


	<b><u>BHARAT HEAVY ELECTRICAL LIMITED</u></b>		<b>Indent No. :</b>	<b>C / 6530/7/3313T</b>
	<b>UNIT'S ADDRESS:</b> HEEP, RANIPUR HARIDWAR - 249403 UTTARANCHAL, INDIA		<b>Enquiry No. :</b> <b>Due Date :</b>	
			<b>Supplier Qtn. No.:</b>	
	<b><u>CONTACT PERSON FROM PURCHASE DEPTT.:</u></b> <b><u>NAME: MR. A.SANYAL</u></b> <b><u>DESIGNATION: DGM (PPX-CAP)</u></b> <b><u>PHONE NO.: 0091 - 1334 - 285291</u></b> <b><u>E-MAIL: asanyal@bhelhwr.co.in</u></b> <b><u>FAX NO. : 0091 - 1334 - 226462</u></b>		<b>Date :</b>	
<b><u>SPECIFICATION CUM COMPLIANCE CERTIFICATE FOR 3D CORDINATE MEASURING MACHINE - QUANTITY - 1</u></b>				
	<b>NOTE :-</b>			
	<p>1. Vendor must submit complete information against clause at Sl.No. 22.0. The offer, complying this clause, would only be considered.</p> <p>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.</p> <p>3. The offer and all documents enclosed with offer should be in English language only.</p>			
	<b>ADDRESS OF THE SUPPLIER :</b>	<b>ADDRESS OF THE INDIAN AGENT(S) :</b>		
	<b>TELEPHONE NOS.:</b>	<b>TELEPHONE NOS.:</b>		
	<b>FAX NOS.:</b>	<b>FAX NOS.:</b>		
	<b>E-MAIL ADDRESS :</b>	<b>E-MAIL ADDRESS :</b>		
<b>SCOPE:</b>	<b>SUPPLY, ERECTION &amp; COMMISSIONING OF 3D COORDINATE MEASURING MACHINE CENTRE WITH SPECIFICATIONS AS BELOW :</b>			
	<b>No of Machines : 1 No.</b>			
<b>SL. NO.</b>	<b>DESCRIPTION OF BHEL REQUIREMENT</b>	<b>REQUIRED</b>	<b>OFFERED</b>	<b>DEVIATION</b>
1.0	<b>PURPOSE &amp; WORK PIECE MATERIAL</b>			

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
1.1	<b>Purpose:</b> This 3D Computerised Coordinate Measuring machine is mainly intended for checking precision machined components of steam turbine. The checking includes complete dimensional, radius, curve measurement and geometrical form checking in line with drawing requirements.	Vendor to accept			
2.0.	<b>Major Technical Specification: Measuring range, capability and accuracy requirements</b>				
2.1.	Measuring range : X-Axis	3000 mm or more			
2.2.	Measuring range :Y-Axis	2000 mm or more			
2.3.	Measuring range : Z-axis	1500 mm or more			
2.4.	Job weight	5000 Kg or more			
2.5.	Resolution:	0.1 micron or less			
2.6.	<b>Accuracy as measuring uncertainty independent of position of spindle</b>				
2.6.1	Volumetric Length Measuring Error( MPE_E) as per ISO 10360-2	2.8+L/400 micron or better			
2.6.2	Volumetric Probing Error P	2.5 micron or better			
2.6.3	Continuous volumetric scanning Probing error as per ISO 10360-4 MPE_THP	4.0 microns in 70 sec.			
	<b>NOTE: above mentioned accuracies are to be checked with only one probe head. These should be guaranteed in the following temperature gradients; Ambient Temp: 20±2 Degree C, Variation per Hour 1Deg per Hr/per mtr/ per day,</b>				
2.3	<b>Environmental conditions:</b>				
2.31.	The machine shall be used in a enclosed room on shop floor with temperature 20± 2 deg C and relative Humidity 60±10%. Compressed air supply is at 4 to 6 Kg/cm2 and of industrial quality. Power supply 3 Ph AC 415 V +_ 10% , Frequency 50+_3 Hz. Or Single Phase AC 220/230V, Frequency 50+_3 Hz. All machine electricals, control instrumentation's and paints shall be suitably Tropicalised. The equipment should function for 24 hours continuously under above mentioned environmental and input conditions.	vendor to accept & confirm			
2.40.	<b>Air Compressor</b>				

