Bharat Heavy Electricals Limited

(High Pressure Boiler Plant**)**
Tiruchirappalli – 620014, TAMIL NADU, INDIA
An ISO 9001 Company
CAPITAL PURCHASE / MATERIALS MANAGEMENT / MANUFACTURING

ENQUIRY	Phone: +91 431 257 79 38 Fax : +91 431 252 07 19 Email : tvenkat@bheltry.co.in Web : www.bhel.com

	Enquiry Number:	**Enquiry Date:**	**Due date for submission of quotation:**
	2620700085	**22.08.2007**	**04.10.2007**
You are requested to quote the Enquiry number date and due date in all your correspondences. This is only a request for quotation and not an order			

Item	**Description**	**Quantity**	**Delivery (Item required at BHEL on)**
10	Drum U Shell Weld Edge Preparation Station (TWIN Column Floor Type CNC Horizontal Boring Machine) as per the technical specification & commercial conditions applicable (to be downloaded from web site www.bhel.com or http://tenders.gov.in)	1 No.	30.12.2008

BHEL commercial terms & conditions with Price Bid and Bank Guarantee formats along with technical specifications can be downloaded from BHEL web site http://www.bhel.com or from the Government tender website http://tenders.gov.in (public sector units > Bharat Heavy Electricals Limited page) under Enquiry reference "2620700085".

Tenders should reach us before 14:00 hours on the due date Tenders will be opened at 14:30 hours on the due date Tenders would be opened in presence of the tenderers who have submitted their offers and who may like to be present	Yours faithfully, For BHARAT HEAVY ELECTRICALS LIMITED Manager / Capital Purchase / MM / Manufacturing

PART A.

QUALIFYING CRITERIA FOR THE SUPPLY OF TWIN COLUMN CNC FLOOR TYPE HORIZONTAL BORING MACHINE [Drum 'U' Shell Edge Preparation Station]

SECTION – I : COMPANY PROFILE

The BIDDER has to provide the details pertaining to each clause in the table given below, to understand the profile of the BIDDER's COMPANY.

S.No.	PARTICULARS	VENDOR's RESPONSE
1.0	Number of Years of Experience of the BIDDER / VENDOR in the field of Design, Manufacture & Supply of CNC Horizontal Boring Machines [Floor Type Borers].	
2.0	Details on the Codes/Standards followed for Machine Design and Manufacture	
3.0	Details on Manufacturing Facilities available with the VENDOR for : a) Building Large Machine Castings b) Heat Treatment Facilities c) Heavy Machining & Grinding d) Machine Assembly & Testing	
4.0	Details of Quality System (with Stages of Internal Inspection) followed for the Machine Building and Testing of Capacity	
5.0	Capability for Electrical/Electronic Control Panel Design, Manufacturing and Testing, and details on these facilities	

SECTION – II : QUALIFYING CRITERIA

The BIDDER / VENDOR has to meet the following requirements to get qualified for submitting an offer for the CNC Floor Type Borers :
[Additional Sheets shall be attached with the OFFER, to provide requisite details]

S.No.	REQUIREMENTS	VENDOR's RESPONSE
6.0	The BIDDER / VENDOR shall have a minimum of TEN Years of Continuous Experience of in the Field of Design, Manufacture, Supply and Commissioning of Heavy Duty CNC Floor Type Borers [CNC Horizontal Boring Machines] .	
7.0	The BIDDER / VENDOR might have supplied atleast one number of CNC Horizontal Boring Machines with Spindle Power more than 50 kW and Spindle Size 160 mm and above.	

S.No.	REQUIREMENTS	VENDOR's RESPONSE
8.0	Performance Certificate in the enclosed FORMAT for a period, not less than one year, from CUSTOMERS and Reference List of Customers with full contact details of CONTACT PERSON, who are the End Users of CNC Horizontal Boring Machines supplied as per **Clause No.7.0**	
9.0	BHEL reserves the right to verify the information provided by vendor. In case, it is found to be false/ incorrect, the offer shall get rejected.	
10.0	Details on SERVICE-AFTER-SALES Set-Up in India including the Addresses of Agents / Service Centres in India, to be furnished .	

SECTION – III : BID / OFFER FORMATS

The BIDDER / VENDOR has to note the following :

S.No.	REQUIREMENTS	VENDOR's COMPLIANCE
11.0	The BIDDER shall submit the offer in TWO PARTS - Technical **[**with **PART A & PART B]** & Commercial and Price Bid.	
12.0	The OFFER shall contain a comparative statement of Technical Specifications given by BHEL and the Offer Details submitted by the Bidder, against each Clause. A just 'YES' or 'CONFIRMED' or 'NO-DEVIATION' or 'COMPLIES' or 'ACCEPTED' or similar words in the technical comparative statement may lead to disqualification of the Technical Offer.	
13.0	The Technical Offer shall be supported by Product Catalogue and Data Sheets in ORIGINAL and complete technical details of 'Bought-Out-Items' with copies of Product Catalogue (if applicable)	
14.0	The Commercial Offer shall contain the Scope of Supply and the Un-Priced Part of the Price-Bid, for confirmation of the inclusion of all the accessories, tooling, auxiliary parts, spares, consumables, etc. with the main and basic equipment, to meet the technical specification requirements.	
15.0	Earlier performance / field experience (including service support) if any, with BHEL for the VENDOR's Equipment, will be a reckoning factor for the technical qualification of the OFFER.	

PERFORMANCE CERTIFICATE – [SAMPLE FORMAT]

(On Customer's Letter Head)

1. Supplier of the Equipment/Machine :

2. Make & Model of the Equipment :

3. Month & Year of Commissioning :

4. Application for which Machine is used :

5. a. Equipment Serial Number :
   b. Spindle Motor Power in Horse Power/kW :
   c. Spindle Size in Millimeters :
   d. Machine Column Traverse in X-axis in meters :
   e. Machine Specifications (other than those above) :

6. Performance of the Machine (with reasons for recommendation) : Best in the market / Satisfactory / Good / Average / Not Satisfactory

7. Any other Remarks :

Date:

Signature & Seal of the Authority
Issuing the Performance Certificate

TECHNICAL SPECIFICATIONS FOR TWIN COLUMN FLOOR TYPE CNC HORIZONTAL BORING MACHINE [Drum "U" Shell Edge Preparation Station]

S. No.	DESCRIPTION / PARTICULARS	SPECIFICATIONS	VENDOR's OFFER	DEVIATIONS
1.0	**PURPOSE & APPLICATION :**			
1.1	This facility is specifically meant for the generation of 'weld edge preparation' on jobs called as "Drum 'U' Shells", by milling operation. This facility will also be used for all the machining applications, for which any CNC Floor Type Horizontal Boring Machine will be put to use.			
1.2	The **ANNEXURE-1** gives the typical shapes of "U" Shells before machining. The included angle of the 'U' shell varies between 150 ˚ to 220 ˚ , prior to taking up the machining operation. One pair of "U" Shells, after machining, forms a cylindrical shell with two longitudinal weld joints. A typical cylindrical shell formation is shown in **ANNEXURE-2.** For one cylindrical shell, two "U" shells of different thickness (ONE THINNER and ONE THICKER) are used and thicker "U" shell will have machining on the outer and inner peripheral surface, so that while matching with the thinner shell, it gives a uniform thickness for the weld joint. [Refer to DETAIL 'B' in ANNEXURE-2].			
1.3	The THICKER 'U' SHELL will have only two included angles either 145˚ or 180˚ after the machining operation. While the THINNER 'U' SHELL will have the included angles 215˚ or 180˚ (corresponding to matching shell) only after the machining operation.			
1.4	The desired MACHINE CONFIGURATION is given in **ANNEXURE-3**, where two identical CNC Floor Type Horizontal Boring Machines are positioned 'face to face' with a sturdy and rigid FLOOR PLATE in between, to hold the job - Drum 'U' Shell. In order to achieve higher productivity, these two machines have to work simultaneously or in synchronization , on the two limbs of the Drum 'U' Shell. At the same time, these two machines shall have the flexibility of working as two independent work-centres with independent jobs clamped onto the FLOOR PLATE			

