500/600/660/700/800 MW Steam Turbines. The blade roots may be T-Root, curved fir tree root, etc. The profile may be aerofoil section with banana type bow and twisted profile in three dimensions. | Purpose: This PORTABLE Computerised Coordinate Measuring machine (having contact type probe) is mainly intended for checking turbine blades profiles and precision components. The turbine blade checking includes complete dimensional and geometrical checking of blade profile, shroud & tip in line with drawing requirements of 210/250/500/600/660/700/800 MW Steam Turbines. The blade roots may be T-Root, curved fir tree root, etc. The profile may be aerofoil section with banana type bow and twisted profile in three dimensions. |
| 3.50 | Machine to be capable of complete checking of turbines blades including blade height dimensions, profile, Profile orientation w.r.t. root and tip radius at different positions. Representative drawings of blades are enclosed as following: | Machine to be capable of checking of turbines blades including blade height dimensions, profile, Profile orientation w.r.t. root and tip radius at different positions. Sample drawings of 2 blades will be provided as follows :- |
| 3.5.1 | 01030741002, 01030741005, 21030741031, 11030741032, 11030741034, 01030741022 | Blade type 1 - sketch 1, sketch 2, sketch 3 |
| 3.5.2 | 01030741003, 01030741006, 21030741031, 11030741033, 11030741035, 01030741023 | Blade type 2 - sketch 4, sketch 5, sketch 6 |
| 3.5.3 | 01030746002, 01030746005, 21030746035, 11030746031, 11030746033, 01030746022 | NULL |
| 3.5.4 | 01030746003, 01030746006, 21030746035, 01030746032, 01030746034, 01030746023 | NULL |
| 3.5.5 | 01030756001, 01030756003, 21030756031, 01030756032, 01030756034, 01030756021 | NULL |
| 3.5.6 | 01030756002, 01030756004, 21030756031, 01030756033, 01030756035, 01030756022 | NULL |
| 3.5.7 | 01030758001, 01030758003, 11030758031, 11030758033, 01030758021 | NULL |
| 3.5.8 | 01030758002, 01030758004, 01030758032, 01030758034, 01030758022 | NULL |
| 6.1.3 | Vendor to provide the suitable CAD Model of the drawings mentioned at clause no 3.5 which are necessary for blade measurement. | Vendor to provide the suitable CAD Models of blades mentioned at clause no 3.10 (drawings for these blades will be provided after PO placement) which are necessary for blade measurement. |

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| | | |
|------|--|---|
| 9.10 | <p>After successful completion of installation and testing at BHEL, Haridwar, supplier shall carry out complete dimensional checking of components to their specified design accuracies using BHEL 2D AUTOCAD drawing, manual inputs, if available, in the supplied software for blade measurement as per point no. 7.3.1 Further, all the features of the software shall be completely demonstrated and established on the machine. Components to be included for proving are: profile orientation w.r.t. to curved Fir tree root, tip checking & Z-shroud of fir-tree checking w.r.t curved fir-tree root. Drawing references of blades to be included for proving are as per clause 3.5.1 to 3.5.6, the vendor has to demonstrate the checking of these blades to the full satisfaction of BHEL staff. Vendor shall be fully responsible for complete checking of blades as per drawing accuracies and other requirement specified by BHEL to the full satisfaction. BHEL will provide the control segment for holding the blade during checking. During measurement, holding of blade shall be done by holding arrangement provided by BHEL.</p> | <p>After successful completion of installation and testing at BHEL, Haridwar, supplier shall carry out complete dimensional checking of components to their specified design accuracies using BHEL 2D AUTOCAD drawing, manual inputs, if available, in the supplied software for blade measurement. Further, all the features of the software shall be completely demonstrated and established on the machine. Components to be included for proving are; profile orientation w.r.t. to curved Fir tree root, tip checking & Z-shroud of fir-tree checking w.r.t curved fir-tree root. Blades for proving out will include 2 blades types as per clause 3.5 along with 18 other blade types which are similar to the sample drawings provide (drawing for these blades will provide after PO placement), the vendor has to demonstrate the checking of these blades to the full satisfaction of BHEL staff. Vendor shall be fully responsible for complete checking of blades as per drawing accuracies and other requirement specified by BHEL to the full satisfaction. BHEL will provide the control segment for holding the blade during checking. During measurement, holding of blade shall be done by holding arrangement provided by BHEL.</p> |
|------|--|---|

Signed copy of the revisions in the technical specifications is attached.


8/7/13

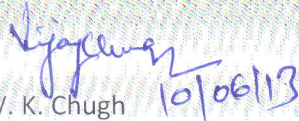
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(E1, TBM&NBS)


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Sanjiv Kumar

(Dy. Mgr., TBM&NBS)


10/06/13

V. K. Chugh

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BHARAT HEAVY ELECTRICAL LIMITED

Indent No. :

SPECIFICATION CUM COMPLIANCE CERTIFICATE FOR PORTABLE COORDINATE MEASURING MACHINE -

NOTE :-

1. Vendor must submit complete information against clause at Sl.No. 18.0. The offer, complying this clause, would only be considered.
2. The vendor should fill the "Offered" Column in compliance to specified requirements and also "Deviations" Column, where there is deviation from the requirement. Duly filled specification cum compliance certificate should be submitted along with the offer. Inadequate, incomplete, ambiguous or unsustainable information against any of the clauses of the specifications/ requirements shall be treated as non-compliance.
3. The offer and all documents enclosed with offer should be in English language only.

