


| | | | | |
|--|--|--|---|---------------------------------------|
| | <u>BHARAT HEAVY ELECTRICALS LIMITED</u> | | Indent No. : | C/6450/8/1266/T Dated 10/05/08 |
|  | UNIT'S ADDRESS: HEEP, RANIPUR HARIDWAR - 249403 UTTARANCHAL, INDIA | | Enquiry No. : Due Date : | |
| | | | Supplier Qtn. No.: | |
| | <u>CONTACT PERSON FROM PURCHASE DEPTT.:</u> <u>NAME: MR. A.SANYAL</u> <u>DESIGNATION: DGM (PPX-CAP)</u> <u>PHONE NO.: 0091 - 1334 - 285291</u> <u>E-MAIL: asanyal@bhelhwr.co.in</u> <u>FAX NO. : 0091 - 1334 - 226462</u> | | Date : | |
| <u>SPECIFICATION CUM COMPLIANCE CERTIFICATION FOR CNC VERTICAL MACINING CENTRE= Qty 1 No.</u> | | | | |
| | NOTE :- | | | |
| | <p>1. Vendor must submit complete information against clause at Sl.No. 5.0 The offer, complying this clause, would only be considered.</p> <p>2. This tender is for two machines of identical configuration. However, proveout components will be different for both the machines as specified at clause no. 1.26</p> <p>3. 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>4. The offer and all documents enclosed with offer should be in English language only.</p> | | | |
| | ADDRESS OF THE SUPPLIER : | | | |
| | TELEPHONE NOS.: | | | |
| | FAX NOS.: | | | |
| | E-MAIL ADDRESS : | | | |
| | | | | |