S. No.	DESCRIPTION / PARTICULARS		SPECIFICATIONS	VENDOR's OFFER	DEVIATIONS
1.5	The machining operation for the EDGE PREPARATION shall be by MILLING process and suitable Milling Heads are to be offered for the efficient and effective machining of the inner side, outer side and the top side of the limbs of the Drum'U' Shell. The typical dimensional sketch for the edge preparation of a thicker shell is given in **ANNEXURE - 4.** The average METAL REMOVAL RATE (MRR) expected from one machine is around 750 cc/min. THE BIDDER IS EXPECTED TO QUOTE FOR THE COMPLETE TOOLINGS AND INDICATE THE CYCLE TIME FOR MACHINING ONE THICKER SHELL (as given in**ANNEXURE - 4/The Shell Length is 11250 mm**) , WITH TWO MACHINES IN OPERATION SIMULTANEOUSLY.				
2.0	**JOB DETAILS [Drum 'U' Shells]**				
2.1	**General Dimensions :**				
2.1.1	Inner Diameter Range		700 mm to 1800 mm		
2.1.2	Shell Wall Thickness Range		80 mm to 200 mm		
2.1.3	Length of Shell		3000 mm to 12500 mm		
2.1.4	Maximum Job Weight		75 Tons [75000 kgs.]		
2.1.5	Material Specifications [as per ASTM Standards]		SA 299, SA 515 Gr.70		
2.1.6	Surface Condition of Shell		Normalised & Shot Blasted		
2.2	**Biggest Job Dimensions / CASE 1 :**	**[THINNER 'U' SHELL]**			
2.2.1	Inner Diameter		1800 mm		
2.2.2	Shell Wall Thickness		175 mm		
2.2.3	Length of Shell		11250 mm		
2.2.4	Job Weight		60 Tons [60000 kgs.]		
2.2.5	Included Angle for the 'U'		220°		
2.2.6	Material Specifications [as per ASTM Standards]		SA 299		

S. No.	DESCRIPTION / PARTICULARS		SPECIFICATIONS	VENDOR's OFFER	DEVIATIONS
2.3	**Biggest Job Dimensions / CASE 2 :**	**[THICKER 'U' SHELL]**			
2.3.1	Inner Diameter		1770 mm		
2.3.2	Shell Wall Thickness		200 mm		
2.3.3	Length of Shell		11250 mm		
2.3.4	Job Weight		60 Tons [60000 kgs.]		
2.3.5	Included Angle for the 'U'		150°		
2.3.6	Material Specifications [as per ASTM Standards]		SA 299		
3.0	**MACHINE SPECIFICATIONS :**				
3.1	The offered machine shall be able to carry out primarily the machining operations mentioned under Specifcation Clause No.1.0 and the following are the minimum machine features, which are to be assured for the offered machine configuration.				
3.2	**MACHINE CONFIGURATION :**				
3.2.1	Technical Details as per **Specification Clause No.1.0** and **ANNEXURE - 3**		Vendor to Confirm		
3.3	**HEAD STOCK**				
3.3.1	Boring spindle diameter		160 mm or above		
3.3.2	Milling spindle diameter		Vendor to Specify		
3.3.3	Ram Cross Section (L **x** B)		Minimum 340 x 340 mm		
3.3.4	Spindle drive power (AC Continuous Rating - S1)		Minimum 60 kW		
3.3.5	Spindle speed (Infinitely variable)		1 to 2000 rpm		
3.3.6	No. of speed ranges		Vendor to Specify		
3.3.7	Max torque on the boring spindle (N-m)		Vendor to Specify		
3.3.8	Max torque on the milling spindle (N-m)		6000 Nm or more		
3.3.9	Spindle taper (ISO-50/ISO-60)		ISO 50 / BT 50		
3.3.10	ISO-60/ISO-50 adapter sleeve		As an OPTIONAL ITEM		

S. No.	DESCRIPTION / PARTICULARS	SPECIFICATIONS	VENDOR's OFFER	DEVIATIONS
3.3.11	Torque-Power-Speed characteristics of the spindle system to be submitted by the vendor.	Vendor to Submit		
3.3.12	Oriented Spindle Stop (Any position)	Vendor to Confirm		
3.3.13	Spindle Cooling System (Details to be submitted)	Vendor to Submit		
3.4	**COLUMN:**			
3.4.1	Column longitudinal travel (X-Axis) - ***to suit JOB Dimensions***	Minimum 14000 mm		
3.4.2	X-axis feed rate (Infinitely variable)	1 to 10 Mtr./min.		
3.4.3	X-axis rapid traverse rate	10 Mtr./min.		
3.4.4	Axis Resolution	0.001 mm		
3.5	**HEADSTOCK TRAVERSE ON COLUMN:**			
3.5.1	Headstock vertical travel (Y-Axis) - ***To meet Job Requirements***	Minimum 3000 mm		
3.5.2	Y-axis feed rate (Infinitely variable)	1 to 10 Mtr./min.		
3.5.3	Y-axis rapid traverse rate	10 Mtr./min.		
3.5.4	Axis Resolution	0.001 mm		
3.6	**RAM/ SPINDLE TRAVERSE: -** ***To meet Job Requirements***	**DESIRED MINIMUM**		
3.6.1	Boring spindle axial travel (W-Axis)	800 mm		
3.6.2	Ram axial travel (Z-Axis)	1000 mm		
3.6.3	Spindle + Ram travel (W+Z)	1800 mm		
3.6.4	Boring Spindle axis feed rate (Infinitely variable)	1 to 5000 mm/min.		
3.6.5	Boring Spindle axis rapid traverse rate	5000 mm/min.		
3.6.6	Ram axis feed rate (Infinitely variable)	1 to 5000 mm/min.		
3.6.7	Ram axis rapid traverse rate	5000 mm/min.		
3.6.8	Axis Resolution	0.001 mm		
3.6.9	Spindle & Ram Axes should be independently programmable with Independent Drives and Feed back system.	Vendor to Confirm		

S. No.	DESCRIPTION / PARTICULARS	SPECIFICATIONS	VENDOR's OFFER	DEVIATIONS
3.7	**FEED AND DRIVE SYSTEM:**			
3.7.1	Feed drives/ motors for X,Y,Z & W axes [AC servo motors] shall be digital type of either Siemens or Fanuc make (Details of model, make, type etc. to be submitted)	Vendor to Submit		
3.7.2	Maximum feed force for all axes	Vendor to Specify		
3.7.3	Feed back system for X, Y & Ram (Z) axes: Heidenhain linear scales with pressurised compressed air cleaning (Details to be submitted by the vendor)	Vendor to Submit		
3.7.4	Feed back system for Spindle (W) Axis: Heidenhain Rotary Encoders (Details to be submitted by the vendor)	Vendor to Submit		
3.7.5	**Type of power transmission:** 1. Pre-loaded backlash free double pinion & rack drive for X-axis. 2. Backlash free re-circulating ball screw with Pre-loaded double nut for all other axes. (Complete description of the aforesaid including diameter of Ball Screw for each axis, to be submitted with the offer)	Vendor to Submit		
3.7.6	Mechanism for locking X, Y & Z axis	Vendor to Specify		
3.7.7	Maximum thrust rating of all axes.	Vendor to Specify		
3.8	**MACHINE GUIDE-WAYS:**			
3.8.1	Width of bed guide-ways, X-axis	Vendor to Specify		
3.8.2	Width of column guide-ways, Y-axis	Vendor to Specify		
3.8.3	Details of Guide ways for Ram axis and bearing details of Spindle axis are to be submitted with offer.	Vendor to Submit		
3.8.4	Guide ways for X-axis, Y-axis & Z-axis: Hydrostatic (Details to be submitted). Details of lubrication system provided on Spindle axis are also to be submitted with the offer.	Vendor to Submit		
3.8.5	Hardness of guide-ways	Vendor to Specify		