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2.41	If operated by Air, party should supply individual compressor of suitable capacity. Machine should be equipped with air drier, Oil filtration unit and dehumidifier. Spares for two years of trouble free operation of pneumatic system must be offered item -wise. Compressor is to be preferably Indian make.	Vendor to offer			
3	<b>Machine Capabilities</b>				
3.1	M/C should be capable of complete automatic inspection of precision components. It should be able to perform inspection of all parameters on five faces of a component from start to finish without operator's intervention in between.	Vendor to accept			
3.2	The system to be capable of measurement in point to point as well as in continuous scanning mode with same probe head	Vendor to accept			
3.3	The M/c to 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			
3.4	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			
4.0	<b>Constructional Features</b>				
4.1	The machine should have rigid traveling bridge, stationary table type of construction with wrap around bearing to provide high torsional rigidity during bridge movement. X and Z measuring system axis should be of glass/ ceramic for high stiffness and resistance to environment .	Vendor to confirm			
4.2	Protection for X & Y guide ways covered with bellows	Vendor to confirm			
4.3	Motorised Drive system with wear proof guides to achieve minimum stick/slip ratio. Motorised in all axes with CNC programmed control and manual joystick as well	Vendor to confirm			
4.4	Speed Range selectable in manual mode from 0 to 70 mm/sec or better	Vendor to confirm			
4.5	Speed in CNC mode - movement along axes selectable from computer upto 300 mm/sec or more	Vendor to confirm			

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4.6	Speed in CNC mode - movement in vectoral mode selectable from computer Upto 500 mm/sec or more	Vendor to confirm			
4.7	Operating panel				
4.7.1	Portable with Joystick & Functional keys to provide manually controlled motorised movement in all axes.	Vendor to confirm			
4.8	Speed control				
4.8.1	Should have provision of speed control during CNC run	Vendor to confirm			
5.0	<b>Measuring System</b>				
5.1	Scales : High Precision double Grating Glass/ ceramic / special material scale with freedom from temperature variations	Vendor to confirm			
5.2	Scale fixing : Scale should not be self adhesive backing tape type. It should be inside an enclosure.	Vendor to confirm			
5.3	Probing System : Active Scanning probe system	Vendor to confirm			
5.4	Probe Head : Universal six-directional probe head with linear and torsionally rigid spring parallelogram, electro magnetic coils for measuring force generation with linear measuring system, suitable for static zero point, single flank and double /self-centering measurements.	Vendor to confirm			
5.5	Scanning : Should be capable of fast continuous/uninterrupted scanning measurement with built-in inductive measuring system. Also should be able to scan in inclined plane.	Vendor to confirm			
5.6	Data Acquisition rate : Min 200 Points per sec in continuous scanning mode	Vendor to confirm			
5.7	Scanning speed : Upto 100 mm/sec or better	Vendor to confirm			
5.8	Provision for locking axis : Independent selection of probe axis locking for allowing different probing possibilities.	Vendor to confirm			
5.90	Probe carrying capacity : minimum 500gm and upto 500 mm extension.	Vendor to confirm			
5.10	Collision Protection : Built-in protection should be provided in the system against the damages caused by the collision of the entire probing system including probe extensions with the component under inspection. Tip extension,adapters and probe to be collision protected.	Vendor to confirm			
5.11	Minimum Probe Diameter : 1.0 mm	Vendor to confirm			

