

	<b>TECHNICAL SPECIFICATION OF VERTICAL BORER, TABLE DIA=2000 MM</b>				
<b>SCOPE:</b>	<b>SUPPLY, ERECTION &amp; COMMISSIONING OF VERTICAL BORERS COMPLYING WITH SPECIFICATIONS AS BELOW :</b>				
<b>SL. NO.</b>	<b>DESCRIPTION OF BHEL REQUIREMENT</b>	<b>REQUIRED</b>	<b>OFFERED</b>	<b>DEVIATION</b>	<b>REMARKS</b>
<b>1.0</b>	<b>PURPOSE &amp; WORKPIECE MATERIAL</b>				
<b>1.1</b>	<b>Purpose:</b> This machine is required to rough & finish machine components of SteamTurbines like Valve cones, Servomotor casings, Yokes, Bearings, Sealing rings etc. demanding high accuracies & surface finish.	Vendor to note & accept			
<b>1.2</b>	<b>Work Piece Material:</b> Carbon Steel, Nimonic Steel, Alloy Steel, Stainless Steel, Inconel, Cast Iron, Stellite and Non-Ferrous materials like Aluminium Alloys, Bronze, Copper, Babbit material etc. having Hardness up to 500 BHN.	Vendor to note & accept			
<b>2.0</b>	<b>SPECIFICATION:</b>				
<b>2.1</b>	<b>MACHINE CONFIGURATION</b>				
<b>2.1.1</b>	Double Column Vertical Borer with Single Ram	Vendor to note			
<b>2.2</b>	<b>CAPACITY &amp; SIZE</b>				
<b>2.2.1</b>	Maximum Height for Turning & Facing	1600 mm or more			
<b>2.2.2</b>	Maximum Turning Diameter	2100mm or more			
<b>2.2.3</b>	Maximum Workpiece Weight	15000Kg or more			
<b>2.2.4</b>	Maximum Swing Diameter	Vendor to inform			
<b>2.2.5</b>	Minimum Boring Diameter (using standard turning tool holder & tool clamped on the ram)	400mm or less			
<b>2.2.6</b>	Minimum Boring Diameter (using Boring Bar & tool clamped on the ram)	60mm or less			
<b>2.3</b>	<b>TABLE</b>				
<b>2.3.1</b>	Table Diameter	Minimum 2000mm			
<b>2.3.2</b>	Load Capacity	15000Kg or more			
<b>2.3.3</b>	Table Speed ( Infinitely Variable )	0.5-200 rpm (approx)			
<b>2.3.3.1</b>	No. of Speed Ranges from Gear Box	2 or 3 (max)			
<b>2.3.4</b>	Power of Main Drive ( S1 - Continuous Rating ) AC	Vendor to inform			
<b>2.3.5</b>	Details of Main Drive viz.Type, Make, Model etc.	Vendor to inform			
<b>2.3.6</b>	No. of Jaws/Vices	4			
<b>2.3.7</b>	Table Torque - Speed diagram should be submitted.	Vendor to submit			
<b>2.3.8</b>	Type of Bearing for the Table (Details to be submitted)	Vendor to inform			
<b>2.3.9</b>	Size of T - slots, their position and accuracy. Drawing of Table showing details of the T - slots etc. should be submitted.	Vendor to submit			
<b>2.3.10</b>	Two perpendicular accurate Slots should be provided at the Center of the table to use for alignment purposes. Sizes ( Width & Depth ), accuracy etc. of these slots should be furnished along with a Drawing.	Vendor to inform & submit			

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2.3.11	Single piece construction of machine table	Vendor to confirm			
2.3.12	Position of machine table - with ref. to shop floor in vertical direction.	Vendor to inform			
2.4	<b>CROSS RAIL</b>				
2.4.1	Vertical Travel.	Vendor to inform			
2.4.2	Vertical Traverse Rate.	Vendor to inform			
2.4.3	Maximum Height of Cross Rail bottom from Table Top	Vendor to inform			
2.4.4	Minimum Height of Cross Rail bottom from Table Top	Vendor to inform			
2.4.5	Details of crossrail movement/positioning/locking mechanism	Vendor to submit			
2.5	<b>TOOL HEAD and RAM</b>				
2.5.1	Cross - Section of Ram (It should be rigid enough for troublefree machining with maximum projection of ram and also suitable for specified minimum bore dia)	Vendor to inform & confirm			
2.5.2	Thread Cutting Capacity - Range of pitches	Vendor to inform			
2.5.3	Clamping details for mounting Turning Tool Holders/Attachments on ram, should be submitted.	Vendor to submit			
2.5.4	Maximum angle of ram swivel (manual positioning)	+/- 30 degree or more			
2.6	<b>MAIN TRAVERSES</b>				
2.6.1	Vertical Travel of Ram (Z-Axis) For maximum turning/facing height of 1600mm. (If offered Turning Height, Sl.No.. 2.2.1, is more than 1600mm, Ram travel should also be increased by half value of increase in Turning Height above 1600mm)	Minimum 1200mm			