S. No.	DESCRIPTION / PARTICULARS	SPECIFICATIONS	VENDOR's OFFER	DEVIATIONS
3.8.6	**Metallic Telescopic Covers** made of Stainless Steel to be provided with wipers for X & Y axes guide ways. Joints of telescopic covers should be so sealed to avoid mixing of coolant & hydrostatic oil is to be provided. Telescopic covers for X-axis should be with a slant towards Chip Conveyor	Vendor to Offer and Confirm		
3.9	**FLOOR PLATE: -** ***To suit JOB REQUIREMENTS***	**DESIRED MINIMUM**		
3.9.1	Floor Plate Area (LxB)	15 M **x** 2.5 M		
3.9.2	Number of Floor Plates	Vendor to Submit		
3.9.3	Size of each Floor Plate	Vendor to Submit		
3.9.4	Load Bearing Capacity, Tons/Sq. Meter	Vendor to Specify		
3.9.5	Thickness	Vendor to Submit		
3.9.6	T-Slot Size	Vendor to Specify		
3.9.7	T-Slots Pitch as per DIN standard	Vendor to Submit		
3.9.8	Direction of Tee Slots in the Floor Plates.	Along X-Axis		
3.10	**CONSTRUCTION:**			
3.10.1	Vendor to furnish details of material, hardness & constructional details, including explanatory drawings, of various components / assemblies like Column, bed, head stock, ram, spindle, table etc. of the machine.	Vendor to Submit		
3.10.2	Video images on CD including hard copy explaining the technical features / Literature with photographs, drawings explaining the technical features should be enclosed with the offer	Vendor to Submit		
3.10.3	Automatic deflection compensation for ram and column effective at any extension of the ram plus spindle is to be provided taking into consideration weight of all possible cutters/ attachments offered. Details of the offered system should be submitted with offer.	Vendor to Confirm & Submit		
3.10.4	Head Stock and Column Counterbalancing System. (Details of the offered system to be submitted)	Vendor to Submit		

S. No.	DESCRIPTION / PARTICULARS	SPECIFICATIONS	VENDOR's OFFER	DEVIATIONS
3.11	**OPERATOR'S PLATFORM:**			
3.11.1	Operator's platform to carry minimum 250 kgs. The platform shall be with Independent Motorised Vertical Movement for total Vertical Traverse as well as forward stroke of sufficient length . Push Button switches are to be provided on the Operator's Platform at suitable location for motorised movement. A 15 Amp. Plug Point with ON/ OFF switch is also to be provided on the Platform.	Vendor to Confirm		
3.11.2	Horizontal movement of complete Platform.	Vendor to Specify		
3.11.3	Minimum Height of Platform from Shop Floor.	Vendor to Specify		
3.11.4	Splash / Chip guards on operator platform for protection of operator, operator's panel and to avoid spillage of coolant & chips on operator's platform.	Vendor to Offer & Confirm		
3.12	**OPERATION AND CONTROL SYSTEM:**			
3.12.1	**OPERATOR'S PANEL:**			
3.12.1.1	Swiveling type operator's panel having complete CNC and machine control system with CRT of required configuration shall be provided on the operators platform. All switches on the Operator's panel including that for table rotation should be within reach of operator of average height (Indian) for convenient, efficient & safe operation. All displays/indications should also be conveniently placed accordingly. Layout showing complete details of the panel should be submitted.	Vendor to Furnish Details		
3.12.1.2	An auxiliary pendant, which can be taken to the table for job setting and similar other purposes, should be provided.	Vendor to Furnish Details		

S. No.	DESCRIPTION / PARTICULARS	SPECIFICATIONS	VENDOR's OFFER	DEVIATIONS
3.12.2	**CNC SYSTEM & FEATURES :**			
3.12.2.1	Make : Fanuc / Siemens.	Vendor to Furnish Details		
3.12.2.2	Type : PC based latest version	Vendor to Furnish Details		
3.12.2.3	Model (Latest version, as available at the time of ordering, shall be supplied).	Vendor to Furnish Details		
3.12.2.4	Details of Standard features. List to be submitted.	Vendor to Furnish Details		
3.12.2.5	Details of optional features, recommended by vendor, to be submitted.	Vendor to Furnish Details		
3.12.2.6	Details of other optional features	Vendor to Furnish Details		
3.12.2.7	The system should have full alphanumeric keyboard, TFT colour display(10.4" or more), additional draw-out type Qwerty Key Board and mouse in suitable enclosure, RS232C serial interfaces, parallel interface for printer, COM port for telediagnostics, network ready with LAN, electronic hand wheels for all axes, 3.5" floppy drive unit for data input/output, hard disk of sufficient capacity **(Largest size available at the time of order shall be supplied)**, graphic simulation and preinstalled system software & other required softwares etc.	Vendor to Furnish Details		
3.12.3	**MANUAL CONTROL :**			
3.12.3.1	Complete manual control of machine with required switches / keys should be provided on operator's panel for selection of required axis, axis direction, cutting feed, spindle rpm, Direction of Spindle Rotation, i.e. CW/ CCW, cutting feed and spindle rpm on/off, display of axis position values etc, for manual operation without using CNC program or MDI mode. Diagram/ Sketches for switches/ keys provided on operators pendant to be submitted.	Vendor to Furnish Details		

S. No.	DESCRIPTION / PARTICULARS	SPECIFICATIONS	VENDOR's OFFER	DEVIATIONS
3.12.4	**HAND HELD UNIT:**			
3.12.4.1	Hand Held unit, Type B-MPI of Siemens make or equivalent alongwith sufficient length of interfacing cable is to be offered with complete details.			
3.12.5	**UPS FOR CNC SYSTEM:**			
3.12.5.1	UPS of 30 minutes for CNC system with inbuilt cooling and charge status display (Battery charging /discharging time should be specified by vendor)	Vendor to Furnish Details		
3.13	**MACHINE LIGHTS:**			
3.13.1	Machine Lights for sufficient illumination of complete working area on both sides of operator's platform should be provided for clear visibility.	Vendor to Furnish Details		
3.13.2	A magnetic base portable spot light with sufficiently long cable should also be provided.	Vendor to Furnish Details		
3.13.3	Any lights required in the foundation/ pit area shall also be foreseen and supplied by the vendor.	Vendor to Furnish Details		
3.13.4	All light fittings, consumables, adapters/receptacles should have compatibility with Indian equivalents	Vendor to Furnish Details		
3.12.5	Flashing / rotary type End of Cutting and Program Stop Light.	Vendor to Furnish Details		
3.14	**AIR CONDITIONERS:**			
3.14 .1	Air Conditioners with Dehumidifiers of suitable / sufficient capacity to be provided for all Electrical / Electronic Panels / Cabinets including Operator’s Panel considering specified ambient conditions. Detailed specifications of the same are to be submitted.	Vendor to Furnish Details		

S. No.	DESCRIPTION / PARTICULARS	SPECIFICATIONS	VENDOR's OFFER	DEVIATIONS
3.15	**HYDRAULIC SYSTEM : Details should be Submitted by the Vendor**			
3.15.1	The System should be centralised. Hydraulic Tank shall preferably be located at floor level	Vendor to Furnish Details		
3.15.2	Make Rexroth / Vickers Sperry or equivalent from a reputed manufacturer. (Details to be submitted)	Vendor to Furnish Details		
3.15.3	Filtration System, Details to be submitted.	Vendor to Furnish Details		
3.15.4	Failure indication	Vendor to Furnish Details		
3.15.5	Automatic shut off provision, Details to be submitted.	Vendor to Furnish Details		
3.15.6	Refrigerated type cooling and electric heating (Electric heating only if required) system of sufficient capacity to maintain complete Hydraulic System, including lubrication oil, hydrostatic oil and gearbox oil, etc. at a temperature not exceeding 40 deg C irrespective of the ambient conditions. Complete details should be submitted	Vendor to Furnish Details		
3.15.7	Hydraulic pump capacity **(flow / pressure)**	Vendor to Furnish Details		
3.15.8	Each pump should have an independent motor. Tandem pumps should not be used	Vendor to Furnish Details		
3.15.9	**First filling of all required Oils & Grease etc.** to be supplied by vendor. Indigenous (Indian) source or Indian equivalent and specifications of oils/ greases are also to be provided by the vendor.	Vendor to confirm		
3.16	**COOLANT SYSTEM :**			
3.16.1	Coolant System with all accessories for following variants shall be provided. Selection of all the variants shall be through program and push buttons provided on the Operator's panel as well.	Vendor to Furnish Details		
	a) Recirculating Type Flood Coolant System with nozzles around spindle.	Vendor to Furnish Details		
	b) Mist coolant system	Vendor to Furnish Details		
	c) Air coolant system	Vendor to Furnish Details		
	d) High Pressure Coolant thru Spindle	Vendor to Furnish Details		

S. No.	DESCRIPTION / PARTICULARS	SPECIFICATIONS	VENDOR's OFFER	DEVIATIONS
3.16.2	All attachments, tool holders, boring bars, cassettes, adapters etc. shall have the provision so that coolant is available directly at the tool-cutting tip.	Vendor to Furnish Details		
3.16.3	Coolant collection and recirculation system should be leak-proof & perfect to avoid any spillage on shop floor, trenches for cables & foundation pit of the machine etc.	Vendor to Furnish Details		
3.16.4	Coolant Filtration System: Recirculating type coolant system with Vacuum Rotary drum type Filtration System and magnetic separator.	Vendor to Furnish Details		
3.16.5	Coolant Flow Diagram showing filters, pumps, valves, tanks etc. to be submitted with the offer.	Vendor to Furnish Details		
3.16.6	Pressure & rate of flow of coolant for different variants should be furnished in the offer. The Pressure should be sufficient for the coolant to reach the tool tip at full pressure.	Vendor to Furnish Details		
3.16.7	For finer control of Pressure and Coolant Flow Rate, after its activation through program or switches, Rotary/ potentiometer switches shall be provided on the Operator’s Panel.	Vendor to Furnish Details		
3.16.8	Coolant pump & motor details for all variants of coolant system are to be submitted with the offer.	Vendor to Furnish Details		
3.16.9	The coolant tank should be fitted with skimmer for regular cleaning of coolant from contamination with tramp oil.	Required.		