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5.12	Inbuilt counter weight Mechanism : For different types of probe combinations with different weights enabling probe head to come to zero after changing probe configuration.	Vendor to confirm			
5.13	Measuring Force : 0.05 to 1.0 Newton selectable in magnitude and direction through computer. Active Measuring force preferred.	Vendor to confirm			
5.14	Probe Changing : Probe head must have manual/automatic probe change facility enabling the operator to use different probe combinations without recalibration. Supplier to quote for the necessary accessories allowing user to use minimum 4 probe configuration in one CNC Run without necessity of re-calibration.	Vendor to confirm			
5.15	Storage of probe calibration data: Software must allow to store 99 probe configurations calibration data.	Vendor to confirm			
6	<b>Computer system : BHEL reserves the right to procure computer system and printer locally. Price of computer to be quoted separately mentioning make and detailed technical specifications.</b>	<b>Vendor to accept</b>			
6.1	Minimum Configuration : The IBM compatible (Preferably Indian make like HCL, Tata Elexi, Accel ICIM, INFOWORD) PC/workstation with minimum configuration, 512x2MB RAM, Speed 3.4 GHz or more, 160 GB IDE-Hard disk, 19" Colour TFT monitor, NVIDIA Quadro4 380XGL Graphics 64 MB, floppy, mouse, keyboard CD-RW/DVD, USB Port, USB pen Drive (1 GB Memory) Combo disc drive and 2 x LAN 10/100 connection for connecting the machine to our internal LAN network	Vendor to confirm & provide details			
6.2	Printer/ Plotter : High Speed Inkjet colour printer ( Preferably Indian Make like HCL, Tata Elexi, Accel ICIM, INFOWORD)	Vendor to confirm & provide details			
6.3	UPS : 20 minute back up facility for PC/Work station	Vendor to confirm			
7.1	<b>Application Software on Unix/ PC. Base</b>				
7.1.1	Dimensional and Geometrical Measuring software should have facilities for/ to; Both manual and CNC operation, it should have component misalignment compensation in plane and space.	Vendor to confirm			
7.1.2	Auto recognition of standard Geometrical elements	Vendor to confirm			
7.1.3	Different evaluations such as distance, Intersection points and conical sections etc. should be possible.	Vendor to confirm			

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7.1.4	Prepare the part programs directly on the work piece as well as based on the CAD model through offline programming facility.	Vendor to confirm			
7.1.5	Automatic generation of probe path and measuring parameters for CNC program from the CAD model	Vendor to confirm			
7.1.6	Auto decisions during Alignment and Geometry measurements through intelligent interface.	Vendor to confirm			
7.1.7	Built in graphics interface.	Vendor to confirm			
7.1.8	CNC part program and parameters for CNC runs are automatically generated during manual measurement to simplify part programming .	Vendor to confirm			
7.1.9	Movement of the machine should be possible in work piece co-ordinate system. In this case, the probe can be moved parallel to axis of the work piece for inspection of inclined holes, deep bores.	Vendor to confirm			
7.1.10	Intermediate results should be available with graphical assistance and display in CAD window.	Vendor to confirm			
7.1.11	Possibility to connect CMM computer to existing company Network through LAN to enable viewing and printing of reports from any other computer in the network	Vendor to confirm			
7.1.12	It should be possible to evaluate form and position errors as per ISO standard 1101 including evaluation with Maximum Material Condition (MMC).	Vendor to confirm			
7.2	<b>Software for Curve Measurement should have facility for/ to</b>				
7.2.1	digitizing /Measurement of known / unknown 2D Curves & 3D Curves (Reverse Engineering) ;Collection of point data by measurement from unknown curves, - Output of the measured curve as surface data by compensating the probe diameter, compatible to CAD software	Vendor to confirm			
7.2.2	Measurement of 2D Curves & 3D Curves against nominal data, analysis, evaluation; The nominal data of the curve can be input manually by keying in the data from the table given in the drawing or from the CAD files. Then the measurement is done against this data.	Vendor to confirm			