| SCOPE: SUPPLY, ERECTION & COMMISSIONING OF CNC VERTICAL MACHINING CENTRE WITH SPECIFICATIONS AS BELOW : No of Machine : 1 No. | | | | | |
|--|--|--|---------|-----------|---------|
| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
| 1.0 | PURPOSE & WORKPIECE MATERIAL | | | | |
| 1.1 | Purpose: This Vertical Machining Center is mainly intended for machining of Tooling items e.g. Side Block, Middle Block, Marking Template, 2D & 3D machining of tooling components (precision jigs & fixtures). Work Piece material : Generally the material will be Mild steel, Alloy Steels, Carbon Steel and Cast Iron in ferrous metals and Aluminium, Brass, Copper, Bronze etc. in Non Ferrous Metals. The machine should be capable of machining still tougher material if required and also for other heavy and accurate machining jobs requiring various machining operations like milling, drilling, boring, tapping etc. | Vendor (to accept) | | | |
| 1.2 | Major Technical Specification: WORKING RANGES: MAXIMUM TRAVERSES: | | | | |
| 1.2.1 | Longitudinal table travel Axis X: | 1200 mm or more | | | |
| 1.2.2 | Vertical travel Axis Y: | 600 mm or more | | | |
| 1.2.3 | Transverse / Lateral Column travel Axis Z | 600 mm or more | | | |
| 1.2.4 | 4th Axis NC Rotary table / Dividing Head, continuous mode , with necessary motors, drives, cables & spares. | Dia 250 mm or more & accuracy +/- 15 arc sec. | | | |
| 1.3 | WORK PIECE CARRIER | | | | |
| 1.3.1 | Clamping Surface: (Minimum) | 1250 mm X 650 mm | | | |
| 1.3.4 | Distance from column face to center line of spindle (Maximum and Minimum) | Vendor to intimate | | | |
| 1.3.5 | Height of table top from the floor | Vendor to intimate | | | |
| 1.3.6 | Distance from spindle nose to table top (Maximum and Minimum) | Vendor to intimate | | | |
| 1.3.7 | Load carrying capacity of Table: | 1500 Kg. or more | | | |
| 1.3.8 | A. The tabletop should be provided with T-slots at suitable pitch. The No, size and pitch of T slot, Central Slot tolerance, Lateral slot size and tolerance is to be specified in the technical offer. B. The tabletop and central tennon shall be accurately machined for using as reference surface. C. TABLE top sketch to be provided along with offer | Vendor to confirm and inform technical details. Vendor to confirm | | | |
| 1.4 | MAIN SPINDLE: | | | | |
| 1.4.1 | Spindle diameter (mm) | Vendor to intimate | | | |
| 1.4.2 | Power rating at 100 % duty cycle (KW) | 15 kW or more | | | |
| 1.4.3 | Spindle Motor make, model etc (Should comply with IEC / IS specifications) | Vendor to intimate | | | |
| 1.4.4 | Spindle torque at 100% duty cycle (Nm). | Vendor to intimate | | | |
| | Torque/Power/Speed Diagram of spindle motor is to be submitted with the offer. | Vendor to provide details indicated. | | | |
| 1.4.5 | Speed ranges (continuously variable): (RPM) | 20 RPM or less TO 6000 RPM OR MORE | | | |
| 1.4.6 | Spindle taper: | BT50 | | | |
| 1.5 | FEEDS AND DRIVE SYSTEM | | | | |
| 1.5.1 | Rapid traverse X-Axis | 20 m/min or more. | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|----------|--|----------------------------|---------|-----------|---------|
| 1.5.2 | Rapid traverse Y-Axis | 20 m/min or more. | | | |
| 1.5.3 | Rapid traverse Z-Axis | 20 m/min or more. | | | |
| 1.5.4 | Feed Rate in X-Axis (Infinitely variable) | 1 to 10,000 mm/min or more | | | |
| 1.5.5 | Feed Rate in Y-Axis (Infinitely variable) | 1 to 10,000 mm/min or more | | | |
| 1.5.6 | Feed Rate in Z-Axis (Infinitely variable) | 1 to 10,000 mm/min or more | | | |
| 1.5.7 | Feed drives/ motors (AC Servo motors) Seimens make , digital type (Detail of motor , make , type etc to be submitted) | Vendor to intimate | | | |
| 1.5.8 | Feed back system for X, Y, Z axes. Heidenhain or equivalent linear scales with pressurised compressed air cleaning (Details to be submitted) | Vendor to intimate | | | |
| 1.5.9 | Details of system to ensure zero backlash for the axes | Vendor to intimate | | | |
| 1.5.10 | Mechanism for locking / Clamping the axes | Vendor to intimate | | | |
| 1.5.11 | Clamping force of each axes to be furnished | Vendor to intimate | | | |
| 1.5.12 | All linear traversing axes shall be provided with steel telescopic covers of rust resistant material with wipers. Joints of telescopic covers should be so sealed to avoid coolant and other lubricating oil seepage. | Vendor to confirm | | | |
| 1.5.13 | Vendor to furnish material , hardness of guideways & constructional details , including explanatory drawings of various components/ assemblies like gear box , Guideways / slides , telescopic covers,assessoris , Table , Feed transmission system , hydraulic and lubrication system , feed back system etc. of the machine. | Vendor to intimate | | | |
| 1.6 | AUTOMATIC TOOL CHANGER | | | | |
| 1.6.1 | Type | Vendor to intimate | | | |
| 1.6.2 | Tool selection method | Random & Shortest path | | | |
| 1.6.3 | No.of Tools in the magazine | 24 tools or more | | | |
| 1.6.4 | Diameter of tool : a) With all pockets full. | 100 mm or more | | | |
| 1.6.5 | b) With adjacent pocket empty | 160 mm or more | | | |
| 1.6.7 | Tool Change Time (Chip-to-Chip) | Vendor to intimate | | | |
| 1.6.8 | Tool Change Time (Tool-to-tool) | Vendor to intimate | | | |
| 1.6.9 | Tool Length: | 350 mm or more | | | |
| 1.6.10 | Tool Weight | 15 Kg or more | | | |
| 1.6.11 | ATC shall have following features: | | | | |
| 1.6.12 | ? Machine operation should be possible even in situation when the ATC is out of order due to some Mechanical / Electronic problem. | Vendor to Confirm | | | |
| 1.6.13 a | ? Provision of compressed air blow through push button for cleaning of spindle mounted on machine headstock during manual tool change. The Push Button to be provided either in the Headstock or hand held terminal. | Vendor to Confirm | | | |
| 1.6.13 b | ? Sutable M code based system and Software based system shall have to be provided to retrieve the struck up tool in the tool loading and un-loading cycle. | Vendor to Confirm | | | |
| 1.6.14 | ? Provision of cleaning of spindle taper by compressed air blow during ATC cycle. | Vendor to Confirm | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|----------|---|--|---------|-----------|---------|
| 1.6.15 | ? Provision of manual tool loading and unloading with push button mounted on headstock at a convenient location or on the Hand Held terminal. | Vendor to Confirm | | | |
| 1.6.16 | ? One set of tool holder retention studs to suit tool magazine pockets and quantity sufficient to cover all the pockets shall be offered as part of the basic machine. | Vendor to Confirm Qty | | | |
| 1.7 | COOLANT SUPPLY SYSTEM | | | | |
| 1.7.1 | Coolant system with all accessories for following 2 variants shall be provided. Selection of all variants shall be through program and push buttons as well. | Vendor to confirm | | | |
| 1.7.2.a | Recirculating type flood coolant system through adjustable trajectory multiple nozzle around the spindle. | Vendor to confirm | | | |
| 1.7.2. b | High Pressure Coolant through Spindle | Vendor to confirm | | | |
| 1.7.3 | All attachments, tool holders, adapters etc. shall have the provision for internal / through coolant , otherwise the length of the External coolant nozzle / External coolant pressure / External coolant flow rate should be such that it should be sufficient to flood the tool cutting tip while cutting. | Vendor to confirm | | | |
| 1.7.4 | Coolant collection and recirculation system should be leakproof & perfect to avoid any spillage on shop floor, trenches for cables & foundation pit of the machine etc. | Vendor to confirm | | | |
| 1.7.5 | Coolant Filtration System: Vacuum type coolant filtration unit (KNOLL make or equivalent) comprising of coolant tank, vacuum rotational filter, filter drum (made of high quality steel net), vacuum pump, coolant pump, flushing pump, oil separator etc.shall be offered as part of basic machine. The Technical details including make , model to be furnished with the offer. | Vendor to confirm and intimate: make , model no.and its technical details. | | | |
| 1.7.6 | Coolant Flow Diagram showing filters, pumps, valves, tanks etc.to be submitted with the offer. | Vendor to confirm and furnish details | | | |
| 1.7.7 | 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 confirm and furnish details | | | |
| 1.7.8 | Coolant Tank Capacity | Vendor to intimate | | | |
| 1.7.9 | 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 confirm and furnish details | | | |
| 1.7.10 | Coolant pump and motor details for all variants | Vendor to confirm | | | |
| 1.7.11 | The coolant tank should be fitted with skimmer for regular cleaning of coolant from contamination with tramp oil. | Vendor to confirm | | | |
| 1.7.12 | Filtration Purity | Vendor to inform | | | |
| 1.8 | CHIP CONVEYOR : | | | | |
| 1.8.1 | 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 | | | |
| 1.8.2 | Type of chip conveyor | Vendor to confirm | | | |
| 1.8.3 | Elevation of chip conveyor for chip bin | Vendor to inform | | | |
| 1.8.4 | Material of chip conveyor to be rust resistant | Vendor to inform | | | |
| 1.8.5 | Provision for smooth flow of chips to the conveyor. | Vendor to inform | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---------|---|--|---------|-----------|---------|
| 1.8.6 | Operation of chip conveyor (forward & reverse) through push buttons on operator's panel and at Chip Conveyor | Vendor to inform | | | |
| 1.8.7 | Layout showing location of chip conveyor to be submitted. | Vendor to inform | | | |
| 1.9 | Machine Enclosure with Access Door | | | | |
| 1.9.1 | Machine shall have sound dampening enclosure with interlocked doors in the tool and workpiece area and access door at operator's panel. Enclosure shall have large safety glass, viewing window like ROTOCLEAR or equivalent for viewing the job and ongoing process. | Vendor to confirm and intimate technical details. | | | |
| 1.10 | Machine Lights | | | | |
| 1.10.1 | Machine light (Halogen light) for illumination of complete encapsulated working area for clear visibility. | Vendor to confirm | | | |
| 1.10.2 | Tube lights in electrical cabinets for maintenance purpose | Vendor to confirm | | | |
| 1.10.3 | 4 coloured signal light displaying operational status of the machine and visible from distance. | Vendor to confirm | | | |
| 1.10.4 | A magnetic base portable spotlight with sufficient long cable should also be supplied. | Vendor to confirm | | | |
| 1.11 | All light fittings, consumables, adapters/receptacles should have compatibility with Indian Equivalent. | | | | |
| 1.12 | Electrical Control Cabinet & Operator's Pendant | | | | |
| 1.12.1 | Electrical Control Cabinet & Operator's Pendant shall be fitted with proper cooling arrangement for working in a centralized air-conditioned hall having temperature up to 30 degree Celsius. Electrical cabinet shall be provided with a 220V, 5 Amp socket for maintenance purpose. | Vendor to confirm | | | |
| 1.13 | Hand held unit | | | | |
| 1.13.1 | Vendor to offer type B-MPI of Siemens make with all its features or equivalent along with sufficient length of interfacing cable. | Vendor to inform with details | | | |
| 1.14 | Mist/Flue Gas Extraction System | | | | |
| 1.14.1 | Machine shall have Mist Extraction System/ Flue Gas Extraction System such as Electro Suction Filter unit including all connection and installation at convenient location. | Vendor to confirm and also intimate make and Model with Technical details. | | | |
| 1.15 | OTHER TECHNICAL FEATURES | | | | |
| | The offered machine should have following features to facilitate working/extended life of the machine: | | | | |
| 1.15.1 | All the traversing axis shall have direct measuring type closed loop feed back system for positioning and measurement. | Vendor to confirm | | | |
| 1.15.2 | In Cycle hour counter with reset facility. | Vendor to confirm | | | |
| 1.15.3 | Coolant flushing gun with sufficient length of pipe for manual cleaning of workpiece. | Vendor to confirm | | | |
| 1.15.4 | Compressed air point with manually operated ON/OFF valve and flexible piping for work piece/ pallet cleaning. | Vendor to confirm | | | |
| 1.15.5 | Percentage type spindle load meter. | Vendor to confirm | | | |
| 1.15.6 | Centralized Automatic Lubrication System for lubrication of all moving and rotating parts. It should have system of alarm/ interlock in case of lubrication failure. | Vendor to confirm | | | |
| 1.15.7 | Standard Calibration mandrel for referencing and job setting. | Vendor to confirm | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|----------------|---|-------------------|---------|-----------|---------|
| 1.15.8 | Air filter, Regulator & Lubricator (FLR) and Air Dryer unit of appropriate capacity to arrest moisture, other suspended particle etc.for providing dry and cleans air for machine operation. | Vendor to confirm | | | |
| | AIR COMPRESSOR: | | | | |
| | Independent Air Compressor (of reputed Indian make Elgi or equivalent) 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 5 Kg/sq.cm with high moisture could be used as and when required. The compressor unit should be suitable for continuous duty operation | Vendor to confirm | | | |
| | Make & Model of Air Compressor and Refrigerator type Dryer | Vendor to confirm | | | |
| | Spares Package for Air compressor with item-wise list and 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. Price of unit quantity of each item is to be quoted. | Vendor to confirm | | | |
| 1.15.9 | One set of tools for service and maintenance. | Vendor to confirm | | | |
| 1.15.10 | First filling of all required Oils , lubricants, & Grease etc. for the machine and auxiliary system. to be supplied by vendor. Indigenous (Indian) source or Indian equivalent and specifications of oils/ greases are also to be provided by the vendor.The vendor shall also submit estimated annual consumption of all these items on 7000 hours per year working basis. | Vendor to confirm | | | |