S. No.	DESCRIPTION / PARTICULARS	SPECIFICATIONS	VENDOR's OFFER	DEVIATIONS
3.17	**ELECTRICAL SYSTEM :**			
3.17.1	415V + 10% / -10%, 50HZ +/-3 HZ, 3 Phase AC (3 wire system with out neutral) Power Supply Source 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/control cabinets, shall be the responsibility of vendor. Requirement of grounding/earthing with required material details is to be informed by vendor well in advance so that same could be incorporated during construction of foundation.	Vendor to confirm		
3.17.2	**Tropicalisation:** All electrical / electronic equipment shall be tropicalized	Vendor to confirm		
3.17.3	All electrical & electronic control cabinets & panels should be dust and vermin proof	Vendor to confirm		
3.17.4	All electrical components in the cabinets should be mounted on DIN Rail	Vendor to confirm		
3.17.5	All electrical and electronic panels including operator's panel should be provided with fluorescent lamps for sufficient illumination and power receptacles of 220Volts, 5/15 Amp AC. All adapters / receptacles should have compatibility with Indian equivalents.	Vendor to confirm		
3.17.6	Motors shall be of SIEMENS / ABB or other reputed make conforming to IEC Standards and acceptable to BHEL	Vendor to confirm		
3.17.7	All cables moving with traversing axes should be installed in Caterpillar/ Drag chain. Additionally, all the cable trays required for laying of cables should be included in the offer.	Vendor to confirm		
3.17.8	Vendor should ensure the proper earthing for the machine and its peripherals.	Vendor to confirm		
3.17.9	In-cycle hour counter with reset facility is to be included in the offer.	Vendor to confirm		

S. No.	DESCRIPTION / PARTICULARS	SPECIFICATIONS	VENDOR's OFFER	DEVIATIONS
3.18	**SAFETY ARRANGEMENTS:**	Vendor to confirm		
	Following safety features in addition to other standard safety features should be provided on the machine:	Vendor to confirm		
	a. .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 and panels) should be available.	Vendor to confirm		
	b. A detailed list of all alarms / indications provided on machine should be submitted by the supplier.	Vendor to confirm		
	c. All the pipes, cables etc. on the machine should be well supported and protected.	Vendor to confirm		
	d. All the rotating parts used on machine should be statically & dynamically balanced to avoid undue vibrations.	Vendor to confirm		
	e. Emergency Switches at suitable locations as per International Norms are to be provided.	Vendor to confirm		
	f. Oil & water pipe lines should not run with electrical cable in the same tray / trench.	Vendor to confirm		
	g. Safety Lights at both ends of moving column (preferably Flashing during X-travel).	Vendor to confirm		

S. No.	DESCRIPTION / PARTICULARS	SPECIFICATIONS	VENDOR's OFFER	DEVIATIONS
3.19	**ENVIRONMENTAL PERFORMANCE OF THE MACHINE :**	Vendor to confirm		
	The Machine shall conform to following factors related to environment :	Vendor to confirm		
	(a) Maximum noise level shall be 85 dB(A) at normal load condition, 1 M 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 so required.	Vendor to confirm		
	(b) There shall not be any emissions from the machine except fumes of cutting fluid during machining.	Vendor to confirm		
	(c) 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 confirm		
	(d) No hazardous chemicals shall be required to be used in the machine.	Vendor to confirm		
	(e) If any safety / environmental protection enclosure is required it should be built in the machine by the vendor.	Vendor to confirm		
	(f) Paint of the machine should be oil / coolant resistant and should not peel off and mix up with coolant.	Vendor to confirm		
4.0	**CHIP CONVEYOR :**			
4.1	A chip conveyor to carry both short and curly chips efficiently and effectively to the chip bin to be provided on one end of the machine . Two Chips bins of appropriate size of Indian make, with wheels & handle for movement, should also be supplied	Vendor to confirm		
4.2	Type of chip conveyor	Vendor to Submit Details		
4.3	Width of conveyor	Vendor to Submit Details		
4.4	Elevation of chip conveyor for chip bin	Vendor to Submit Details		

S. No.	DESCRIPTION / PARTICULARS	SPECIFICATIONS	VENDOR's OFFER	DEVIATIONS
4.5	Material of chip conveyor (to be rust resistant)	Vendor to Submit Details		
4.6	Provision for smooth flow of chips to the conveyor.	Vendor to confirm		
4.7	Operation of chip conveyor (forward & reverse) through push buttons on operator's panel and at Chip Conveyor	Vendor to confirm		
4.8	Layout showing location of chip conveyor to be submitted.	Vendor to Submit Details		
5.0	**SERVO VOLTAGE STABILIZER:**			
5.1	Indian make Oil **/ Air** Cooled servo Controlled Voltage Stabilizer suitable for complete machine, its drives, controls, PLC etc. with no undesirable Harmonics in the stabiliser output.	Required		
5.2	Make Preferred : NEEL / DELTA / AEI / POWER AID	Vendor to Submit Details		
5.3	Model & Rating	Vendor to Submit Details		
5.4	Spares Package for the Voltage Stabiliser for 2 years working should also be offered with item wise list.	Vendor to Submit Details		
5.5	Catalogue of the Voltage Stabiliser shall be submitted with the offer.	Vendor to Submit Details		
6.0	**ULTRA ISOLATION TRANSFORMER**			
6.1	Indian make Ultra Isolation Transformer suitable for complete machine , its drives, controls, PLC etc. shall be supplied	Required		
6.2	Make Preferred : NEEL / DELTA / AEI / POWER AID	Vendor to Submit Details		
6.3	Model and Rating	Vendor to Submit Details		
6.4	Spares Package for the Ultra Isolation Transformer for 2 years working should also be offered.	Vendor to Submit Details		
6.5	Catalogue of the Ultra Isolation Transformer shall be submitted with the offer.	Vendor to Submit Details		

S. No.	DESCRIPTION / PARTICULARS	SPECIFICATIONS	VENDOR's OFFER	DEVIATIONS
7.0	**PNEUMATIC SYSTEM:**			
7.1	**AIR COMPRESSOR: [OPTIONAL ITEM]**			
7.1.1	Independent Air Compressor (of reputed Indian make) with refrigerated type Dryer & Filter of suitable capacity for the total compressed air requirements of the machine & accessories and to suit required air quality should be supplied. The system should be so designed to have additional provision and required accessories before Refrigerated type Air Dryer so that BHEL compressed air supply having pressure 60 to 70 psi. could be used as and when required. The compressor unit should be suitable for continuous duty operation.	Vendor to Submit Details		
7.1.2	Make & Model of Air Compressor and Refrigerator type Dryer.	Vendor to Submit Details		
7.1.3	Make & Model of Refrigerator type Dryer.	Vendor to Submit Details		
7.1.4	Capacity (Flow, Pressure & kW)	Vendor to Submit Details		
7.2	**COMPRESSED AIR POINTS:**			
7.2.1	Compressed Air Point with manual ON/ OFF Valve and flexible pipe of suitable length for work piece cleaning.	Required		
	Programmable Compressed Air Point in the Head Stock to be used as Coolant for Carbide Tools.	Vendor to Confirm		
8.0	**TOOLINGS:**			
8.1	Complete Description of Tooling System	Vendor to Submit Details		
8.2	All cutting tools, tool holders, arbors, boring bars, clamping elements etc. recommended for machining of prove-out components. (Refer to Clause No. 1.0 and ANNEXURE - 4 for prove-out component for which tooling is required)	Vendor to Submit Details		