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7.2.3	Deviation calculation from nominal & measured curves; The difference between the nominal and the measured data in the normal vector direction is calculated as deviation. Actual measured data (scanned) should match (without referring any staring point, if possible) automatically with nominal data (from strak data/drawing) irrespective of measurement done by single/multiple probing and pointing out starting position of scanning. Best fit calculation of measured curves and output of deviations. Graphical presentation of nominal curves , measured curves & deviations. Import of Curve data from CAD systems & strak data in various formats: VDA, ASCII, PAB & DXF formats. Export of Curve data in VDA and ASCII format.	Vendor to confirm			
7.2.4	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.				
7.2.5	The back-up of the software shall be provided on CDs.				
8	<b>Protections</b>				
8.1.	The equipment should have protection against power variation in the form of a suitable online UPS with isolation transformer (preferably Neel or Autoelectric; make-these all are Indian make) for smooth and trouble free operation of the machine and its controls independent of existing power fluctuation. The supplier should mention the make , model and rating of voltage stabilizer and isolation transformer alongwith the offer. Spares required for reliable performance to be separately quoted. All Electrical/Electronic equipment shall be tropicalized and cabinets and Panels shall dust and vermin proof. All electrical components in the cabinets should be mounted on DIN rail. All Electrical / Electronic panels with door locks.	Vendor to offer			
9	<b>Accuracy Tests</b>				
9.1.	Quality Plan for detailed accuracy test procedures as per standard ISO 10360 / VDI 2617 / ISO 14253 to be conducted at supplier's works and repeated at BHEL works to be submitted. It should include; Maximum permissive volumetric length measurement error test as per ISO 10360-2,Maximum permissive probing error test as per ISO 10360-2,Scanning probing error test as per ISO 10360-4.	Vendor to accept			
10	<b>Foundation, Erection &amp; Commissioning, prove out and Inspection</b>				

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10.1	Foundation : Foundation shall be made by BHEL as per supplier's drawings. Three (03) copies of machine layout and foundation drawings showing details as below, shall be provided by the supplier within 04 weeks of placement of order; a. Foundation diagram detailing out complete concrete construction depth, Load diagram of foundation, Layout of power linesService requirement for air, water, power supply for machine shall be intimated with foundation details. The foundation should be designed by the supplier with self leveling dampers to be provided to neutralize the vibration effect due to other production machines in nearby area. Special Materials like foundation bolts, anchoring materials, fixators. Dampers level ling shoes etc. are to be provided by the supplier	Vendor to confirm & provide			
10.2	Erection & Commissioning : Vendor shall supervise erection and all special erection / commissioning tools, tackles, instruments e.g. the laser alignment equipment, test mandrels, commissioning spares etc. required for the erection and 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			
10.3	<b>Proving Out :</b>				
10.3.1	After successful commissioning of machine, Supplier has to carry out complete checking of atleast two nos. of components (Valve cover 1no. & casing 1 no.) as per BHEL drawing.	Vendor to accept			
10.4	<b>Inspection</b>				
10.4.1	Pre- shipment inspection as per accuracy tests at supplier's works is required. Supplier shall inform BHEL for carrying out pre- inspection at appropriate time. Deputed BHEL persons shall do pre acceptance at vendor works and give despatch clearance. During pre acceptance all the accuracy test mentioned at point no. 9 shall be witnessed by BHEL personnel.	Vendor to accept			
10.5	<b>Machine Acceptance</b>				
10.5.1	Final acceptance shall be given at BHEL Haridwar following completion of Erection, Commissioning, accuracy tests and proving out.	Vendor to accept			
11.0.	<b>Training of BHEL Personnel at supplier works</b>				