2.6.2	Maximum Distance between Table Top and Standard Turning Tool Holder with Tool.	Vendor to inform			
2.6.3	Minimum Distance between Table Top and Standard Turning Tool Holder with Tool.	Vendor to inform			
2.7	<b>MACHINE GUIDEWAYS</b>				
2.7.1	Width of Cross Rail guideways	Vendor to inform			
2.7.2	Width of column guideways	Vendor to inform			
2.7.3	X & Z guide ways should be hydrostatic (Details should be submitted)	Vendor to confirm			
2.7.4	Hardness of guideways	HRC60 or more			
2.7.5	<b>Metallic Telescopic Covers:</b> Waterproof Telescopic Covers of rust resistant steel should be provided with pads/wipers on both left and right sides of tool head on the crossrail and also above & below the crossrail on both columns covering the guide ways. Joints of telescopic covers should be sealed to avoid mixing of coolant & hydrostatic oil . The movement of telescopic covers should be troublefree and requiring minimum maintenance.	Vendor to offer			
2.8	<b>FEEDS AND DRIVE SYSTEM</b>				
2.8.1	Cutting feed in X & Z Axes ( Infinitely Variable )	0 - 4000mm/min or more			
2.8.2	Rapid feed in X & Z Axes	Min. 4000mm/min			

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2.8.3	Feed drives/motors X & Z axes [AC servo motors] of Siemens or Fanuc digital type (detail of model, make, type, rating etc. should be submitted)	Vendor to offer			
2.8.4	Backlash free movement mechanism in X & Z axes should be ball- screw type	Vendor to offer			
2.8.5	Mechanism for locking X & Z axis	Vendor to offer			
2.8.6	PLC should be of Siemens/ Fanuc make	Vendor to inform			
2.8.7	Drive controller of axis drives should be of Siemens/ Fanuc/ ABB make	Vendor to inform			
2.8.8	The machine should be equipped with Digital Read out system of axis resolution 0.005 mm for X & Z traverses	Vendor to offer			
2.9	<b>OPERATOR'S PANEL</b>				
2.9.1	Swiveling type operator's panel having complete machine control system shall be provided and suitably located on operator's platform for convenient, efficient & safe operation of the machine. All switches with suitable interlocks with table rotation should be within reach of operator of average height (5' 5") for easy & safe operation. All displays/indications should also be conveniently placed accordingly. A protection cover made of steel sheet or equivalent should be provided above the operator's panel.	Vendor to offer			
2.10	<b>MACHINE LIGHTS</b>				
2.10.1	Machine Lights for sufficient illumination of complete working area on the table, on the ram to view tool inside long casing type jobs and operator's panel also, should be provided for clear visibility.It should have 220V AC supply.	Vendor to offer			
2.10.2	A magnetic base portable spot light with sufficiently long cable should also be provided. It should have 220V AC supply.	Vendor to offer			
2.11	<b>HYDRAULIC SYSTEM</b> (Details should be Submitted by the Vendor)				
2.11.1	The System should be centralised & re-circulating type. Hydraulic tank should be placed preferably at shop floor. Max. Hydraulic Pressure should not exceed 100 kg/sq.cm., if possible.	Vendor to offer			
2.11.2	System's make Rexroth / Vickers Sperry or equivalent reputed manufacturer (Details to be submitted)	Vendor to inform			
2.11.3	Filtration System, Details should be submitted.	Vendor to submit			
2.11.4	Failure indication	Vendor to offer			
2.11.5	Automatic shut off provision, Details should be submitted.	Vendor to offer			
2.11.6	Refrigerated type cooling and electric heating system of sufficient capacity for complete Hydraulic System, including lubrication oil, hydrostatic oil and gearbox oil, etc. to ensure oil temperature not exceeding 40 degree Celsius irrespective of ambient conditions, to be offered with complete details.	Vendor to offer			