| 1.15.11 | Machine should have provision to switch from direct position feed back system to indirect position feed back system (built in motor encoder)through PLC required for service purpose only. | Vendor to confirm | | | |
| 1.15.12 | One set of special maintenance/ calibration tools for geometrical accuracy tests including calibration mandrel,granite block cylinder dial gauges, Fluke multimeter and other special tools as required for service and maintenance of the machine shall be offered. Also, tools required for accuracy tests after replacement of spindle. | Vendor to confirm | | | |
| 1.15.13 | AIR CONDITIONERS: | | | | |
| (a) | 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 offer | | | |
| (b) | In case of order, vendor shall confirm to supply the following information about Air Conditioners and Chiller Unit (s) used in the machine: Type of Refrigeration/ Chiller unit. Capacity of the chiller unit. Type of compressor with complete specifications. Type of Thermostatic Expansion Valve with complete specifications. Fan size and flow in CFM (cubic feet meter) of the Condenser unit. Specifications of the Evaporator Unit (Width Plate type/ Coil type) Functional requirement of temperature of Cooling Oil to be maintained between range T1 to T2. Type of temperature indicator/ controller used in the chiller unit with complete specifications. | Vendor to confirm | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---------|--|------------------------------------|---------|-----------|---------|
| 1.16 | HYDRAULIC SYSTEM : Details should be Submitted by the Vendor | | | | |
| 1.16.1 | The Hydraulic System shall be of Re-circulating Type. Hydraulic Tank should be preferably placed at shop floor. | Vendor to offer and confirm | | | |
| 1.16.2 | Pumps, Valves, Switches (Pressure & Flow) should be of Make : Rexroth / Vickers / Parker / Hawe. | Vendor to offer and confirm | | | |
| 1.16.3 | Filtration System: Sufficient no. of filters (with electric clogging indicator and alarm on PLC) should be used to avoid frequent clogging of the filters and other maintenance related problems. Filter elements should, preferably, be of Make : EPE / Hydac. | Vendor to offer and confirm | | | |
| 1.16.4 | Failure indication | Vendor to offer | | | |
| 1.16.5 | Automatic shut off provision, Details should be submitted. | Vendor to offer | | | |
| 1.16.6 | Hydraulic pump capacity (flow / pressure) to be intimated. | Vendor to inform | | | |
| 1.16.7 | No Tandem pumps should be used. Maximum desired permissible pressure is 100 Kg/sqcm. If anywhere, more than 100 Kg/sqcm pressure is used, then one set of such hose pipes and seal kit of such Hydraulic cylinder should be supplied in spare in addition to other spares. | Vendor to confirm & offer | | | |
| 1.17 | CNC SYSTEM & FEATURES : | | | | |
| 1.17.1 | Make : Fanuc / Siemens. | Vendor to confirm | | | |
| 1.17.2 | Type : PC based latest version | Vendor to confirm | | | |
| 1.17.3 | Model: Sinumerik 840D with PC Version PCU 50, NCU 573.5 or higher with Intel Pentium III, 1GHz, 512 MB SDRAM (or higher), Windows XP Operating System or equivalent Fanuc system. (Latest version, as available at the time of ordering, should be supplied). | Vendor to offer and submit details | | | |
| 1.17.4 | The system should, preferably, have OP 15 Operator's Panel with TFT colour display (15 inch or more), 19 Inch Machine Control Panel , Full CNC Keyboard with Qwerty keys and Mouse/Trackball or equivalent for Fanuc system, RS232-C interface for I/O devices, COM1(V.24), COM (V.24), LPT1 Parrallel Interface for Printer, VGA, MPI interface & USB, 2 Channels and Expansion slots. The operator Panel configuration will be as per Rittal VIP6000 or equivalent. The CNC System shall also have Electronic hand wheels selectable for all axes, USB Port with 1 GB Pen drive (for each machine) for data input/output, Hard disk of 10 GB or higher (Largest size available at the time of order shall be supplied), Graphic Simulation, COM port for telediagnosics, Network ready with LAN and preinstalled system software & other required softwares etc. (Details should be submitted by Vendor) | Vendor to offer and submit details | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---------|--|-----------------------------|---------|-----------|---------|
| 1.17.5 | The CNC System should necessarily have the following features: Access locks on the operator panel, Coordinate System Rotation, Coordinate System Transformation, Look Ahead of Minimum 70 blocks, Helical Interpolation, Scaling, Programmable mirror image machining, Process oriented Canned Cycles for Drilling, Milling & Turning operations, Rigid Tapping and Tool Management. The system shall also have SITOP Power, DC-UPS Module 15 with AKKU module to ensure automatic unattended shutdown of the system in case of power failure or even in normal machine shutdown, Display of PLC ladder on 840D monitor & Simatic S-7 loaded on the hard disk and Display of servo-waveforms on 840D monitor or equivalent features in Fanuc system. | Vendor to offer and confirm | | | |
| 1.17.6 | UPS of 30 minutes for CNC System with inbuilt cooling and charge status display. | Vendor to confirm | | | |
| 1.17.7 | Details of Standard features. List to be submitted. | Vendor to specify | | | |
| 1.17.8 | Features of CNC System required for identified jobs or foreseen by the vendor as required. | Vendor to specify | | | |
| 1.18 | MACHINE NETWORKING | Vendor to confirm | | | |
| 1.18.1 | 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. The following is the details of existing networking in BHEL : a. Base Networking protocol : TCP/IP b. Physical layer connection : 100 Mbps RJ 45 UTP connection. c. Operating system : Windows 2000 / XP and different variants of Unix d. Software for part program transfer : SIN DNC It should cover following features also: | Vendor to offer | | | |
| 1.18.2 | The machine should appear as a node just as any other PC in the entire network (Network Neighbourhood). | Vendor to confirm | | | |
| 1.18.3 | The program transfer should be simple copy & paste method just as it is done in case of PCs. | Vendor to confirm | | | |
| 1.18.4 | The networking should be capable to transfer programs from/to machine across the network in CNC mode. | Vendor to confirm | | | |
| 1.18.5 | The network should be capable to transfer programs with UNIX based stations. | Vendor to confirm | | | |
| 1.18.6 | All necessary Anti-Virus measures shall be incorporated. | Vendor to confirm | | | |
| 1.18.7 | 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 | | | |
| 1.19 | TELE DIAGNOSTIC SERVICE | | | | |
| 1.20 | Tele-diagnostic service should be provided through International telephone lines along with required Hardware / Software for the supplied CNC system to access both CNC and PLC. This should be provided free of charge for the guarantee period. Terms and conditions for the service after guarantee period should be informed by vendor. Help guide should be provided for use of the system/service. | Vendor to confirm | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---------|--|---|---------|-----------|---------|
| 1.21 | FAULT DIAGNOSTIC SYSTEM | | | | |
| 1.21.1 | Supplier's own diagnostic system with required Software and Hardware installed on the CNC system, which shows detailed cause and remedy for the fault on the CNC system display with full video diagnostics indicating the element /device causing the fault. Vendor should also offer a PC note book along with Simatic S7 software (licensed copy), necessary cables, PCMCIA card / Adaptor (for Communication with MPI port) for diagnostic purpose. The Note Book PC should be loaded with complete Electrical Schemes, Mechanical Assembly drawings, Hydraulic Circuit Diagrams, Operation and Maintenance Manuals, Machine Alarm list along with Help text wiring diagram, On-Line display of PLC user should be available on the note book PC. | Vendor to offer | | | |
| 1.21.2 | Provision of OEM Screen with soft keys enabling the service personnel to bring back the tool carriers of the ATC&APC to its initial/nearest position in case of interruption of tool carrier's positioning cycle due to alarm on the machine or power failure. With this OEM screen, service personnel should be able to perform individual steps of Tool carriers positioning cycle manually. Separate Hand Held Pendent should also be provided to retrieve the tool carrier to its initial position. | Vendor to offer | | | |
| 1.21.3 | Machine should have provision to switchover from position feedback system -2 (direct) to Position feed back system-1 (Motor encoder) through PLC program (for service personnel only). | Vendor to offer | | | |
| 1.21.4 | DIAGNOSTIC SYSTEM.: Machine should be equipped with help texts for all type of alarms and messages .This page must contain the probable reasons,remedial action to be taken,location and circuit reference. | Vendor to offer | | | |
| 1.22 | VOLTAGE STABILIZER: | | | | |
| 1.22.1 | Power Supply will be provided by BHEL at a single point near the machine, as per layout recommended by Vendor. All types of cables, connections, circuit breakers etc. required for connecting BHEL's power supply point to different parts of the machine, Voltage Stabilizer, Isolation Transformer, control cabinets etc. shall be supplied by the vendor. A suitable servo-controlled voltage stabilizer of either NEEL/SUVIK/Servomax/Automatic Electric-make (All these are Indian Make) and of appropriate rating shall be supplied and connected to the machine by the vendor. The Oil / Air Cooled Servo Controlled Voltage Stabilizer (of reputed Indian make) should be suitable for the complete machine, its drives, controls, PLC etc. for unbalanced load & supply conditions considering specified power supply & ambient conditions.Catalogue of the same shall be submitted along with the offer. | Vendor to inform along with make , model and technical details | | | |
| 1.22.2 | The offer should be submitted with spares package (Variacs-2 nos., Correcting servomotors-4 nos., Control cards-2 nos) required for long term maintenance of this stabilizer. | Vendor to offer | | | |
| 1.22.3 | Make | NEEL, Aplab or Auto Electric | | | |
| 1.22.4 | Model, Rating & Input/Output Voltage etc. | Vendor to inform with technical details. | | | |
| 1.22.5 | Monitoring device with cutoff facility for under/over output voltage, Devices for load current measurement, MCCB at input for overload/short circuit protection. (Details to be submitted) | Vendor to inform with technical details. | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---------|--|-----------------------------|---------|-----------|---------|
| 1.22.6 | 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 inform and offer. | | | |
| 1.23 | ULTRA ISOLATION TRANSFORMER | | | | |
| 1.23.1 | Ultra Isolation Transformer (of reputed Indian make like NEEL/SUVIK/SERVOMAX/AUTOMATIC ELECTRIC) suitable for complete machine , its drives, controls, PLC etc. for unbalanced load & supply conditions considering specified power supply & ambient conditions. | Vendor to offer | | | |
| 1.23.2 | Make | Vendor to inform | | | |
| 1.23.3 | Model, Rating & Input/Output Voltage etc. | Vendor to inform | | | |
| 1.24 | SPARES: | | | | |
| 1.24.1 | Following spare parts of electrical/electronics and CNC system shall be offered itemwise per machine: | | | | |
| 1.24.2 | PCU-50 with system software and hard disk- 1 No. | Vendor to offer | | | |
| 1.24.3 | Operator panel with OP-15A, 15" colour flat screen- 1 No. | Vendor to offer | | | |
| 1.24.4 | Portable 40 GB hard disk with USB interface - 1 No. | Vendor to offer | | | |
| 1.24.5 | Portable Floppy Drive 1 Nos. | Vendor to offer | | | |
| 1.24.6 | NCU (as used in the machine) module with NCU box having fan and battery- 1 No. | Vendor to offer | | | |
| 1.24.7 | PLC input and output cards- 1 No. each type (Digital, fast I/O & analogue) | Vendor to offer | | | |
| 1.24.8 | 19" Machine Control Panel- 1 No. | Vendor to offer | | | |
| 1.24.9 | I/R Module for 611D/U and Power Modules for Spindle X-axis, Y-axis, Z-axis and B-axis - 1 No. each | Vendor to offer | | | |
| 1.24.10 | Complete position feed back system including linear scales & Heidenhain Transducer (Scanning Head) for X-axis, Y-axis, Z-axis, Heidenhain encoder for the table - 1 No. each | Vendor to offer | | | |
| 1.24.11 | SIEMENS UPS SITOP DC-USV-Module 15 with AKKU -1 No. | Vendor to offer | | | |
| 1.24.12 | Profibus control components-1 No. each type | Vendor to offer | | | |
| 1.24.13 | Control Card of 611D- 1 No. each type | Vendor to offer | | | |
| 1.24.14 | Filter and Choke Module-1 No. | Vendor to offer | | | |
| 1.24.15 | Simatic net card used for external PLC (if applicable) -1 No. | Vendor to offer | | | |
| 1.24.16 | External PLC CPU if used in the machine-1 No. | Vendor to offer | | | |
| 1.24.17 | Following spare parts shall be offered as essential spares for the machine | | | | |
| 1.24.18 | Proportional Control Valve Controller 2 Nos. each type(if applicable) | Vendor to offer | | | |
| 1.24.19 | All proximity switches used in the machine- 1 No. each type | Vendor to offer | | | |
| 1.24.20 | Set of Push Buttons- 1 No. each type | Vendor to offer | | | |
| 1.24.21 | Set of Indicating Lamp- 10 Nos each type | Vendor to offer | | | |
| 1.24.22 | Set of Contactors- 2 Nos. EACH TYPE | Vendor to offer | | | |
| 1.24.23 | Set of Overloads/ Automats- 1 No. each type | Vendor to offer | | | |
| 1.24.24 | Machine Status Indicating Lamp (Complete unit) - 1 No | Vendor to offer | | | |
| 1.24.25 | Axis Servo motors - 1 No. each type . | Vendor to offer | | | |
| 1.24.26 | Spares Package for Tool Monitoring System | Vendor to offer | | | |
| 1.24.27 | Spindle motor with encoder - 1 No. | Vendor to offer | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---------|---|---------------------|---------|-----------|---------|
| 1.24.28 | Spares Package for all Accessories | Vendor to offer | | | |