SCOPE: SUPPLY, ERECTION & COMMISSIONING OF PORTABLE COORDINATE MEASURING MACHINE CENTRE WITH SPECIFICATIONS AS BELOW :

No of Machines : 1 No.

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---------------|--|-----------------------------------|---------|-----------|---------|
| 1.0 | PURPOSE & WORK PIECE MATERIAL | | | | |
| 1.10(revised) | Purpose: This PORTABLE Computerised Coordinate Measuring machine (having contact type probe) is mainly intended for checking turbine blades profiles and precision components. The turbine blade checking includes complete dimensional and geometrical checking of blade profile, shroud & tip in line with drawing requirements of 210/250/500/600/660/700/800 MW Steam Turbines. The blade roots may be T-Root, curved fir tree root, etc. The profile may be aerofoil section with banana type bow and twisted profile in three dimensions. | Vendor to accept | | | |
| 2.0. | Major Technical Specification: Measuring range, capability and accuracy requirements | | | | |
| 2.10 | Measuring range: | 1200 mm or more | | | |
| 2.20 | Single point articulation | vendor to confirm | | | |
| 2.30 | Machine should be able to reach the intricate areas with easiness within the specified range | vendor to confirm | | | |
| 2.40 | Accuracy as measuring uncertainty independent of position of spindle | | | | |
| 2.50 | Volumetric Maximum Deviation | (5.0+L/40) <= 55 micron or better | | | |
| 2.60 | Single point Probing Error P | 40 micron or better | | | |
| 2.70 | Environmental conditions: | | | | |

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(T K Sahal/Sr. Mgr-QC-B)
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(SR Choudhary/Sr. MGR-Inst.)
S. Choudhary/Sr. MGR-Inst.
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(N. Haber/AGM-FM-2)
N. Haber/AGM-FM-2
6.2.13

(V. K. CHUGH /AGM-TBM)

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|----------------|--|----------------------------|---------|-----------|---------|
| 2.7.1 | The machine shall be used on shop floor with working temperature of 5 deg C to 45 deg C | vendor to accept & confirm | | | |
| 2.7.2 | Relative Humidity 80±10% for temperature upto 32 deg C decreasing to 50% relative humidity at 45 deg C. Power supply 3 Ph AC 415 V + 10%, Universal worldwide voltage 110-240 V AC, Frequency 50+ 3 Hz. Compliant with low voltage directive 2006/95/EC applicable norm: EN61010-1(2001). All machine electricals, control instrumentation's and paints shall be suitably Tropicalised. The equipment should function for 3 shift working under above mentioned environmental and input conditions. | vendor to accept & confirm | | | |
| 2.7.3 | The machine should be capable of temperature sensor technology. | vendor to accept & confirm | | | |
| 3.00 | Machine Capabilities | | | | |
| 3.10 | M/c should be capable of complete inspection of precision components. It should be able to perform inspection of all parameters on five faces of a component from start to finish. | Vendor to accept | | | |
| 3.20 | The system to be capable of measurement from point to point. | Vendor to accept | | | |
| 3.30 | The M/c should be capable of processing the measurement of all geometrical parameters including nominal/actual comparison and evaluation of all forms and position errors e.g. flatness, straightness, roundness, cylindricity, parallelism etc as per ISO-1101 simultaneously in the same measurement run. | Vendor to accept | | | |
| 3.40 | Reporting of results with a printout showing details of dimensions as inspected with deviations from tolerances indicated specifically indicating magnitude of deviation and tolerance band utilization. | Vendor to accept | | | |
| 3.50(revised) | Machine to be capable of checking of turbines blades including blade height dimensions, profile, Profile orientation w.r.t. root and tip radius at different positions. Sample drawings of 2 blades will be provided as follows :- | Vendor to accept | | | |
| 3.5.1(revised) | Blade type 1 - sketch 1, sketch 2, sketch 3 | | | | |
| 3.5.2(revised) | Blade type 2 - sketch 4, sketch 5, sketch 6 | | | | |
| 3.5.3(revised) | NULL | | | | |
| 3.5.4(revised) | NULL | | | | |
| 3.5.5(revised) | NULL | | | | |
| 3.5.6(revised) | NULL | | | | |
| 3.5.7(revised) | NULL | | | | |
| 3.5.8(revised) | NULL | | | | |
| 3.60 | The machine should show the message for using the wrong probe and should be capable enough for custom probes. | Vendor to accept | | | |