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2.11.7	Each pump should have an independent motor. Tandem pumps should not be used. Maximum desired permissible pressure is 100 bar. If anywhere, pressure is more than 100 bar then one set of such pipeline should be offered in spare in addition to other spares.	Vendor to offer			
2.11.8	Complete hydraulic system should be designed to avoid any leakage or spillage.	Vendor to confirm			
2.12	<b>FIRST FILLING OF OILS</b>				
2.12.1	First filling of all required Oils & Grease etc. for the machine, voltage stabilizer, isolation transformer 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 offer			
2.13	<b>COOLANT SYSTEM</b>				
2.13.1	Machine should have Recirculating Type Flood Coolant System	Vendor to offer			
2.14	<b>REQUIREMENT FOR ELECTRICAL EQUIPMENT</b>				
2.14.1	Voltage = 415V +10% / -10% , Frequency= 50Hz +3 / -3 , No. of phases = 3 phase with neutral. Power Supply source, as above, 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 including Voltage Stabilizer, Transformer & Air-Compressor etc. shall be the responsibility of vendor. Requirement of grounding/earthing with required material details should be informed by vendor well in advance so that same could be incorporated during construction of foundation.	Vendor to accept & offer			
2.14.2	<b>Tropicalisation:</b> All electrical / electronic equipment shall be tropicalized.	Vendor to offer			
2.14.3	All electrical & electronic control cabinets & panels should be dust and vermin proof.	Vendor to offer			
2.14.4	All motors shall conform to IEC or Indian Standards	Vendor to offer			
2.14.5	Vendor should ensure the proper earthing for the machine and its peripherals/accessories. Any material requirement for the same should be informed with foundation design/drawings. The vendor can take earthing connection from the nearest column of the production shop.	Vendor to offer			
2.15	<b>SAFETY ARRANGEMENTS</b> Following safety features in addition to other standard safety features should be provided on the machine:	Vendor to offer			
2.15.1	Machine should have adequate and reliable safety interlocks / devices to avoid damage to the machine, workpiece and the operator due to the malfunctioning or mistakes.	Vendor to offer			
2.15.2	A detailed list of all alarms / indications provided on machine should be submitted by the supplier.	Vendor to submit			

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2.15.3	All the pipes, cables etc. on the machine should be well supported and protected. These should not create any hindrance to machine operator's movement for effective use of machine.	Vendor to offer			
2.15.4	All the rotating parts used on machine should be statically & dynamically balanced to avoid undue vibrations & noise.	Vendor to confirm			
2.15.5	Emergency Switches at suitable locations as per International Norms should be provided.	Vendor to offer			
2.15.6	Oil & water pipe lines should not run with electrical cable in the same trench.	Vendor to offer			
2.16	<b>ENVIRONMENTAL PERFORMANCE OF THE MACHINE :</b> The Machine should conform to following factors related to environment :	Vendor to offer			
2.16.1	Maximum noise level shall be 85 dB(A) at normal load condition, 1 meter away from the machine with correction factor for back ground noise, if necessary. This will be measured as per international standards like DIN 45635-16, if required. Supplier to demonstrate compliance to noise level, if so required.	Vendor to confirm			
2.16.2	There shall not be any emissions from the machine except fumes of cutting fluid during machining.	Vendor to confirm			
2.16.3	There should not be any effluent from the machine. In case there are any effluents from the machine, requisite effluent treatment plant or pollution control device should be built into the machine by the supplier.	Vendor to confirm			