S. No.	DESCRIPTION / PARTICULARS	SPECIFICATIONS	VENDOR's OFFER	DEVIATIONS
9.0	**IN PROCESS MEASURING SYSTEM : [OPTIONAL]**			
9.1	Automatic job measuring system, comprising of Spindle Mounted Renishaw make Wireless system, with measuring cycles, calibration system and all types of probes/ stylii required for measuring all machined dimensions of the prove-out components.	Vendor to Submit Details		
9.2	Automatic Tool Offset measuring system with measuring cycles, calibration system etc suitable for all types of tools recommended for prove-out components. Vendor to furnish detailed description of the system along with offer.	Vendor to Submit Details		
10.0	**DIAGNOSTIC SYSTEM:**			
10.1	**TELE-DIAGNOSTIC SERVICE :**			
10.1.1	Tele-diagnostic service should be provided through International telephone lines along with required Hardware / Software package for the supplied CNC system for remote diagnosis and correction of the problems in both CNC System and PLC of the machine. 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. Subsequently, it should be possible to use other platforms, such as Internet or ISDN, subject to their availability in future.	Vendor to Submit Details		
10.2	**FAULT DIAGNOSTIC SYSTEM:**			
10.2.1	Supplier's own diagnostic system with required hardware and software should be supplied and installed on the CNC system. This should include customised auto-diagnostic system with supporting hardware and software which shows detailed cause and remedy for the fault on the display with full video diagnostic help for faults related to mechanical and electrical maintenance.	Vendor to Submit Details		
10.3	Help guide should be provided to use both diagnostic systems	Vendor to Confirm		

S. No.	DESCRIPTION / PARTICULARS	SPECIFICATIONS	VENDOR's OFFER	DEVIATIONS
11.0	**LEVELING & ANCHORING SYSTEM**	Required		
11.1	Complete anchoring system including foundation bolts, anchoring materials, fixators, leveling shoes etc shall be supplied for the Machine, Floor Plates etc.	Vendor to Submit Details		
12.0	**TOOLS FOR ERECTION, OPERATION & MAINTENANCE :**			
12.1	Special 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.for operation and maintenance of the machine should be supplied. List of such tools should be submitted with offer	Vendor to Submit Details		
12.2	Test mandrel for checking spindle run-out & alignment should be supplied	Required		
13.3	**CNC ANGULAR MILLING HEAD/ RIGHT ANGLE MILLING HEAD:**	***To suit JOB REQUIREMENTS***		
13.3.1	Power	Vendor to Submit Details		
13.3.2	Max torque	Vendor to Submit Details		
13.3.3	Speed Range (Infinitely Variable)	Vendor to Submit Details		
13.3.4	Speed ratio (1:1 between spindle of Machine and Head)	Vendor to Submit Details		
13.3.5	Spindle taper	Vendor to Submit Details		
13.3.6	Traverse Range of C-axis	360°		
13.3.7	Resolution of C-axis : -	2.5°		
13.3.8	Power-Torque-Speed characteristic diagram to be submitted	Vendor to Submit Details		
13.3.9	Wt. of the head	Vendor to Submit Details		
13.3.10	Coolant system: Internal (thru spindle) **&** External coolant with requisite flexible pipes on its snout is to be provided.	Required		
13.3.11	Pull Stud for mounting the Head and for mounting the Tools in the taper of the Head shall be supplied by the vendor.	Required		

S. No.	DESCRIPTION / PARTICULARS	SPECIFICATIONS	VENDOR's OFFER	DEVIATIONS
14.0	**SPARES:**			
14.1	Itemised breakup of mechanical, hydraulic, electrical and electronic spares used on the machine in sufficient quantity as per recommendation of Vendor for 2 years of trouble free operation on three shifts continuous running basis should be offered by vendor. The list to include following, in addition to other recommended spares: **(Unit Price of each item of spare should be offered)**	Vendor to Submit Details		
14.2	**Mechanical & Hydraulic Spares:** All types of pumps, All types of Valves, All types of pressure switches / transducers, All types of filters, All types of seals	Vendor to Submit Details		
14.3	**Electrical /Electronic / CNC Spares:** All types of Relays, Contactors, Proximity Switches, Push Buttons, Indicating Lamps, Semiconductor Fuses, Special Fuses, Circuit Breakers, Main Power Switch, Encoders, Scanning Heads for Linear Scales, MMC module, NCU module, Operator's panel with Display Unit, Floppy Disk Unit, I/O Cards for PLC, Servo Motors for Feed Drives, Power Module & Control Cards for Main Drive as well as Feed Drives etc.	Vendor to Submit Details		
14.4	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 Submit Details		
14.5	Recommended set of spares for all attachments are to be offered with details.	Vendor to Submit Details		
14.6	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 Submit Details		

S. No.	DESCRIPTION / PARTICULARS	SPECIFICATIONS	VENDOR's OFFER	DEVIATIONS
15.0	**DOCUMENTATION :** **THREE SETS** of following documents (Hard copies) in English language should be supplied along with the machine	Vendor to Confirm		
15.1	Operating manuals of Machine & CNC system			
15.2	Programming Manuals of Machine & CNC system			
15.3	Detailed Maintenance manual of machine with all drawings of machine assemblies/sub-assemblies/parts including Electrical / Pneumatic/ Coolant / Hydraulic circuit diagrams. All Assembly/ Sub Assembly Drawings shall be supplied with the part list also			
15.4	Maintenance, Interface & commissioning manuals for CNC system, spindle & feed drives.			
15.5	Manufacturing drawings for all supplied tool holders, coolant connections, tailstock center, adapters, sleeves, fixtures etc.			
15.6	Catalogues, O&M Manuals of all bought out items including drawings,wherever applicable.			
15.7	Detailed specification of all rubber items and hydraulic/lube fittings			
15.8	Operating Manuals, Maintenance Manuals & Catalogues for supplied Automatic Tool Offset & Job Measuring Systems, Voltage Stabilizer, Isolation Transformer, Air-Compressor and all supplied Accessories.			
15.9	PLC program print-outs with comments in English.	Vendor to Confirm		
15.10	PLC program on CD, NC data & PLC data on floppy.	Vendor to Confirm		
15.11	Complete back-up of hard disk on GHOST CD and clear written Instructions (3 copies) to take back-up and reloading of a new hard disk.	Vendor to Confirm		
15.12	Complete Master List of parts used in the machine shall be submitted by the vendor.	Vendor to Confirm		
15.13	One additional set of all the above documentation on CD ROM, wherever possible.	Vendor to Confirm		

S. No.	DESCRIPTION / PARTICULARS	SPECIFICATIONS	VENDOR's OFFER	DEVIATIONS
16.0	**TRAINING:**			
16.1	BHEL Persons should be trained at supplier's Works for mutually agreed period (minimum 10 working days) in the area of (a) CNC Part Programming/ Technology, Use of all CNC Features, Programming for Measuring Systems & supplied accessories etc. (b) Electrical, Electronic & CNC maintenance for machine & other supplied equipments (c) Mechanical & Hydraulic maintenance of the machine & other supplied equipments (d) Operation of the machine & other supplied equipments.	Vendor to Confirm		
16.2	Air-fare, boarding & lodging for the trainees shall be borne by BHEL.	Vendor to NOTE		
16.3	Competent, English speaking experts shall be arranged by the vendor	Vendor to Confirm		
16.4	Vendor to quote for training on man / week basis	Vendor to Confirm		
16.5	Vendor should commit to organize and quote for training of Electronics Engineer and Programmer at the CNC System Manufacturer's works for advanced features and specialised training if so required by BHEL	Vendor to Confirm		
17.0	**FOUNDATION:**			
17.1	Vendor shall submit the preliminary layout drawing for getting BHEL's approval within one month from the date of Letter of Intent (LOI)/ P.O. , whichever is earlier. Soil condition data will be furnished by BHEL alongwith the approval. Complete Foundation Design including details, like Static/ Dynamic load details etc. and final Layout Drawings shall be submitted by the supplier within three months after getting BHEL's approval. The Layout should consist of all requirements pertaining to complete machine and all accessories, including space requirement for Voltage Stabiliser, Isolation Transformer, Air Compressor, Chip Bin & any other accessory. BHEL shall construct complete foundation for the machine .	Vendor to Confirm		