| 1.24.29 | All types of spares for total machine and accessories should be available for atleast ten years after supply of the machine. If machine or control is likely to become obsolete in this period, the vendor should inform BHEL sufficiently in advance and provide drawings of parts / details of spares & suppliers to enable BHEL to procure these in advance, if required. | Vendor (to confirm) | | | |
| 1.24.30 | Repair service contract with supplier of CNC system for service & spares for motor drives, CNC Unit and Milling Spindle should also be offered by the vendor. | Vendor to offer | | | |
| 1.24.31 | Vendor to confirm that complete list of spares for machine and accessories, along with specification / type / model, and name & address of the spare supplier shall be furnished along with documentation to be supplied with the machine. | Vendor (to confirm) | | | |
| 1.24.32 | Mechanical, Hydraulic, Electrical and Electronic spares used on the machine, with item-wise breakup, are to be recommended and offered by the vendor in sufficient quantity for 2 years trouble free operation of the complete machine including CNC system and its accessories 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. The offered package should include items mentioned below, in addition to other recommended spares. | Vendor to offer | | | |
| 1.24.33 | Mechanical , Hydraulic & Lubrication System Spares: * Main Machine Spindle- 1 No. * All types/varieties of pumps used on machines i.e.Hydraulic, lubrication, coolant and oil cooling pumps (1 No. each type) * All types of D.C. Control valves (1 No.. each type) * All types of flow control, pressure regulators, pressure reducer valves, coolant gun, Nozzles used on m/c. (1 No. each type) * All types of pressure switches, flow switches and float switches (2 No.. each type) * All types of Pressure Gauges (1 No. each type) * All types of filter inserts (2 nos. each of regenerative type &5 nos. each of disposal type) * Shaft seals (1 No.. each type) * O-Rings and Piston rings (2nos. of each type) * Accumulator with charging kit if the same is used in the m/c (1 no each type) * All types of pneumatic valves (1 No.. of each type) * All types of Hydraulic Hoses (1 No.. of each type) | Vendor to offer | | | |
| 1.24.34 | * Bearings (3 sets) *All types of Belts (2 Nos. each type) * Flexible Bellow Cover (1 No.. each type) * Special Oil/ Grease/ Cooling Agent (if any)- Sufficient qty. for 1 year (operatio on 3 shift basis. * Hydro Motor (1 No. each type) * Coiled Flexible air/coolant pipes (1 No. each type) | Vendor to offer | | | |
| 1.24.35 | COOLANT & PNEUMATIC SYSTEM: Spare for Coolant Filtration System comprising Filter Drum (1 No.), All types of Pumps (1 No.. Each type), All types of Valves (1 No. each type), Alltypes of Pressure Switches (1 No. Each type), All types of Pressure Gauges (1 No. Each Type), All types of Filter Cartidges (2 Nos. Each type), All types of Air Pressure Regulators (1 No. Each type), | Vendor to offer | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---------|---|--|---------|-----------|---------|
| 1.24.36 | Additionally the vendor shall recommend essential spare package for 2 years 3 shift trouble free working of the machine with detailed list along with item wise price in commercial offer, specification and source of supply. | Vendor to offer | | | |
| 1.24.37 | All the spares should be offered individually priced. | | | | |
| 1.25 | DOCUMENTS: | | | | |
| 1.25.1 | 3 hard copies of all Siemens programming (Basic and Advance), Cycles, Tool management etc. and all operational manuals shall be supplied in English language. | Vendor to offer | | | |
| 1.25.2 | Following manuals/diagrams/ list/ specifications shall be supplied in English language along with the machine documentation: | Vendor to offer | | | |
| 1.25.3 | Basic Machine operation and maintenance/ service manual - 3 copies | Vendor to offer | | | |
| 1.25.4 | Electrical schematic & wiring diagram of the machine- 3 copies | Vendor to offer | | | |
| 1.25.5 | PLC print-out in Operand form with comments in English- 3 copies | Vendor to offer | | | |
| 1.25.6 | GHOST back up of PCU-50 hard disk on CD | Vendor to offer | | | |
| 1.25.7 | Complete list of parts used in the machine along with specification, part/ ordering numbers and address of manufacturer in case of purchased item- 3 copies. | Vendor to offer | | | |
| 1.25.8 | Detailed assembly drawing with clear marking of each component and giving reference of manufacturer of each assembly/sub-assembly- 3 copies. | Vendor to offer | | | |
| 1.25.9 | Hydraulic, Pneumatic, Lubrication and Coolant circuit diagram along with part list, complete specification and make of each element used – 3 copies. | Vendor to offer | | | |
| 1.25.10 | Wiring diagram indicating lay out of cables, plugs, junction boxes, terminal strips etc.- 3 sets | Vendor to offer | | | |
| 1.25.11 | List of all bearings, L.M. guides, ball bushings etc. with full specification and make.- 3 sets. | Vendor to offer | | | |
| 1.25.12 | Alarm list and fault diagnostic manual- 3 sets | Vendor to offer | | | |
| 1.25.13 | Spare part list along with specification, part number and address of manufacturers- 3 sets. | Vendor to offer | | | |
| 1.25.14 | Service and user manuals of all bought out items- 3 sets. | Vendor to offer | | | |
| 1.25.15 | CDs of provided control system documentation. | Vendor to offer | | | |
| 1.25.16 | 840D documents comprising Operating manuals, Signals, Interfacing and diagnostic guide- 1 set | Vendor to offer | | | |
| 1.25.17 | Help guides for tele-diagnostic service systems- 3 sets | Vendor to offer | | | |
| 1.25.19 | All O&M manuals including electrical schematic ,wiring diagram,cable layout,junction box details and connector diagrams soft copy on CD-3nos. | | | | |
| 1.25.20 | Vendor to submit one set of all documents in best available condition one month prior to training cum pre acceptance of BHEL Engineers. | Vendor to confirm | | | |
| 1.26 | TOOLING PACKAGE | | | | |
| 1.26.1 | The Vendor to offer tooling package consisting of all toolongs i.e. cutting tools , tool holders & standard clamping kit (capable of clamping variety of tooling components) for machining of following components. The tooling package should also contain sufficient number of consumables (inserts, Screws, Shims etc as well as Solid Carbide Tools) to machine the quantity of componenets mentioned below against each component. Item wise price shall be clearly indicated in the price bid. Detailed drawing /catalogue of all the toolings are to be supplied in the event of order (in 3 sets). | Vendor to Confirm and offer. Details to be finalized during technical discussion | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---------|---|---|---------|-----------|---------|
| 1.26.2 | Drawing No. R7757-0240/009 Qty. 1 No. | Vendor to offer | | | |
| 1.26.3 | Drawing No. R7762-1587/009 Qty. 1 No. | Vendor to offer | | | |
| 1.26.4 | Drawing No. R7762-1587/013 Qty. 1 No. | Vendor to offer | | | |
| 1.26.5 | Drawing No. R7845-1065 Qty. 1 No. | Vendor to offer | | | |
| 1.27 | MANUAL CONTROL : | | | | |
| | 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 confirm. Layout of panel showing requisite switches to be submitted. | | | |
| 1.28 | TROPICALISATION | | | | |
| 1.28.1 | All electrical / electronic equipment shall be tropicalized. | Vendor to confirm | | | |
| 1.28.2 | All electrical & electronic control cabinets & panels should be dust and vermin proof. | Vendor to confirm | | | |
| 1.28.3 | All electrical components in the cabinets should be mounted on DIN Rail. | Vendor to confirm | | | |
| 1.28.4 | All electrical / electronic panels to be provided with adequate door locks. All electrical & electronic panels including operator's panel should have sufficient illumination and power receptacles/plug points of 220Volts, 5/15 Amp AC with on/off switch. All electrical adapters/receptacles, fittings, consumables etc. should be compatible with Indian equivalents. | Vendor to confirm | | | |
| 1.28.5 | All motors shall conform to IEC or Indian Standards | Vendor to confirm | | | |
| 1.28.6 | All cables moving with traversing axes should be installed in caterpillar / Drag chain. Additionally, all the cable trays/chains etc. required for laying of cables should be included in the offer. | Vendor to confirm | | | |
| 1.28.7 | Vendor should ensure the proper earthing for the machine and its peripherals/accessories. Any material requirement for the same should be informed with foundation design/drawings. The vendor can take earthing connection from the nearest available location of the production shop. | Vendor to confirm | | | |
| 1.29 | OPERATING CONDITIONS & THERMAL STABILITY : | | | | |
| 1.29.1 | Power Supply (AC): Voltage = 415V +10% / -10% of fluctuations , Frequency= 50Hz +3 / -3 , No. of phases = 3 phase with neutral. Ambient Operating Conditions: Temperature = 5 to 45 degree Celsius , Relative Humidity = 95% max. | Vendor to accept & confirm | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---------|--|----------------------------|---------|-----------|---------|
| 1.29.2 | 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 20 deg Celsius in 24 hours. (Vendor to confirm that machine is suitable for above and details of provisions on the machine for the same are to be furnished by Vendor) | Vendor to accept & confirm | | | |
| 1.29.3 | 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 | Vendor to accept & confirm | | | |
| 1.29.4 | 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 accept & confirm | | | |
| 1.30 | SAFETY ARRANGEMENTS | | | | |
| 1.30.1 | Following safety features in addition to other standard safety features should be provided on the machine: | Vendor to confirm | | | |
| 1.30.2 | 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 | | | |
| 1.30.3 | A detailed list of all alarms / indications provided on machine should be submitted by the supplier. | Vendor to confirm | | | |
| 1.30.4 | 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 confirm | | | |
| 1.30.5 | All the rotating parts used on machine should be statically & dynamically balanced to avoid undue vibrations & noise. | Vendor to confirm | | | |
| 1.30.6 | Emergency Switches at suitable locations as per International Norms should be provided. | Vendor to confirm | | | |
| 1.30.7 | Oil & water pipe lines should not run with electrical cable in the same tray/trench. | Vendor to confirm | | | |
| 1.31 | ENVIRONMENTAL PERFORMANCE OF THE MACHINE | | | | |
| 1.31.1 | The Machine should conform to following factors related to environment : | | | | |
| 1.31.2 | Maximum noise level shall be 85 dB (A) at 1 meter away from the machine with correction factor for back ground noise, if necessary. This will be measured as per international standards like DIN 45635-16. Supplier to demonstrate compliance to noise level, if asked for. | Vendor to confirm | | | |
| 1.31.3 | There shall not be any emissions from the machine. All fumes etc. during machining shall be arrested by Fume extraction system mentioned at point 1.15 and 1.15.1 | Vendor to confirm | | | |
| 1.31.4 | 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 | | | |
| 1.31.5 | No hazardous chemicals shall be required to be used in the machine. | Vendor to confirm | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---------|--|-------------------------------|---------|-----------|---------|
| 1.31.6 | If any safety / environmental protection enclosure is required it should be built in the machine by the vendor. | Vendor to confirm | | | |
| 1.31.7 | Paint of the machine should be oil / coolant resistant and should not get peeled off and mixed up with coolant. | Vendor to confirm | | | |
| 1.32 | ACCURACY TESTS | | | | |
| 1.32.1 | Geometrical Accuracy Tests shall be in accordance with relevant & prevailing international standards viz. ISO 1708 or equivalent applicable standard. Detailed Test Charts for the same, clearly showing the accuracies to be achieved on the machine, shall also be submitted with the offer. | Vendor to confirm and submit. | | | |
| 1.32.2 | All the Geometrical accuracies including test pieces machining, NAS test piece machining, etc. should be demonstrated to BHEL engineers during pre-acceptance at Supplier's works. The repeat test of the geometrical accuracies shall also be demonstrated at BHEL Hardwar, the same shall have to be arranged by the vendor. Test pieces are to be supplied by vendor. Drawings of test pieces to be submitted with the offer. | Vendor to confirm and submit. | | | |
| 1.33 | GEOMETRICAL ACCURACIES : | | | | |
| 1.33.1 | Submit test chart for all accuracies as per DIN 8609/ ISO 10791 standard or equivalent applicable standard. | Vendor to confirm | | | |
| 1.33.2 | All the above accuracies should be demonstrated to BHEL engineers during pre-acceptance at supplier's works and during erection & commissioning at BHEL works. | Vendor to confirm | | | |
| 1.33.3 | MACHINE POSITIONING ACCURACIES & REPEATABILITY:Should be measured as per VDI/DGQ 3441 (Latest Revision) using LASER INTERFEROMETER. | Vendor to confirm | | | |
| 1.33.4 | Positioning accuracy in X / Y axis (Pa) per 1000 mm | Vendor to inform | | | |
| 1.33.5 | Positioning accuracy in Z axis (Pa) per 1000 mm | Vendor to inform | | | |
| 1.33.6 | Repeatability in X / Y/Z axis (Ps) | Vendor to inform | | | |
| 1.33.7 | NAS- Test Piece machining | Vendor to confirm | | | |
| 1.33.8 | Positioning accuracy over entire traverse in X / Y axis (Pa) | vendor to inform | | | |
| 1.33.9 | Positioning accuracy over entire traverse in Z axis (Pa) | vendor to inform | | | |
| 1.33.10 | All the Positioning and Repeatability accuracies should be demonstrated to BHEL engineers during pre-acceptance at Suppliers works and again during Erection & Commissioning at BHEL Works. | Vendor to confirm | | | |
| 1.34 | LEVELING & ANCHORING SYSTEM | | | | |