2.16.4	No hazardous chemicals shall be required to be used in the machine.	Vendor to confirm			
2.16.5	If any safety / environmental protection enclosure is required it should be built in the machine by the vendor.	Vendor to confirm			
2.16.6	Paint of the machine should be oil / coolant resistant and should not get peeled off and mixed up with coolant.	Vendor to confirm			
2.17	<b>Tool Storage Cabinets</b> ( 4 nos. ) of reputed (Indian) make having covered heavy duty drawers of suitable sizes with lock facility to store offered tooling items etc. Catalogue/sketch etc. to be submitted.	Vendor to offer			
3.0	<b>SERVO VOLTAGE STABILIZER</b>				
3.1	Oil / Air Cooled Servo Controlled Voltage Stabilizer (of reputed Indian make e.g. Neel Mumbai) suitable for complete machine, its drives, controls, PLC etc. for unbalanced load & supply conditions considering specified power supply & ambient conditions.	Vendor to offer			
3.2	Make	Vendor to inform			
3.3	Model, Rating & Input/Output Voltage etc.	Vendor to inform			

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3.4	Spares Package for Servo Voltage Stabilizer, with item-wise breakup, are to be recommended and offered by the vendor in sufficient quantity for 2 years of trouble free operation considering three shifts continuous running of the machine. Detailed list is to be submitted. Price of unit quantity of each item is to be quoted.	Vendor to offer			
4.0	<b>ULTRA ISOLATION TRANSFORMER</b>				
4.1	Ultra Isolation Transformer (of reputed Indian make e.g. Neel Mumbai) suitable for complete machine , its drives, controls, PLC etc. for unbalanced load & supply conditions considering specified power supply & ambient conditions.	Vendor to offer			
4.2	Make	Vendor to inform			
4.3	Model, Rating & Input/Output Voltage etc.	Vendor to inform			
5.0	<b>TOOLINGS</b>				
5.1	<b>TOOL HOLDERS</b> All tool holders & boring bars shall be available for direct clamping in ram. All tool holders & boring bars should have holes for lifting by suitable eye-bolts, if required. Drawings/Sketches of the offered tool holders are to be submitted with the offer.	Vendor to offer			
5.1.1	Tool holder for 40*40mm tool shank with direct clamping of tools for internal / external turning and LH/RH facing operations with provision for clamping 32*32mm shank tools with packing pieces.	Vendor to offer			
5.1.2	Tool holder with provision to clamp standard dia 50mm boring bar with clamping length of approx. 300mm	Vendor to offer			
5.1.3	Boring Bar, dia. 120mm, length 600mm , suitable for clamping of 32*32mm shank tools radially & axially as well with provision for clamping 25*25mm shank tools using packing pieces.	Vendor to offer			
5.1.4	Boring Bar, dia. 80mm, length 400mm , suitable for clamping of 25*25mm shank tools radially & axially.	Vendor to offer			
5.2	<b>ADDITIONAL TOOLING REQUIREMENTS</b>				
5.2.1	Mounting details of each type of toolings to be explained & submitted with the help of drawings / sketches.	Vendor to submit			
5.2.2	Offered tooling system to be rigid to carryout machining without undue vibration, which can effect job accuracy and surface finish in extreme machining conditions like max. overhang of ram etc. .	Vendor to confirm			
6.0	<b>LEVELING &amp; ANCHORING SYSTEM</b>				
6.1	Complete set of anchoring materials including foundation bolts, nuts, washers, fixators, leveling shoes etc for alignment of table/ram and to fix the machine to the foundation should be supplied. Details to be submitted.	Vendor to offer			
7.0	<b>TOOLS FOR ERECTION, OPERATION &amp; MAINTENANCE</b>				

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7.1	Tools and Equipment required for erection of the machine shall be brought by the vendor. Necessary tools like Torque Wrench, Spanners, Keys, grease guns etc. for operation and maintenance of the machine should be supplied by the vendor. List of such tools should be submitted with offer.	Vendor to offer			