S. No.	DESCRIPTION / PARTICULARS	SPECIFICATIONS	VENDOR's OFFER	DEVIATIONS
18.0	**ERECTION & COMMISSIONING**			
18.1	Supplier to take full responsibility for carrying out the erection, start up, testing of machine, it's control system & all types of other supplied equipment, 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 and helping personnel shall also be provided by BHEL. Details of these requirements should be informed by vendor in advance.	Vendor to Confirm		
18.2	Erection & Commissioning of Voltage stabilizer, Isolation Transformer & Air Compressor shall also be responsibility of the vendor.	Vendor to Confirm		
18.3	Successful proving of BHEL components by the supplier shall be considered as part of commissioning. All tests, as mentioned at **Specification Clause 22.2** (Machine Acceptance) shall form part of the commissioning activity.	Vendor to Confirm		
18.4	Test mandrel for checking run-out/taper & alignment should be supplied	Vendor to Confirm		
18.5	Tools, Tackles, Test Mandrels, instruments and other necessary equipment including Laser equipment required to carry out all above activities should be brought by the supplier.	Vendor to Confirm		
18.6	Commissioning spares, required for commissioning of the machine within stipulated time, shall be brought by the supplier on returnable basis.	Vendor to Confirm		
18.7	All Cover Plates required for the machine and its peripherals including pits, if any, shall be supplied and installed by the vendor. The plates should be sourced from India	Vendor to Confirm		

S. No.	DESCRIPTION / PARTICULARS	SPECIFICATIONS	VENDOR's OFFER	DEVIATIONS
18.8	Portion, if any, of the machine, accessories and other supplied items where paint has rubbed off or peeled during transit or erection should be repainted and merged with the original surrounding paint by the vendor. For this purpose, the vendor should supply sufficient quantity of touch-up paint of various colours of paint used.	Required		
18.9	Schedule of Erection and Commissioning shall be submitted with the offer.	Vendor to Submit Details		
18.10	Charges, duration, terms & conditions for E&C should be furnished in detail	Vendor to Submit Details		
19.0	**ACCURACY TESTS:**			
19.1	**GEOMETRICAL ACCURACIES :**			
19.1.1	Geometrical Accuracy Tests shall be in accordance with ISO 3070 standard 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		
19.1.2	All the above accuracies to be demonstrated to BHEL engineers during pre-acceptance tests at Suppliers works and during Erection & Commissioning at BHEL Works.	Vendor to Confirm		
19.2	**MACHINE POSITIONING ACCURACIES & REPEATABILITY:** **Should be measured as per VDI/DGQ 3441 (Latest Revision)**			
19.2.1	Positioning Accuracy (Pa per 1000mm) for X,Y,Z,W Axes	0.015 mm		
19.2.3	Repeatability (Ps per 1000mm) for X,Y,Z,W Axes	0.008 mm		
19.2.5	Total positioning error P for entire travel for X,Y,Z,W Axes	Vendor to Specify		

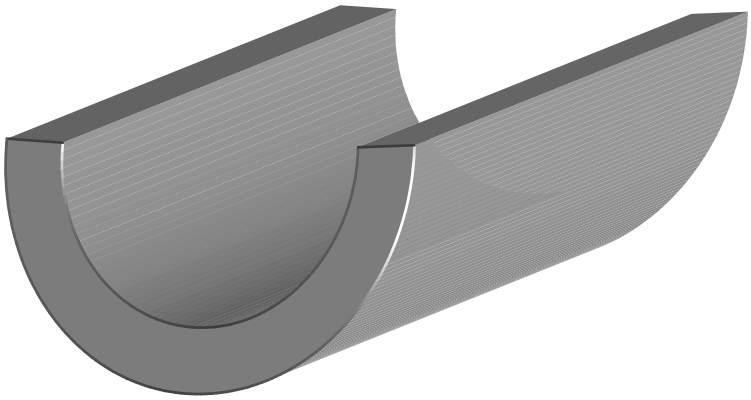
S. No.	DESCRIPTION / PARTICULARS	SPECIFICATIONS	VENDOR's OFFER	DEVIATIONS
19.2.7	All the above accuracies to be demonstrated to BHEL engineers during pre-acceptance at Suppliers works and during Erection & Commissioning at BHEL Works	Vendor to Confirm		
20.0	**AMBIENT CONDITIONS & THERMAL STABILITY :**			
20.1	Total machine including CNC system and all supplied items should work trouble free and efficiently under following operating conditions and should give specified accuracies. Power Supply: Voltage: 415 V - 10%, +10% Frequency: 50 Hz +3%, - 3% No. of phases = 3 Ambient Conditions: Temperature = 15 to 50 Degree Celsius Relative Humidity = 95% max.	Vendor to confirm that machine is suitable for the listed conditions and details of provisions on the machine for the same are to be furnished by Vendor		
20.2	Weather conditions are tropical, Atmosphere may be dust laden during some part of the year. Machine shall be kept in the normal shop floor condition. Max. temperature variation is up to 25 deg Celsius in 24 hours.			
20.2	Thermal Stability of the complete machine keeping in view specified Ambient Conditions and accuracy requirements of BHEL components and trouble free operation of the machine should be ensured by vendor.			
20.3	The machine, including attachments and accessories, should be suitable for 24 hrs. continuous operation to its full capacity for 24 hour a day and 7 days a week throughout. Vendor to ensure and confirm the same.	Vendor to Confirm		

S. No.	DESCRIPTION / PARTICULARS	SPECIFICATIONS	VENDOR's OFFER	DEVIATIONS
21.0	**PROVE-OUT OF BHEL COMPONENTS :**			
21.1	Drawing of prove-out component is given in ANNEXURE - 4. Vendor to submit preliminary process, time study & tool list recommended by them along with the offer. Complete machining of prove out components shall be done by Vendor at BHEL works to the specified design accuracy and surface finish, using cutting tools and CNC programs to be provided by the vendor to prove the machine after complete erection, tests & test piece machining etc. Material for the prove-out components shall be provided by BHEL. Vendor should submit the CNC programs, setting schemes, process sheets, tooling layouts, time studies etc. in advance for the prove out components. Vendor shall be fully responsible for machining of prove-out components as per drawing and other requirements specified by BHEL to the full satisfaction of BHEL. .	Vendor to Confirm and Submit Details		
22.0	**MACHINE ACCEPTANCE: (Tests/Activities TO be Performed by Vendor)**	Should be accepted & confirmed by Vendor		
22.1	**Tests/Activities should be carried out at supplier's works on the machine before dispatch :**			
22.1.1	Geometrical Accuracy Tests as per test chart.			
22.1.2	Positioning Accuracy Tests as per VDI-DGQ/3441			
22.1.3	The machine should be tested for continuous running of 48 hrs. If any break down occurs during this test, the test should be repeated for 48 hrs from that time.			
22.1.4	Demonstration of all features of the machine, CNC system and all Accessories.			
22.1.5	Machining of **NAS Test Piece.** Vendor to supply test piece and tooling for it's machining..			

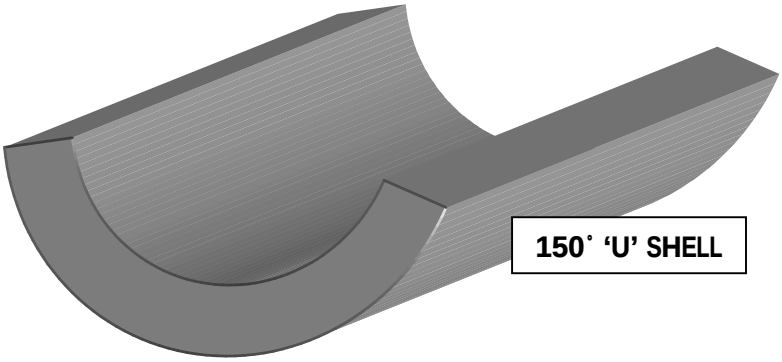
S. No.	DESCRIPTION / PARTICULARS	SPECIFICATIONS	VENDOR's OFFER	DEVIATIONS
22.2	**Test to be carried out at BHEL works while commissioning the machine :**			
22.2.1	Geometrical Accuracy Tests as per test chart.			
22.2.2	Positioning Accuracy Tests as per VDI-DGQ/3441			
22.2.3	Full load test to demonstrate the maximum power & cutting capacity of the machine.			
22.2.4	The machine should be tested for continuous running of 48 hrs. If any break down occurs during this test, the test should be repeated for 48 hrs from that time.			
22.2.5	Demonstration of all features of the machine, CNC system & all accessories to the satisfaction of BHEL for their efficient and effective use.			
22.2.6	Demonstration by actual use of all supplied attachments and accessories to their full capacity.			
22.2.7	Machining of **NAS Test Piece.** Vendor to supply test piece and tooling for it's machining..			
22.2.8	Job prove out as per **Spec Clause No.1.0 and ANNEXURE-4**			
22.2.9	Two weeks supervision of independent operation of machine by BHEL after job prove-out.			
22.2.10	Training of BHEL machine operators in operation of complete machine & accessories etc by the supplier's experts / engineers during their stay at BHEL works			
23.0	**PACKING:**			
23.1	Sea worthy & rigid packing for all items of complete machine, CNC System, all Accessories and other supplied items to avoid any damage/loss in transit. When machine is despatched in containers, all small loose items shall be suitably packed in boxes	Vendor to Confirm		