| | Complete set of anchoring materials including foundation bolts, nuts, washers, fixators, leveling shoes etc for alignment and fixing of the machine on the floor should be supplied. Details to be submitted. | Vendor (to offer) | | | |
| 1.35 | TOOLS FOR ERECTION, OPERATION & MAINTENANCE | | | | |
| 1.35.1 | Tools and Equipment required for erection of the machine shall be brought by the vendor. Necessary tools like Torque Wrench, Spanners, Keys, grease guns etc. required for operation and maintenance of the machine should also be supplied by the vendor. List of such tools should be submitted with offer. | Vendor (to offer) | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---------|--|----------------------------|---------|-----------|---------|
| 1.35.2 | Set of Test Mandrels/Special Gauge for checking spindle run-out & alignment of headstock/tailstock etc. should be brought by the vendor. | Vendor to confirm | | | |
| 1.36 | FOUNDATION | | | | |
| 1.36.1 | Vendor shall submit the preliminary layout drawing for getting BHEL's approval within one month from the date of Letter of Intent (LOI) or Purchase Order, whichever is earlier. Complete Foundation Design including details viz. static / dynamic load details etc. and final layout drawings shall be submitted by the supplier within three months after getting BHEL's approval for Preliminary layout Drgs. The layout should consist of all requirements pertaining to complete machine including space requirement for Voltage Stabilizer, Isolation Transformer, Air dryer, Chip Bin & all other accessories/offered items. The vendor shall provide an optimised layout of the offered machines. BHEL shall construct complete foundation for the machine under supervision of supplier and at supplier's responsibility. Vendor should arrange equipments required for the testing of foundation, if required by the vendor. The vendor shall also indicate detailed specifications of grouting compound and grouting procedure etc. for foundation bolts of the machine. | Vendor to accept & offer. | | | |
| 1.36.2 | Tenative Soil condition data at BHEL, Hardwar is as detailed below: a) The value of allowable bearing capacity is 11 t/m ² (Lowest obtained from shear and settlement criteria at 4.2m depth). The gross value of bearing capacity may be adopted as 17t/m ² for an assumed footing size of 4m x 6m at a depth of 4.2m. b) The value of Angle of Internal Friction () may be adopted as 32deg at 4.2m depth. c) The Coefficient of Elastic Uniform Compression (Cu) may be adopted as 3.0 kg/cm ³ at 4.2m depth for 10m ² or more contact area of foundation. | For vendor's information. | | | |
| 1.37 | TRAINING | | | | |
| 1.37.1 | BHEL Persons should be trained at vendor's works for mutually agreed period in the area of (a) CNC Part Programming, Use of all CNC Features, Machining Technology of the Proveout Component 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 equipment. Vendor should provide training of Electronics Engineer and Programmer at the CNC System Manufacturer's works for Advanced features and specialized training. Party should arrange 840 D Advance system training for CNC Service personnel at Siemens training centre in India. | Vendor (to offer) | | | |
| 1.37.2 | Air-fare, boarding & lodging for the trainees shall be borne by BHEL. | For vendor's information. | | | |
| 1.37.3 | Competent, English speaking experts shall be arranged by the vendor for satisfactory & effective training of BHEL personnel. | Vendor to accept & confirm | | | |
| 1.38 | MACHINE PRE-ACCEPTANCE AT VENDOR'S WORKS | | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---------|---|----------------------------|---------|-----------|---------|
| 1.38.1 | BHEL persons deputed for training will be doing pre-acceptance at vendor's works and give dispatch clearance after satisfaction from all angles. During pre-acceptance, all accuracy tests mentioned at point number 1.33 (including sub-clauses) shall be witnessed by the team. Also during pre-acceptance, vendor shall have to machine any one type of mutually agreed component from the list of drawings mentioned at 1.26.2 to 1.26.5 on a block of Material similar to material indicated in component Drawing (Point no 1.26.2 to 1.26.5) in the presence of BHEL representatives and submit 3D Co-ordinate Measuring Machine reports for machined components. | Vendor to accept & confirm | | | |
| 1.38.2 | Raw material , Fixturing , Consumables for cutting tools for machining of components during Pre-acceptance shall be supplied by the Vendor. Consumables used for pre-acceptance shall be quoted separately. | Vendor to accept & confirm | | | |
| 1.39 | ERECTION & COMMISSIONING | | | | |
| 1.39.1 | Supplier to take full responsibility for carrying out the erection, start up, testing of machine, it's control & all types of other supplied equipment/accessories, machining of test pieces etc. Service requirement like power, air & water shall be provided by BHEL at only one point to be indicated by supplier in their foundation/layout drawings. Other requirements like crane(capacity of EOT Crane in the shop is 10 Ton only) and helping personnel shall also be provided by BHEL. Details of these requirements should be informed/discussed by vendor and agreed with BHEL in advance. In case crane of higher capacity is required, representative of vendor to hire mobile crane from local sources. Compressed air pressure available in the shop is 5.0 Kg/Cm ² . If the required compressed air pressure for operating of the machine is more than the stated pressure , the vendor to quote suitable compressor (of Indian make preferable) as an optional item. | Vendor to confirm & offer | | | |
| 1.39.2 | Erection & Commissioning of Voltage stabilizer, Isolation Transformer , Air Dryer and other accessories with all electrical & mechanical connections shall also be responsibility of the vendor. | Vendor to offer | | | |
| 1.39.3 | Successful proving of BHEL components by the supplier shall be considered as part of commissioning. All tests, as mentioned at Sl. No. 1.32, 1.33 and testing/demonstration of tele diagnostic service shall also be part of the commissioning activity. | Vendor to confirm | | | |
| 1.39.4 | Tools, Tackels, Test Mandrels, instruments and other necessary equipment (including Laser equipment, if required) required to carry out all erection & commissioning activities should be arranged and brought by the supplier. | Vendor to confirm | | | |
| 1.39.5 | Commissioning spares, required for commissioning of the machine within stipulated time, shall be brought by the supplier on returnable basis. | Vendor to confirm | | | |
| 1.39.6 | Broad Schedule of Erection and Commissioning shall be submitted with the offer. | Vendor to submit | | | |
| 1.39.7 | Charges, duration, terms & conditions for Erection & Commissioning should be furnished in detail separately by vendor along with offer. | Vendor to offer | | | |
| 1.39.8 | Portion, if any, of the machine, accessories and other supplied items where paint got rubbed or peeled off during transit or erection should be repainted and matched with the original adjoining paint by the vendor. For this purpose, the vendor should supply sufficient quantity of touch-up paint of various colours/shades of paints used. The vendor shall ensure performing touching after commissioning but before final acceptance. | Vendor to confirm | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---------|--|-----------------------------|---------|-----------|---------|
| 1.40 | PROVE OUT OF BHEL COMPONENTS | | | | |
| 1.40.1 | Drawing nos. mentioned in 1.26.2 to 1.26.5 will be proveout component. These Drawings are enclosed. <i>Job setting plan, Machining process plan & Requirement of Tools etc. for machining of proveout components shall be discussed and mutually agreed with vendor (Final proveout component drawing no. may change, however, the machining features of the changed components shall be in line with the original component drawing).</i> 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 proveout components shall be provided by BHEL. <i>Vendor shall submit final job setting plan, machining process plan, tool layout & list with complete description, time study etc. for the proveout machining within two months of placement of order.</i> | Vendor to confirm & offer | | | |
| | Vendor shall submit CNC programs prior to start of erection of Machine at BHEL works. Vendor shall be fully responsible for machining of proveout components as per drawing and other requirements specified by BHEL to the full satisfaction of BHEL. Clarifications, if any required by vendor, regarding accuracy requirements of the proveout components, whether specified or not, should be discussed and cleared by vendor during initial technical discussions. | Vendor to accept & confirm. | | | |
| 1.40.2 | Vendor shall be responsible for any deviation/rejection in proveout component due to wrong machining or malfunctioning of the machine during proveout machining and also for the delay in machining due to improper recommended tooling etc.. Any change in tooling during proveout shall be at the responsibility and cost of the vendor. The vendor shall supply the toolings changed at proveout stage as per quantity mentioned under the heading of 'Tooling Package'. | Vendor to accept & confirm. | | | |
| 1.41 | FINAL MACHINE ACCEPTANCE | | | | |
| 1.41.1 | Final acceptance shall be made by BHEL Hardwar after completion of following activities: | | | | |
| 1.41.2 | Demonstration of specified/offered Geometrical accuracies as per test chart/standard after machine commissioning | Vendor to accept & confirm. | | | |
| 1.41.3 | Demonstration of specified/offered Positioning accuracies as per VDI-DGQ/3441 and specified values after machine commissioning | Vendor to accept & confirm. | | | |
| 1.41.4 | Demonstration of all features of the machine, control system & accessories to the satisfaction of BHEL for efficient and effective use of the machine along with demonstration of Machine networking as indicated at point no: 1.18.7 | Vendor to accept & confirm. | | | |
| 1.41.5 | Machining of test piece as per international standard, NAS test piece machining. Vendor to supply test pieces. | Vendor to accept & confirm. | | | |
| 1.41.6 | Training of BHEL machine operators in operation of complete machine, software & accessories etc by the supplier's experts / engineers during their stay at BHEL works. | Vendor to accept & confirm. | | | |
| 1.41.7 | Prove out of BHEL components as per contract agreement. | Vendor to accept & confirm. | | | |
| 1.41.8 | One Week supervision after successful prove out. | Vendor to accept & confirm | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|---------|---|-----------------------------|---------|-----------|---------|
| 1.42 | PACKING | | | | |
| | 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 offer | | | |
| 1.43 | GUARANTEE | | | | |
| | Guarantee for complete machine,CNC Control, softwares and all supplied accessories/equipments for 24 months from the date of final acceptance of the machine. Any spare required during guarantee period shall have to be arranged by the vendor free of cost and duty levied have to be borne by the vendor. | Vendor to confirm & offer | | | |
| 1.44 | COLOUR OF THE MACHINE | | | | |
| | Painting of Machine / Electrical Panels : RAL 6011 Apple Green (Polyurethane Paint) | Vendor to offer | | | |
| 2.0 | ADDITIONAL INFORMATION | | | | |
| 2.1 | Following information shall be supplied with the offer: | | | | |
| 2.2 | Machine Model No. | Vendor to inform | | | |
| 2.3 | Total connected load (KVA) | Vendor to inform | | | |
| 2.4 | Space required (Length, Width, Height) for complete machine & accessories | Vendor to inform | | | |
| 2.5 | Catalogue of the machine | Vendor to submit | | | |
| 2.6 | Total weight of the machine | Vendor to inform | | | |
| 2.7 | Weight of heaviest part of machine | Vendor to inform | | | |
| 2.8 | Weight of the heaviest assembly of the Machine | Vendor to inform | | | |
| 2.9 | Dimensions of largest part of the machine | Vendor to inform | | | |
| 2.10 | Detailed catalogues , sketch/ photographs of the m/c and accessories/ attachments should be submitted with the offer. | Vendor to confirm | | | |
| 2.11 | Hydraulic, Pneumatic & oil pipings should be preferably metallic except places where flexible pipings are essential.All the pipes required for the same shall be included in the standard scope of the machine. | Vendor to confirm | | | |
| 3.0 | SAFETY ARRANGEMENTS: | | | | |
| | Following safety features in addition to other standard safety features should be provided on the machine: | Vendor to comply | | | |
| | 1.Machine should have adequate and reliable safety interlocks / devices to avoid damage to the machine, workpiece and the operator due to the malfunctioning or mistakes. Machine | Vendor to comply | | | |
| | 2. A detailed list of all alarms / indications provided on machine should be submitted by the supplier. | Vendor to comply | | | |
| | 3. All the pipes, cables etc. on the machine should be well supported and protected. | Vendor to comply | | | |
| | 4. All the rotating parts used on machine should be statically & dynamically balanced to avoid undue vibrations. | Vendor to comply | | | |
| | 5. Emergency Switches at suitable locations as per International Norms are to be provided. | Vendor to comply | | | |
| | 6. Oil & water pipe lines should not run with electrical cable in the same tray / trench. | Vendor to comply | | | |
| | 7. Safety Lights at both ends of moving column (preferably Flashing during X-travel). | Vendor to comply | | | |
| 4.0 | GENERAL INFORMATION | | | | |
| | All the information and drawings attached with tender document are exclusive property of BHEL Hardwar. Under no circumstances these should be passed to any third party without prior permission of BHEL and must not be used directly or indirectly detrimental to the interest of BHEL. | Vendor to accept & confirm. | | | |

