



# Bharat Heavy Electricals Limited

(High Pressure Boiler Plant)

Tiruchirappalli – 620014, TAMIL NADU, INDIA

CAPITAL EQUIPMENT / MATERIALS MANAGEMENT

An ISO 9001  
Company

<b>ENQUIRY</b>	Phone: +91 431 257 70 49 Fax : +91 431 252 07 19 Email : <a href="mailto:csguna@bheltry.co.in">csguna@bheltry.co.in</a> Web : <a href="http://www.bhel.com">www.bhel.com</a>
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	<b>Enquiry Number:</b>	<b>Enquiry Date:</b>	<b>Due date for submission of quotation:</b>
	<b>2620800042</b>	<b>19.06.2008</b>	<b>24.07.2008</b>

You are requested to quote the Enquiry number date and due date in all your correspondences. This is only a request for quotation and not an order

Item	Description	Quantity	Delivery (Item required at BHEL on)
10	CNC Vertical Machining Centre as per the technical specification & commercial conditions applicable (to be downloaded from web site <a href="http://www.bhel.com">www.bhel.com</a> or <a href="http://tenders.gov.in">http://tenders.gov.in</a> )	1 No.	30.04.2009

**BHEL commercial terms & conditions with Price Bid and Bank Guarantee formats along with technical specifications can be downloaded from BHEL web site <http://www.bhel.com> or from the Government tender website <http://tenders.gov.in> (public sector units > Bharat Heavy Electricals Limited page) under Enquiry reference “2620800042”.**

Tenders should reach us before 14:00 hours on the due date  
Tenders will be opened at 14:30 hours on the due date  
Tenders would be opened in presence of the tenderers who have submitted their offers and who may like to be present

Yours faithfully,  
For BHARAT HEAVY ELECTRICALS LIMITED  
  
Manager / Capital Equipment / MM

**PART A****VERTICAL MACHINING CENTER****SECTION – I : QUALIFYING CRITERIA**

The BIDDER has to compulsorily meet the following requirements to get qualified for considering the technical offer for the VERTICAL MACHINING CENTER.

S. No.	REQUIREMENTS	Vendor's Response
1	<p>Only those vendors (OEMs), who have supplied and commissioned at least one <b>CNC Vertical Machining Center / CNC Vertical Bed type Milling &amp; Drilling Machine</b> with</p> <ol style="list-style-type: none"> <li><b>1. Spindle power 18 KW or more</b></li> <li><b>2. Table size of 1400 mm x 850 mm or more and</b></li> <li><b>3. Table Load carrying capacity 1400 Kg or more</b></li> </ol> <p>in the past ten years and such machine should be working satisfactorily for a minimum period of one year after commissioning, as on the date of opening of this Tender are eligible to quote.</p> <p><i>(However, if such machine is already supplied to BHEL, then that machine should be working satisfactorily for a minimum period of six months after commissioning, as on the date of opening of this Tender.)</i></p>	
<b>The vendor should submit the following information where similar machine has been supplied, for qualification of this offer.</b>		
1.1	Name and postal address of the customer or company where similar machine is installed.	
1.2	Name and designation of the contact person of the customer.	
1.3	Phone, FAX no and email address of the contact person of the customer.	
1.4	Month and Year of commissioning of the machine.	
1.5	Parameters of machine supplied, viz. Table size, Table load carrying capacity, Spindle power and the application for which the machine is supplied.	

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1.6	Along with the Technical offer, the Vendor should submit one Performance certificate from the customer for the satisfactory performance of the machine supplied to them. For obtaining the Performance certificate, a suggestive format is provided in <b>SECTION – IV</b> .	
2.0	BHEL reserves the right to verify the information provided by vendor. In case the information provided by vendor is found to be false/ incorrect, the offer shall be rejected.	

### **SECTION – I I**

The BIDDER / VENDOR is requested to provide the following information:

<b>S. No.</b>	<b>REQUIREMENTS</b>	<b>Vendor's Response</b>
3.0	The BIDDER/VENDOR to furnish Reference List of Customers, with full address, details of contact person, where Vertical Machining Centers / CNC Vertical Bed type Milling & Drilling Machines have been supplied in the past.	
4.0	Details of Vertical Machining Centers / CNC Vertical Bed type Milling & Drilling Machines supplied to other BHEL units, if any. (Year of commissioning, Table size, Table load carrying capacity, Spindle power).	
5.0	Details on SERVICE-AFTER-SALES Set-Up in India including the Address of Agents / Service Centers in South India.	
6.0	Any Additional Data to supplement the manufacturing capability of the BIDDER for the subject equipment.	