S. No.	DESCRIPTION / PARTICULARS	SPECIFICATIONS	VENDOR's OFFER	DEVIATIONS
24.0	**GUARANTEE :**			
24.1	24 months from the date of acceptance of the machine.	Vendor to Confirm		
25.0	**GENERAL : The vendor should submit the following information:**			
25.1	Machine Model	Vendor to Furnish Details		
25.2	Total connected load (in kVA):	Vendor to Furnish Details		
25.3	Floor area required (Length, Width, Height) for complete machine & accessories	Vendor to Furnish Details		
25.4	Painting of Machine/ Electrical Panels: RAL 6011 Apple Green (Polyurethane Paint)	Required		
25.5	Total weight of the machine	Vendor to Furnish Details		
25.6	Weight of heaviest part of machine	Vendor to Furnish Details		
25.7	Weight of the heaviest assembly/ subassembly of the Machine	Vendor to Furnish Details		
25.8	Dimensions of largest part/ subassembly/ assembly of the machine	Vendor to Furnish Details		

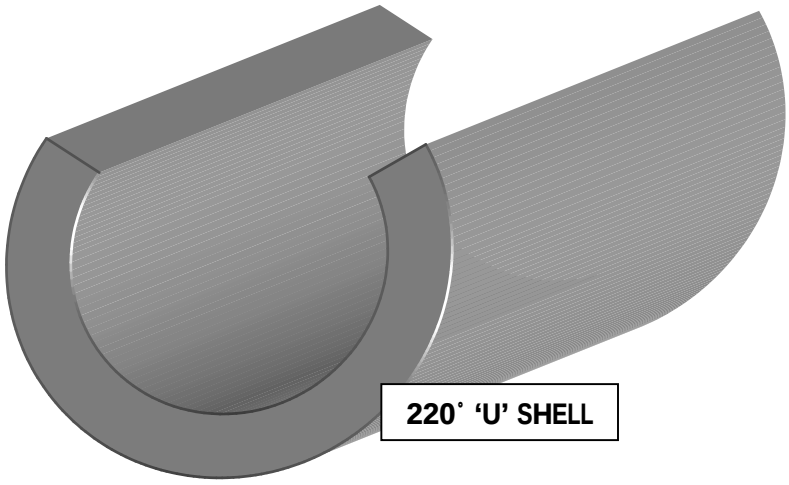
ANNEXURE - 1



180˚ 'U' SHELL



150˚ 'U' SHELL

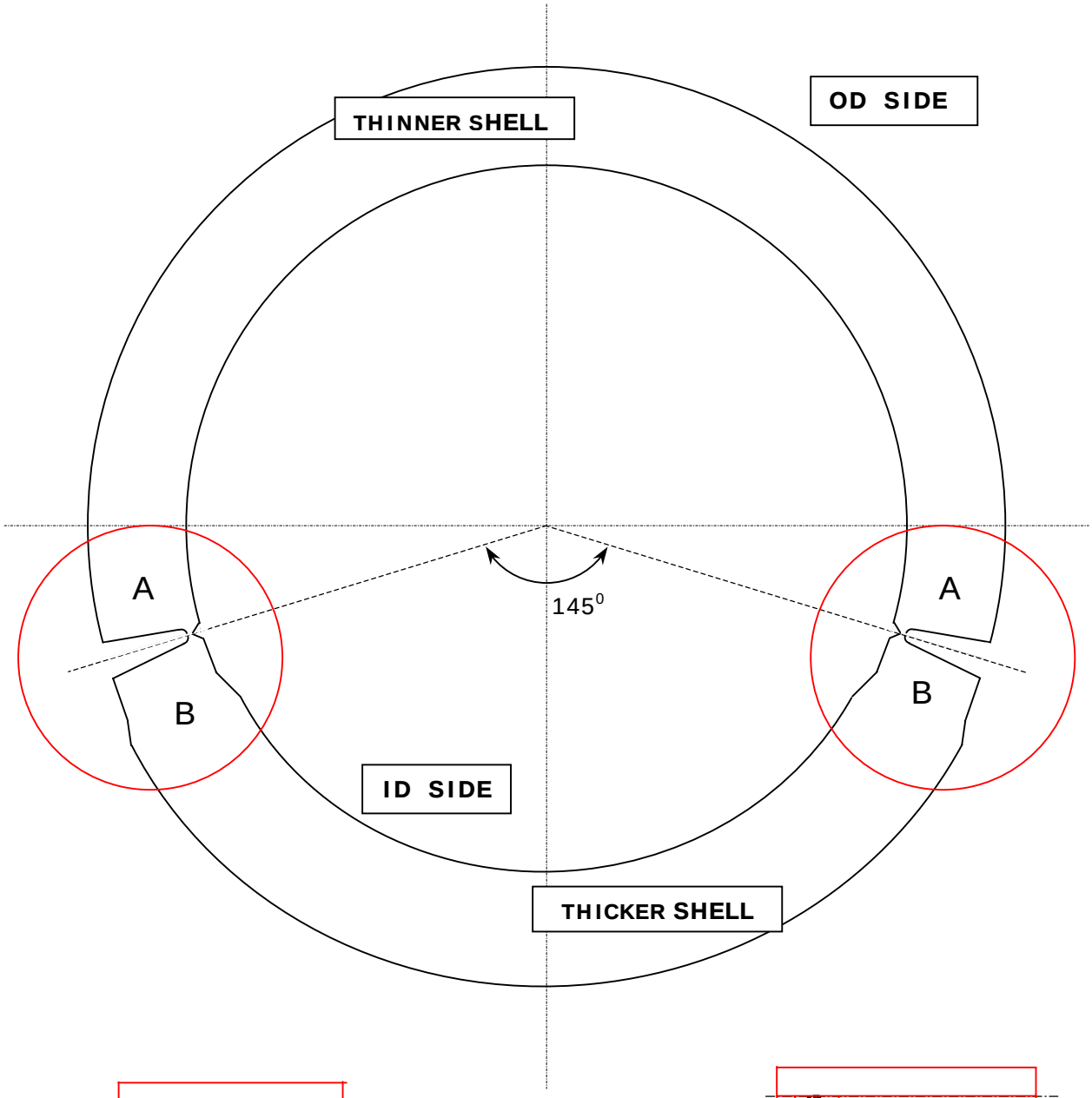


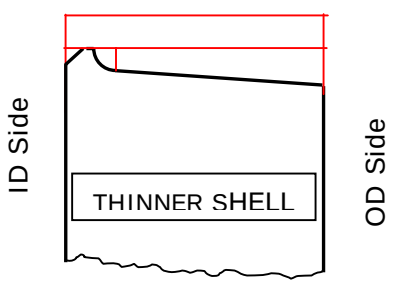
220˚ 'U' SHELL

TYPICAL DRUM 'U' SHELLS

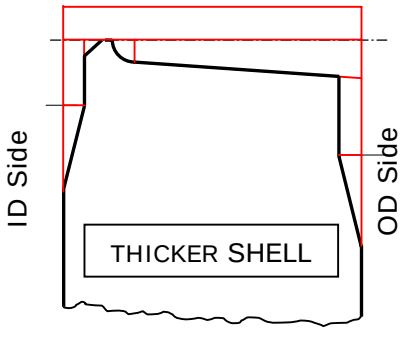
ANNEXURE - 2

DRUM 'U' SHELL EDGE PREPARATION DETAILS



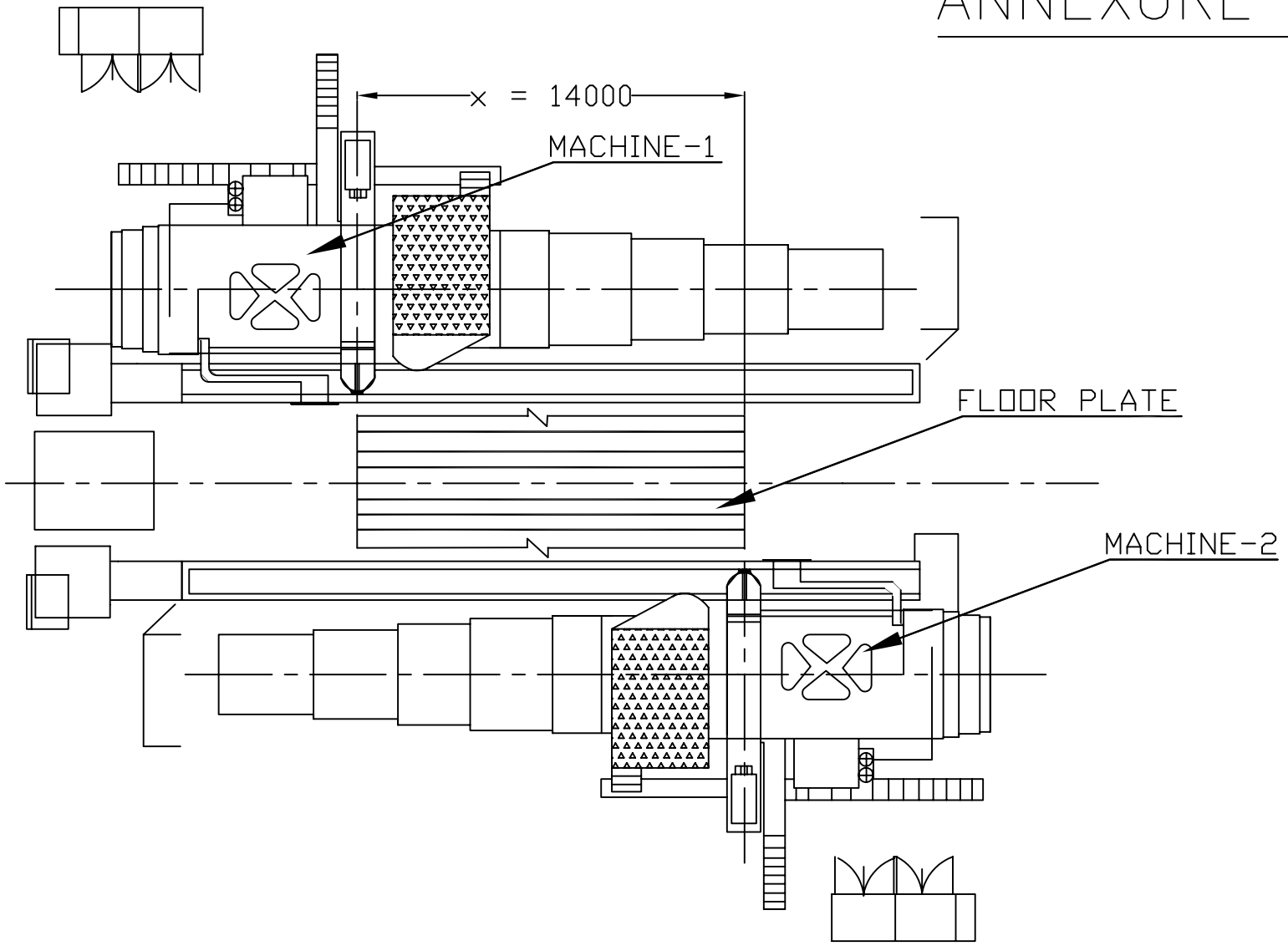


Detail A



Detail B

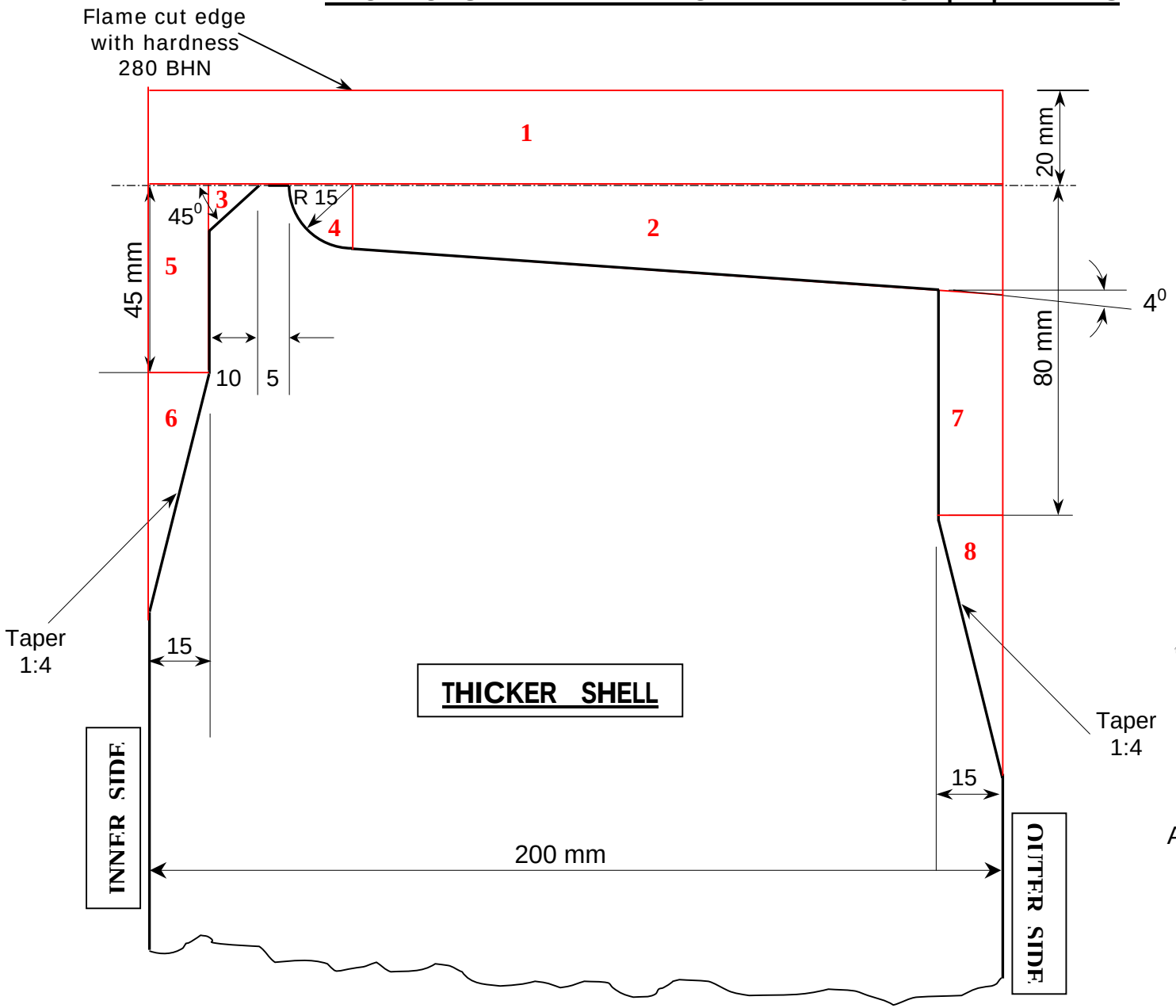
ANNEXURE – 3



SCHEMATIC LAYOUT OF PROPOSED MACHINE

ANNEXURE - 4

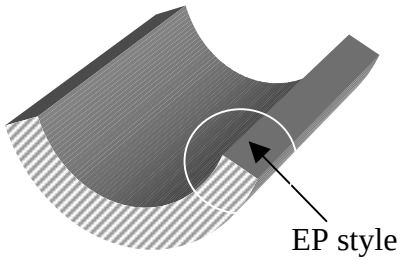
DRUM 'U' SHELL WELD EDGE PREPARATION [EP] DETAILS



NOTE :

Machining of 8 zones to be done
R15 achieved with R30 inserts
Length of Shell – 11500 mm
Shell Material – SA 299 [ASTM]

Included Angle is 145º, after Final Machining



All **Dimensions** are in 'mm'
[Not to scale]