8.0	<b>CHIP &amp; SPLASH GUARD</b>				
8.1	Movable Chip / Splash Guards of sufficient height and made of rust resistant material, should be provided all around the Table (on front side of columns) to avoid spilling of Coolant and scattering of Chips on Operator's Panel and Shop Floor. Front part of splash guards should be provided with safety glass for clear visibility, if required.	Vendor to offer			
9.0	<b>SPARES :</b>				
9.1	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 offer			
9.1.1	<b>Mechanical &amp; Hydraulic Spares :</b> Following Spares are to be offered.	Vendor to offer			
9.1.1.1	Pumps used on machines i.e. Hydraulic, lubrication, coolant and oil cooling pumps ( 1 no. each type )	Vendor to offer			
9.1.1.2	Control Valves ( 1 no. each type )	Vendor to offer			
9.1.1.3	All types of flow control, pressure regulators, pressure reducer valves ( 1 no. each type )	Vendor to offer			
9.1.1.4	All types of pressure switches, flow switches and float switches (1 no. each type)	Vendor to offer			
9.1.1.5	All types of filter inserts of regenerative type (10 nos. of each type)	Vendor to offer			
9.1.1.6	All types of filter inserts of disposal type (30 nos. each type)	Vendor to offer			
9.1.1.7	Accumulators with charging kits (1 no each type)	Vendor to offer			
9.1.1.8	All types of O-rings & Hydraulic Hoses (1 set of each type)	Vendor to offer			
9.1.2	<b>Electrical /Electronic Spares :</b> Following Spares are to be offered.	Vendor to offer			
9.1.2.1	Contactors ( 2 Nos each type )	Vendor to offer			
9.1.2.2	Limit switches ( 2 No each type )	Vendor to offer			
9.1.2.3	Automets ( 2 Nos each type )	Vendor to offer			
9.1.2.4	Proximity switches ( 2 Nos each type )	Vendor to offer			
9.1.2.5	Pressure Switches ( 2 Nos each type )	Vendor to offer			
9.1.2.6	Flow Switches ( 2 Nos each type )	Vendor to offer			
9.1.2.7	Float Switches ( 2 Nos each type )	Vendor to offer			

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9.1.2.8	Signal Lamps ( 50 Nos )	Vendor to offer			
9.1.2.9	Push Buttons ( 10 Nos )	Vendor to offer			
9.1.2.10	Selector Switches ( 1 No each type )	Vendor to offer			
9.1.2.11	Axis reference potentiometer ( 5 Nos )	Vendor to offer			
9.1.2.12	PLC CPU, PLC Power supply ( 1 No each type )	Vendor to offer			
9.1.2.13	I/O board ( 1 No each type )	Vendor to offer			
9.1.2.14	Spare for drive controller	Vendor to offer			
9.1.2.14.1	I/R unit ( 1 No)	Vendor to offer			
9.1.2.14.2	Controller card (1 No. each type )	Vendor to offer			
9.1.2.14.3	Spindle module ( 1 No )	Vendor to offer			
9.1.2.14.4	Power module ( 1 No. each type )	Vendor to offer			
9.1.2.15	Complete DRO unit ( 1 No. )	Vendor to offer			
9.1.2.16	Heidenhein scanning head ( 1 No. each type along with scale )	Vendor to offer			
9.1.2.17	Table encoder ( 1 No )	Vendor to offer			
9.1.2.18	Main switch ( 1 No. )	Vendor to offer			
9.1.2.19	Lubrication unit ( 1 No )	Vendor to offer			
10.0	<b>DOCUMENTATION :</b> Three sets of following documents (Hard copies) in English language should be supplied along with the machine.	Vendor to offer			
10.1	Operating manuals of Machine	Vendor to offer			
10.2	Detailed Maintenance manual of machine with all drawings of machine assemblies/sub-assemblies/parts including Electrical / Coolant / Hydraulic circuit diagrams. All Assembly/ Sub Assembly Drawings shall be supplied with the part list also.	Vendor to offer			
10.3	Interface & commissioning manuals for spindle ,feed drives and auxiliary drive.	Vendor to offer			
10.4	Manufacturing drawings for all supplied clamping jaws, tool holders, boring bars, cassettes, adapters, sleeves, fixtures etc.	Vendor to offer			
10.5	Catalogues, Operation & Maintenance Manuals of all bought out items including drawings, wherever applicable.	Vendor to offer			