| SL. NO. | DESCRIPTION OF BHEL REQUIREMENT | REQUIRED | OFFERED | DEVIATION | REMARKS |
|--|--|----------------------------|---------|-----------|---------|
| 5.0 | QUALIFYING CONDITIONS | | | | |
| 5.1 | Only those vendors (OEMs), who have supplied and commissioned at least one CNC Vertical Machining Center of same (Table size , Traverses, Spindle power & torque at 100% rating, Load Capacity) | Vendor to accept & confirm | | | |
| | or higher sizes for in the past ten years (on the date of opening of Tender) and referred machine is presently working satisfactorily for more than one year (on the date of opening of Tender) after commissioning, should quote. However, if referred machine (s) has/had been supplied to BHEL, then the machine should be presently working satisfactorily for more than six months (on the date of opening of Tender) after its commissioning and acceptance in BHEL. The following information should be submitted by the vendor about the companies where referred machines have been supplied. This is required from all the vendors for qualification of their offer. | | | | |
| 5.2 | Name of the customer / company where referred machine is installed. | Vendor to inform | | | |
| 5.3 | Complete postal address of the customer. | Vendor to inform | | | |
| 5.4 | Month & Year of commissioning. | Vendor to inform | | | |
| 5.5 | Parameters of machine(s) supplied (Table Size, Traverses,, Spindle power & torque, Load Capacity) and application for which the machine is supplied.” | Vendor to inform | | | |
| 5.6 | Name and designation of the contact person of the customer | Vendor to inform | | | |
| 5.7 | Phone, FAX no. and email address of the contact person of the customer. | Vendor to inform | | | |
| 5.8 | Performance certificate from the customer regarding satisfactory performance of machine supplied to them (Original Certificate or Through E-mail directly from the customer). The original performance certificate may be returned after verification by BHEL, if required.” | Vendor to accept & confirm | | | |
| 5.9 | 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. | | | | |
| (P.K.Gupta/DGM-TRP g,TE &Tech) (S.K.Malhotra/DGM-TR Shop) (S.K.Shukla/SDGM-WEX-CNC (N.Halder/DGM-WEX-M) | | | | | |