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11.1.	Training of BHEL personnel at supplier works in the following field ; Programming of CNC system and software operation, Electrical / Electronics maintenance, Mechanical maintenance, user interface. The duration of training shall be minimum two working weeks. However, the supplier should indicate the maximum period for training in each field mentioned above. Separate charges if any for each field are to be indicated on pro rata basis. The training shall be in English language.	Vendor to accept & confirm			
12.0	<b>Spares</b>				
12.1	Supplier shall offer Spares for at least 2 years, two shift trouble free working of machine Spares for Mechanical, electrical and CNC system of the machine tool as well as for attachments, accessories and all peripherals will be quoted with complete item-wise break up of prices and specification and source of supply of all items. The prices of following spares may be quoted separately item wise, even if included in spares package; <b>CNC / PLC SYSTEM;</b> All the electronic cards (P.C.Bs) of the offered CNC system, Input and Output cards of PLC-1 No. each. <b>DRIVE AND MOTOR SPARES; Hand held Pendant</b> Tacho- generators and rotor feed back devices individually priced. Consolidated list of all motors, their data-sheet indicating torque, and power ratings should be submitted alongwith the offer. One complete drive consisting of both controller and power card, One axis feed motor complete.	Vendor to offer			
12.2	FEEDBACK SPARES; Scanning heads for linear measuring scales-3 Nos., ? Standard spares comprising of :Two Nos of each type of following ; contactors, semi conductors and fuses. Limit and proximity switches, push buttons and indicating lamps, Pneumatic valves and selector switches (5 Nos of each type) bearings, filters etc. Complete PC system loaded with necessary software, One hard disc with complete system software and OEM software. Spare add on cards used with controller if any.	Vendor to offer			
12.3	One number each type of bearing used and details of the bearing, Two Nos. of Pneumatic filters, One No. each of the belts in belt drives, Pressure adjusting unit of compressors if supplied with the machine.	Vendor to offer			
12.4	<b>Price List of spares : Item wise Prices of all spares as quoted should be valid for at least one year after commissioning and prove out of the machine.</b>	Vendor to confirm			
13.0.	<b>Optional Accessories</b>				

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13.1.	(i) A probe kit with various extensions to build suitable length should be made available. Details of the probe kit to be furnished with the offer. The probable kit should include the following at least;? Disc probe diameter 20 to 50 mm.? 4 sets of probes with sphere dia 1,3,5 and 8 mm (total 16 No. of probes) (ii)Magnetic Auto Probe change magazine with minimum 4 position and control should be provided for automatic probe change of different pre-calibrated and pre-selected probe configuration/combinations during CNC run, for fast and uninterrupted measurements. Change of probe configurations and recalibrations during measurements should be totally eliminated. Should satisfy all the conditions led down in 4.6 and all the other machine specification.	Vendor to offer			
14	<b>Machine Manuals</b>				
14.1.	3 sets of all operation, programming and maintenance manuals as well as circuit- diagrams of pneumatic and electrical system of machine with detailed of components used, CNC system, PCBs and all accessories as well as purchased item will be supplied in English language along with the machine. One soft copy of each manual to be supplied on CD.Three sets of start up and commissioning manual of drive system, interface manual of CNC system, wiring diagram of machine, Diagnostic manual and alarm listing with help text for each alarm, spare parts list, Licensed software CD, PLC user programme hard copy with comments ( in English)	Vendor to accept & offer			
15	<b>Guarantee</b>				
15.1.	Vendor should offer performance guarantee of 24 months for the total system from the date of successful commissioning / prove out and handing over. Any spare required during guarantee period shall be arranged by the vendor free of cost and duty levied is to be borne by the vendor. Vendor to take full guarantee of the total system including compressor	Vendor to accept			
16	<b>Annual maintenance Contract</b>				
16.1.	Vendor should offer as an option Annual Maintenance Contract charges for up keeping the machine and control with detailed terms and conditions. The offer is to be submitted separately with and without spares.	Vendor to offer			
17	<b>General Requirements</b>				