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Sr. MGR-Inst.)
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| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|-----------------|---|-------------------------------------|---------|-----------|---------|
| 3.70 | The machine should work with battery as well as power supply. The machine should have the battery backup of at least 2 hours. | Vendor to accept | | | |
| 4.00 | Measuring System | | | | |
| 4.10 | The machine must have the feature of homing point. | Vendor to confirm | | | |
| 4.20 | Storage of probe calibration data: Software must allow to store 99 probe configurations calibration data. | Vendor to confirm | | | |
| 5.00 | Laptop system: BHEL reserves the right to procure Laptop system and printer locally. Price of Laptop & Printer to be quoted separately mentioning make and detailed technical specifications. Both items should be of Indian make preferably. Vendor to submit the detailed technical specifications of LAPTOP required for offered system. | Vendor to accept | | | |
| 5.10 | Minimum Configuration: The IBM compatible (Preferably Indian make like HCL, Tata Elexi, Accel ICIM, INFOWORD) PC / workstation with minimum configuration, 4GB RAM, Speed 3.4 GHz or more, 250 GB IDE-Hard disk, 15" Colour screen, NVIDIA Quadro4 380XGL Graphics 64 MB or better, mouse, keyboard CD-RW/DVD, USB Port, USB pen Drive (8 GB Memory) Combo disc drive and 2 x LAN 10/100 connection for connecting the machine to our internal LAN network. The laptop and printer must be Indian make. | Vendor to confirm & provide details | | | |
| 5.20 | Printer/Plotter : High Speed Laser colour printer (Preferably Indian Make like HP, HCL, Tata Elexi, Accel ICIM, INFOWORD) | Vendor to confirm & provide details | | | |
| 5.30 | During technical discussion vendor to demonstrate the blade inspection mentioned at clause no 3.5. The blade shall be clamped by holding device provided by BHEL. | Vendor to confirm | | | |
| 6.10 | Application Software on Unix / PC. Base | | | | |
| 6.1.1 | Vendor to submit the list of standard application software available on the system and special software that to be used on the system for blade measurement. | | | | |
| 6.1.2 | Vendor to offer and supply all the required software for blade measurement mentioned at clause 3.5. | | | | |
| 6.1.3 (revised) | Vendor to provide the suitable CAD Models of blades mentioned at clause no 9.10 (drawings for these blades will be provided after PO placement) which are necessary for blade measurement. | | | | |
| 6.1.4 | Vendor to supply the CAD Software for blade suitable to the machine and must be capable of making CAD Model of fir tree blade. | Vendor to confirm | | | |
| 6.2.1 | Auto recognition of standard Geometrical elements | Vendor to confirm | | | |
| 6.2.2 | Different evaluations such as distance, Intersection points and conical sections etc. should be possible. | Vendor to confirm | | | |
| 6.2.3 | Prepare the part programs for each and every part directly on the work piece. | Vendor to confirm | | | |

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(V. K. CHUGH /AGM-TBM)

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---------------|---|--------------------------|---------|-----------|---------|
| | c) The vendor shall provide full technical support and modification / upgradation of the software during the warranty period of the machine. The technical support shall include trouble shooting through Telephone, E-mails & visit of their experts if required. | Vendor to accept & offer | | | |
| | d) The back-up of the software shall be provided on CDs. | Vendor to accept & offer | | | |
| 7.00 | Accuracy Tests | | | | |
| 7.10 | Vendor to do maximum permissive volumetric length measurement error test as per ISO 10360-2, Maximum permissive probing error test as per ISO 10360-2 or any other equivalent standard at BHEL Haridwar. | Vendor to accept | | | |
| 8.00 | Installation, Commissioning, prove out and Inspection | | | | |
| 8.10 | Installation & Commissioning : Installation & commissioning of the machine shall be arranged by the supplier or by the Indian Agent at their own responsibility. Commissioning, accuracy checks, proving out the components at BHEL's works shall be the responsibility of the supplier. | Vendor to confirm | | | |
| 9.00 | Proving Out : | | | | |
| 9.10(revised) | After successful completion of installation and testing at BHEL, Haridwar, supplier shall carry out complete dimensional checking of components to their specified design accuracies using BHEL 2D AUTOCAD drawing, manual inputs, if available, in the supplied software for blade measurement. Further, all the features of the software shall be completely demonstrated and established on the machine. Components to be included for proving are: profile orientation w.r.t. to curved Fir tree root, tip checking & Z-shroud of fir-tree checking w.r.t curved fir-tree root. Blades for proving out will include 2 blades types as per clause 3.5 along with 18 other blade types which are similar to the sample drawings provide (drawing for these blades will provide after PO placement), the vendor has to demonstrate the checking of these blades to the full satisfaction of BHEL staff. Vendor shall be fully responsible for complete checking of blades as per drawing accuracies and other requirement specified by BHEL to the full satisfaction. BHEL will provide the control segment for holding the blade during checking. During measurement, holding of blade shall be done by holding arrangement provided by BHEL. | Vendor to accept | | | |
| 10.00 | Machine Acceptance | | | | |
| 10.10 | Final acceptance shall be given at BHEL, Haridwar following completion of Installation, Commissioning, accuracy tests and proving out as per clause no 9.00. | Vendor to accept | | | |
| 10.20 | Training of BHEL Personnel at BHEL, Haridwar works | | | | |

Sanjay Kumar
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