INVENTORY NO. SIGN & DATE

REF. DRG. NO.

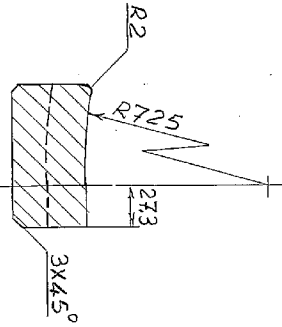
COPYRIGHT AND CONFIDENTIAL
THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED IT MUST NOT BE
USED DIRECTLY OR INDIRECTLY IN ANYWAY DETRIMENTAL TO THE INTEREST OF THE COMPANY1107A60010720-5542R
ON 01/11/2013

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN mm)

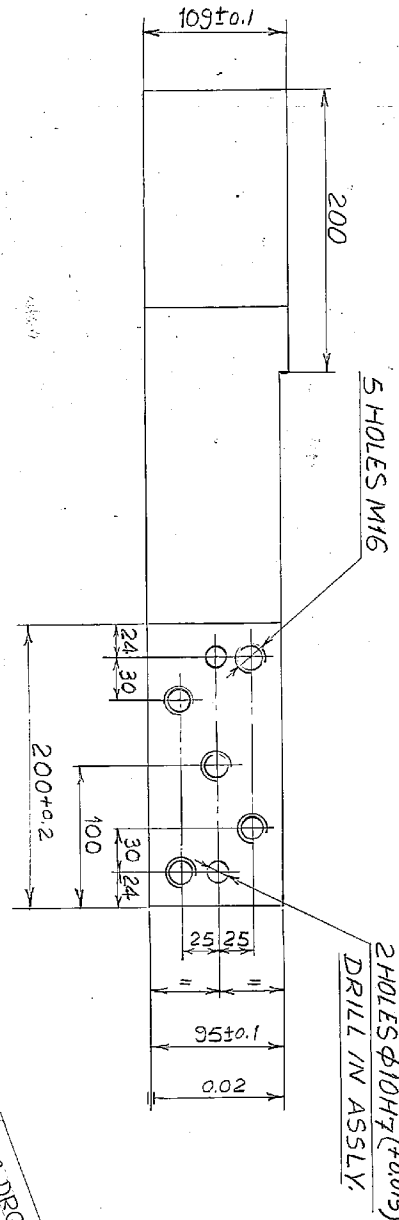
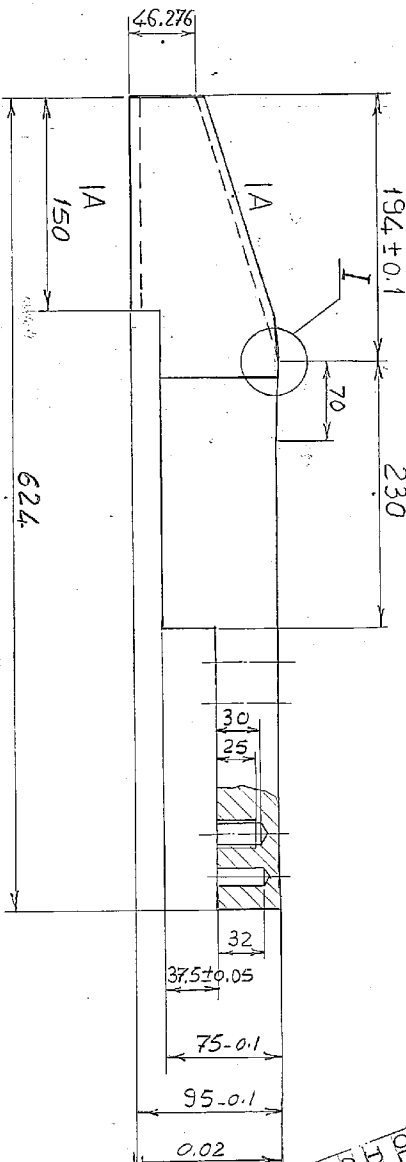
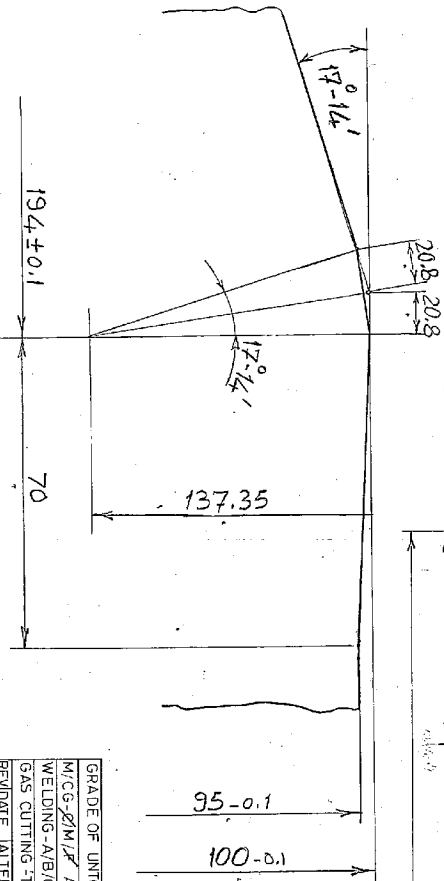
2

FORM DG 44B

A-A



DETAIL - I



THIS DRG. SUPERSEDES
OLD DRG. UNDER SAME
DRG. NO. JTE/1603045
CHADY NO. DATE: 10-11-03
SIGN. LINE

1. 3 NOS TO BE MADE AS SHOWN R7757-0240/011.
2. 3 NOS TO BE MADE MIRROR IMAGE. R7757-0240/009.

GRADE OF UNTOL. DIM. —
M/C-G-20M/P AA 0230208
WELDING-A/B/C/DAA0621104
GAS CUTTING-F13 AA0621101

REV. DATE ALTERED
03/10/10 CHECKED
ZONE JTE/1603045

DEPT. JTE
CODE 209
TITLE
SIDE BLOCK
UPPER BAR

CARD
R7757-0240/009
SHEET NO. 1 OF 1

| VAR. NO. | REMARKS | ITEM NO. | DESCRIPTION | DRAWING NO. | MATERIAL CODE | UNIT WEIGHT | VAR. MATERIAL SPEC. | CARD TYPE-1 | CARD TYPE-2 |
|----------|---------|----------|-------------|-------------|---------------|-------------|---------------------|-------------|-------------|
| 15 | 54, 65 | 15 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 16 | 54, 65 | 16 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 17 | 54, 65 | 17 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 18 | 54, 65 | 18 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 19 | 54, 65 | 19 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 20 | 54, 65 | 20 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 21 | 54, 65 | 21 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 22 | 54, 65 | 22 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 23 | 54, 65 | 23 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 24 | 54, 65 | 24 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 25 | 54, 65 | 25 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 26 | 54, 65 | 26 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 27 | 54, 65 | 27 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 28 | 54, 65 | 28 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 29 | 54, 65 | 29 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 30 | 54, 65 | 30 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 31 | 54, 65 | 31 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 32 | 54, 65 | 32 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 33 | 54, 65 | 33 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 34 | 54, 65 | 34 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 35 | 54, 65 | 35 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 36 | 54, 65 | 36 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 37 | 54, 65 | 37 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 38 | 54, 65 | 38 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 39 | 54, 65 | 39 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 40 | 54, 65 | 40 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 41 | 54, 65 | 41 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 42 | 54, 65 | 42 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 43 | 54, 65 | 43 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 44 | 54, 65 | 44 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 45 | 54, 65 | 45 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 46 | 54, 65 | 46 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 47 | 54, 65 | 47 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 48 | 54, 65 | 48 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 49 | 54, 65 | 49 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 50 | 54, 65 | 50 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 51 | 54, 65 | 51 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 52 | 54, 65 | 52 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 53 | 54, 65 | 53 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 54 | 54, 65 | 54 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 55 | 54, 65 | 55 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 56 | 54, 65 | 56 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 57 | 54, 65 | 57 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 58 | 54, 65 | 58 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 59 | 54, 65 | 59 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 60 | 54, 65 | 60 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 61 | 54, 65 | 61 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 62 | 54, 65 | 62 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 63 | 54, 65 | 63 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 64 | 54, 65 | 64 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 65 | 54, 65 | 65 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 66 | 54, 65 | 66 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 67 | 54, 65 | 67 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 68 | 54, 65 | 68 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 69 | 54, 65 | 69 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 70 | 54, 65 | 70 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 71 | 54, 65 | 71 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 72 | 54, 65 | 72 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 73 | 54, 65 | 73 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 74 | 54, 65 | 74 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 75 | 54, 65 | 75 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 76 | 54, 65 | 76 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 77 | 54, 65 | 77 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 78 | 54, 65 | 78 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 79 | 54, 65 | 79 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 80 | 54, 65 | 80 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 81 | 54, 65 | 81 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 82 | 54, 65 | 82 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 83 | 54, 65 | 83 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 84 | 54, 65 | 84 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 85 | 54, 65 | 85 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 86 | 54, 65 | 86 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 87 | 54, 65 | 87 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 88 | 54, 65 | 88 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 89 | 54, 65 | 89 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 90 | 54, 65 | 90 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 91 | 54, 65 | 91 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 92 | 54, 65 | 92 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 93 | 54, 65 | 93 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 94 | 54, 65 | 94 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 95 | 54, 65 | 95 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 96 | 54, 65 | 96 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 97 | 54, 65 | 97 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 98 | 54, 65 | 98 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 99 | 54, 65 | 99 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |
| 100 | 54, 65 | 100 | 27/79 | 58 | 19/60 | 29 | 31 | 34 | 46 |

BHARAT HEAVY ELECTRICALS LTD.