10.6	Detailed specification of all rubber items and hydraulic/lube fittings	Vendor to offer			
10.7	Operating Manuals, Maintenance Manuals & Catalogues for supplied accessories viz. Voltage Stabilizer, Isolation Transformer, etc.	Vendor to offer			
10.8	Complete list of parts/items( Bill of materials) used in the machine in English language.	Vendor to offer			
10.9	One additional set of all the above documentation on CD ROM, wherever possible.	Vendor to offer			
10.10	PLC user program (Hardcopy) with comments in English	Vendor to offer			

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<b>11.0</b>	<b>TRAINING</b>				
<b>11.1</b>	a) Training of machine operation, mechanical & electrical & electronic maintenance should be provided free of cost at supplier works for one week. b) Pre-dispatch inspection may be carried out by BHEL representative at Party's works. However it is at the discretion of BHEL and final acceptance will be done at BHEL, Hardwar after carrying out all the required accuracy tests etc.	Vendor to offer			
<b>12.0</b>	<b>FOUNDATION</b>				
<b>12.1</b>	Foundation drawing is to be submitted by supplier within 4 weeks of placement of LOI.	Vendor to accept & offer			
<b>13.0</b>	<b>ERECTION &amp; COMMISSIONING</b>				
<b>13.1</b>	Supplier to take full responsibility for carrying out the erection, start up, testing of machine, it's control & all types of other supplied equipment/accessories, machining of test pieces etc. Service requirement like power, air & water shall be provided by BHEL at only one point to be indicated by supplier in their foundation layout drawings. Other requirements like crane and few helping personnel shall also be provided by BHEL. Details of these requirements should be informed/discussed by vendor and agreed with BHEL in advance.	Vendor to offer			
<b>14.0</b>	<b>ACCURACIES</b>				
<b>14.1</b>	Geometrical Accuracy, Positional Accuracy Tests shall be in accordance with relevant ISO (Latest Revision) or equivalent applicable Standard/Suppliers Test chart whichever is finer. 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 offer			
<b>14.2</b>	Table Flatness	0.02/1000mm - concave only			
<b>14.3</b>	Table Radial Runout (at 2.0M dia)	0.01mm			
<b>14.4</b>	Table Axial Runout	0.01mm/1000mm			
<b>15.0</b>	<b>POWER SUPPLY / ENVIRONMENT CONDITION</b>				
<b>15.1</b>	The machine should be suitable for operation in the following conditions: - - Power supply for the machine: 415 V +10 % / -15 %, 3 phase, 50 Hz +/-3 % - For controls: 230 V +10 % / -15 %; 50 Hz + / -3 % - Temperature: 5 to 45 deg C - Relative humidity: 95 % max. - Compressed air: 4 to 6 Kg / sq. cm - Other conditions: Similar to tropical country. - Water supply industrial: 1.5 to 2.0 Kg / sq. cm - Dust laden atmosphere during some part of the year.	Vendor to accept & confirm			

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15.2	The machine should be suitable for continuous operation to its full capacity for 24 hours a day and 7 days a week throughout year. Vendor to ensure and confirm the same.	Vendor to offer & confirm			
16.0	<b>GUARANTEE</b>				
	Guarantee for complete machine and all supplied accessories/attachments/equipments/items for 24 months from the date of acceptance of the machine.	Vendor to offer			
17.0	<b>GENERAL</b>				
17.1	Total Space required (Length, Width, Height) for complete machine, accessories/attachments and other supplied items like Voltage Stabilizer, Isolation Transformer etc.	Vendor to inform			
17.2	<b>Painting of Machine / Electrical Panels</b> : RAL 6011 Apple Green ( Polyurethane Paint )	Vendor to offer			
17.3	Total weight of the machine	Vendor to inform			
17.4	The supplier is to submit a clause wise deviation statement against each clause of this technical specification along with the offer.	Vendor to submit			
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