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17.1.	<b>After sales service:</b> Details of local After sales service support in India should be provided. Following points to be covered ; a) Reference list .b) Installation Experience.c) Application training .d) Part programming capabilities .e) After sales Maintenance	Vendor to submit			
18.0.	<b>ADDITIONAL INFORMATIONS: Following technical details are to be submitted within six weeks of ordering ;</b>				
18.1.	* Specification of CNC system and Feed Drive and its make, Model Number and arrangement of Power transmission * Clamping arrangement and clamping force available on all traversing axes * Type of feedback system available on each axes,- Lubrication arrangement of all moving/ rotating parts with system of interlock/ alarm in case of lubrication failure * Hardness and type of protective covers on the guide ways of all the axes * Construction details of all machine assemblies/ sub-assemblies and major machine elements / accessories- Total connected load of m/s and peripherals.* Total machine weight and maximum weight of heaviest sub-assembly to be handled during erection. * Floor space requirement and overall size and height of the machine. * Requirement of compressed air and other services. * Colour of machine * Details catalogues, sketches/ photographs of the machine/accessories & attachments. * A list of quick wearing parts.	Vendor to inform			
18.2.	Vendor to submit, along with offer, reference list of customers where similar machines have been supplied mentioning broad specifications of the supplied machine i.e. Model, Pallet size, Spindle power, Load Capacity, Max job Envelope, CNC System.	Required			
19.0	<b>MACHINE NETWORKING</b>				
19.1	Machine control should have necessary hardware & software so that it is ready for interfacing with gigabit 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 offer			
19.2	The machine should appear as a node just as any other PC in the entire network (Network Neighbourhood).	Vendor to confirm			
19.3	The program transfer should be simple copy & paste method just as it is done in case of PCs.	Vendor to confirm			
19.4	The networking should be capable to transfer programs from/to machine across the network in CNC mode.	Vendor to confirm			

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19.5	The network should be capable to transfer programs with UNIX based stations.	Vendor to confirm			
19.6	All necessary Anti-Virus measures shall be incorporated.	Vendor to confirm			
19.7	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			
20.0	<b>Safety Arrangements</b>				
20.1.	The design of machine shall be such as to provide utmost operational safety. Mechanical and Electrical stoppers, Electronic interlocks should be provided to ensure coordinated functioning and to prevent damage to various elements of the machine. The m/c should have adequate and reliable safety interlocks/ devices to avoid damage to the machine, work piece and the operator due to malfunctioning or mistakes. Machine function should be continuously monitored and alarm / Warning indications through lights/ alarm number with message on CNC display and Panels should be available. All pipes, cables etc. on the machine should be well supported and protected. These should not create any hindrance to machine operators movements	Vendor to confirm			
21.0	<b>Packing</b>				
21.1.	Seaworthy and rigid packing for all items of complete machine, CNC system , all accessories and other supplied items to avoid damage and loss in transit. When Machine is dispatched in containers , all small loose items shall be suitable packed in boxes.	Vendor to confirm			
22.0	<b>Qualifying Conditions</b>				
22.1	Only those vendors(OEMs), who have supplied and commissioned at least one number CMM of same (X=3000, Y=2000, Z=1500, continious volumetric scanning probing error 4.0 micron or better, non-adhesive type scale fixing and active scanning probe head ) or higher rating in the past 10 years (from date of opening of tenders) and the referred machine is presently working satisfactorily for more than one year after commissioning, should quote. However, if refered machine has/ had been supplied to BHEL, then such machine should be presently working satisfactorily for more than six months(from date of opening of tenders) after its commissioning and acceptance in BHEL.	Vendor to accept and confirm			

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	The following information should be submitted by the vendor about the companies where referred machines have been supplied. This is required from all vendors for qualification of their offer.	Vendor to inform			
22.2	Name of the customer / company, where referred machine(s) is(are) installed.	Vendor to inform			
22.3	Complete postal address of the customer.	Vendor to inform			
22.4	Month & Year of Commissioning.	Vendor to inform			
22.5	Parameters of machine supplied (X, Y, Z , volumetric scanning probing error, non-adhesive scale fixing, active scanning probe head) and application for which the machine is supplied.	Vendor to inform			
22.6	Name and designation of the contact person of the customer.	Vendor to inform			
22.7	Phone , FAX no. and email address of the contact person of the customer.	Vendor to inform			
22.8	Performance certificate from the customer regarding satisfactory performance of machine supplied to them (original certificate or through e-mail directly from the customer). Original certificate may be returned after verification by BHEL, if required.	Vendor to provide			
22.9	BHEL reserves the right to verify information submitted by vendor. In case the information is found to be false/incorrect, the offer shall be rejected.	Vendor to accept and confirm			