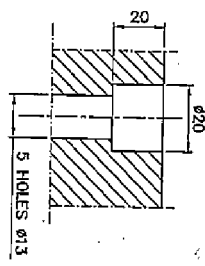
HARDWARE


SCALE

WEIGHT (kg)

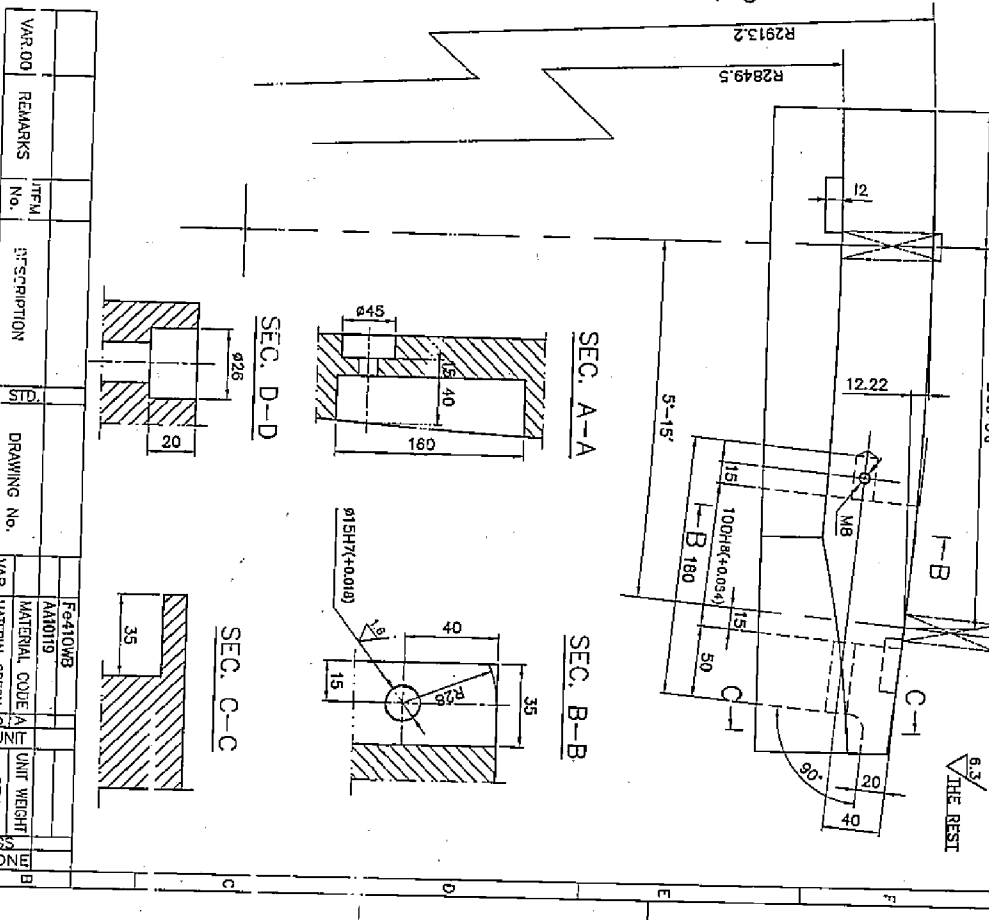
REF. TO ASSY DRG.

ITEM NO.



- | | | |
|--|--|----------------------|
| <div style="display: flex; justify-content: space-between;"> <div> BRHAT HEAVY ELECTRICALS LTD. HARDWAR </div> <div> भारत हेवी इलेक्ट्रिकल्स लि. हार्द्वार </div> </div> | | |
| <div style="display: flex; justify-content: space-between;"> <div> DEPT. JTE CODE 209 </div> <div>  SCALE N.T.S. </div> <div> WEIGHT(KGS) ~11.5 </div> </div> | <div style="display: flex; justify-content: space-between;"> <div> DEN. KALSH CMD V.K.G./S.K.A. </div> <div> NAME SIGN. </div> <div> DWG NO. DATE </div> </div> | |
| TITLE MIDDLE BLOCK TERMINAL SIDE (LOWER BAR) | REF. TO ASSY. DRWG. R7762-1587 | VAR 27.10. |
| DRAWING NO. R7762-1587/009 SHEET NO. 01 No. OF SHEET 01 | ITEM NO. 17 | REV. |

SIZE A 2

[illegible]

ROUND OFF SHARP EDGES.

4 HOLES M12 TO BE DRILLED
IN ASSLY. WITH ITEM No.17
(MIDDLE BLOCK) AS PER ASSLY. DRG.

2 HOLES Ø10H7(+0.015) TO BE
DRILLED IN ASS'Y. WITH ITEM No.17

SEC. C-C

SEC. D-D

SEC. A-A

SEC. B-B

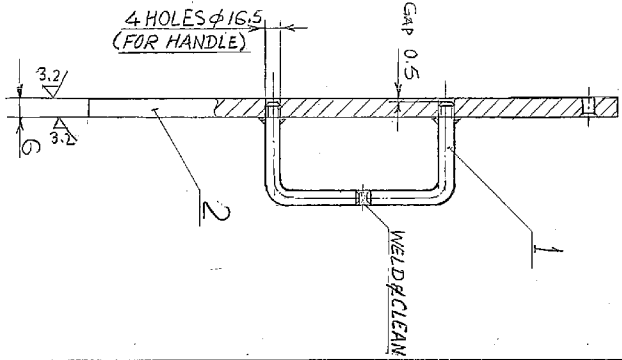
✓ THE REST

BLOCK
(TERMINAL SIDE L.B.)

DRAWING NO. R7762-1587/013
SHEET No. 01 No. OF

SIZE A 2

12.5
THE REST



MARK
R7845-1065
IVC04640E18D1H
0-402-55-30020

| | | | | | | | |
|------------------------------|--|----------------|--|------------------|--|-------------|--|
| IN/PLATE | | - | | FC 410 JUNA | | 7-78 | |
| TYPE 16, TYPE A | | TL-70038 | | A11000/15304 | | 1 | |
| DESCRIPTION | | DRAWING NO. | | FC 410 WAL | | 0.134 | |
| 55 16 80 | | 29 31 | | A11000/153022 | | UNIT WEIGHT | |
| CARD TYPE-1 | | VAR 316 | | MATERIAL SPECN | | 2 | |
| TYPE OF PRODUCT | | COMP. DRG. NO. | | C 1 | | 156 | |
| IYVC045640E(BDH) | | 0-402-05-30020 | | C 1 | | 55 | |
| W/HEADER NO. | | AC/2000/1014 | | QTY | | 71 72 | |
| MODEL NO. | | M/C TRANS NO. | | REF. DRG. NO. | | B | |
| NAME | | SIGN | | DATE | | NO OF | |
| BHARAT HEAVY ELECTRICALS LTD | | CHD/KMS/VKC | | 1.6.77 | | 15.77 | |
| HANDWRAR | | APD/CMS | | 1.2.00 | | 15.77 | |
| SCALE | | WEIGHT (KG) | | REF TO ASSY DRG. | | ITEM NO | |
| N.T.S. | | ~ 8.42 | | | | 15.77 | |
| DEPT UTE | | DRAWING NO. | | NO OF SHEETS | | REV | |
| CODE 209 | | R7845-1065 | | 22 23 24 | | | |
| MARKING TEMPLATE | | CARD CODE | | | | | |
| FOR LOWER BRACKET (N/C) | | SHEET NO. | | NO OF SHEETS | | | |

| | |
|------------------------|------------|
| GRADE OF UNTOL DIM | --- |
| M/C- 2 /M/1 | AA 0230208 |
| WELDING-A/B/C/D/AA | 0621104 |
| GAS CUTTING-T3 | AA 0621101 |
| REV DATE | ALTERED |
| | CHECKED |
| ZONE | |

| | |
|------------------|------------------|
| GMS NO./GR SP NO | STATUS OF DRG |
| REF ID NAME SIGN | DATE |
| EMT KANT | 28-07-20 |
| RE/DATE | ALTERED |
| ZONE | CHECKED |

| | | | |
|------------------------------|----------------|---------------|------------------|
| TYPE OF PRODUCT | COMP. DRG. NO. | WIG TRANS NO. | REF. DRG. NO. |
| IVC04640E8DH | D-42-55-30020 | | |
| ORDER NO. | MODEL NO. | | |
| AC/2000/014 | | | |
| DEPT JTE | SCALE | WEIGHT | REF TO ASSY DRG. |
| CODE 209 | M.T.S. | ~ 84.2 | |
| | | | |
| | | | |
| BHARAT HEAVY ELECTRICALS LTD | | | |
| HARDWARE | | | |
| | NAME | SIGN | DATE |
| | DRN GUSE/AN | | OF |
| | CHD/KMS/VKC | 17/06/77 | VAR |
| | APD CKMS | 6.6/77 | |
| | | 6.8/0 | |
| | | 8/24 | |
| | | 17/72 | |
| | ITEM | | |
| | NO | | |
| | 75.177 | | |

TOTAL SH. = 2; A4 = 2