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**SECTION – III**

The BIDDER to note:

S. No.	PARTICULARS	Vendor's Response
7.0	<p>The BIDDER / VENDOR shall submit the offer in TWO PARTS.</p> <ol style="list-style-type: none"> <li>1. Technical Offer [with PART A &amp; PART B] and Commercial offer.</li> <li>2. Price Bid.</li> </ol>	
8.0	<p>The Technical Offer shall contain a comparative statement of Technical <b>Specifications demanded by BHEL</b> and <b>Offer Details submitted by the Bidder</b>, against each clause.</p> <p>A just 'CONFIRMED' or 'COMPLIED' or 'YES' or 'NO-DEVIATION' or similar words in the technical comparative statement may lead to disqualification of the Technical Offer.</p>	
9.0	<p>The Technical Offer shall be supported by product Catalogues &amp; Data Sheets and also technical details of Bought-Out-Items with copies of Product Catalogue to the extent possible.</p>	
10.0	<p>The Commercial Offer (given with the Technical Offer) shall contain the Scope of Supply and the Un-Priced Part of the Price-Bid, for confirmation.</p>	

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**SECTION – IV**

The performance certificate should be produced **on Customer’s Letter Head.**

**PERFORMANCE CERTIFICATE**

1. Supplier of the machine		
2. Make & Model of the M/C		
3. Month & Year of Commissioning		
4. Application for which M/C is used		
5	a) Table Size b) Table load Carrying Capacity c) Max Job envelope d) Spindle Power (cont. rating) e) Spindle Taper	
6. Performance of the Equipment (Tick whichever is applicable)		<b>Best in the market</b>
		<b>Satisfactory</b>
		<b>Good</b>
		<b>Average</b>
		<b>Not Satisfactory</b>
7. Any Other remarks		
Date:		Signature & Seal of the Authority Issuing the Performance Certificate

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**PART-B**

**TECHNICAL SPECIFICATION OF VERTICAL MACHINING CENTER**

Clause	PARTICULARS AND BHEL SPECIFICATION	BIDDER'S OFFER With Technical Details																									
1.0	<b>PURPOSE &amp; WORKPIECE MATERIAL</b>																										
1.1	<b>PURPOSE:</b> The machine is intended for machining valve components. The following machining operations shall be carried out on the machine. Milling, Drilling, Tapping, Reaming, Spot facing (internal & external).																										
1.2	<p><b>WORKPIECE MATERIAL SPECIFICATION:</b></p> <p>The work piece material is either <b>Steel Casting</b> or <b>Steel Forging</b>.</p> <table border="1" data-bbox="296 776 1337 1153"> <thead> <tr> <th>Material</th> <th>Description</th> <th>ASTM Specification</th> <th>Hardness</th> </tr> </thead> <tbody> <tr> <td rowspan="4">Steel Casting</td> <td rowspan="2">Carbon Steel</td> <td>A216 WCB, WCC</td> <td>185 BHN</td> </tr> <tr> <td>A352 LCB, LCC</td> <td>225 BHN</td> </tr> <tr> <td>Alloy Steel</td> <td>A 217 WC5, WC6, WC9, C12A</td> <td>210 BHN</td> </tr> <tr> <td>Stainless Steel</td> <td>A351 CF3M, CF8, CF8C and CF8M</td> <td>230 BHN</td> </tr> <tr> <td rowspan="3">Steel Forging</td> <td>Carbon Steel</td> <td>SA 105</td> <td>185 BHN</td> </tr> <tr> <td rowspan="2">Alloy Steel</td> <td>SA 182 F22 Class 3</td> <td>210 BHN</td> </tr> <tr> <td>SA 182 F91</td> <td>225 BHN</td> </tr> </tbody> </table> <p><b>Largest Job Size (L x B x H) mm = 1200 X 1000 X 850</b></p> <p><b>Note:</b> 2570 mm long Valve Stem (Ø125 mm) is also planned for head slot milling operation on this machine. Please refer drawing No. 2 V N826 08132 and 3 V N157 23562 in Annexure – I).</p>	Material	Description	ASTM Specification	Hardness	Steel Casting	Carbon Steel	A216 WCB, WCC	185 BHN	A352 LCB, LCC	225 BHN	Alloy Steel	A 217 WC5, WC6, WC9, C12A	210 BHN	Stainless Steel	A351 CF3M, CF8, CF8C and CF8M	230 BHN	Steel Forging	Carbon Steel	SA 105	185 BHN	Alloy Steel	SA 182 F22 Class 3	210 BHN	SA 182 F91	225 BHN	
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Clause	PARTICULARS AND BHEL SPECIFICATION	BIDDER'S OFFER With Technical Details
2.0	<b>CONFIGURATION:</b> Approximate configuration of the Machine is shown in annexure – 2.	
2.1	<b>CONSTRUCTION:</b>	
2.1.1	Vendor to furnish constructional details of the machine including explanatory drawings of various components/ assemblies like Column, Table, ATC, Machine Bed, Feed Transmission System, Feed back System etc. of the machine with details of material & their hardness.	Vendor to specify
2.1.2	Movable Chip / Splash Guard with sufficient transparent windows to view the machining should be provided for the Table with sufficient height to avoid splash of Coolant and scattering of Chips on Operator's Platform and on Shop Floor. The longest stem (2570 mm) specified under note in clause 1.2 shall also be considered while designing the guard. Details of the same shall be submitted	Vendor to specify
2.1.3	Video images on CD / Hard copy of literature with photographs & drawings explaining the technical features shall be enclosed with the offer	Vendor to specify
2.1.4	Machine should be metric execution.	Vendor to confirm
2.2	<b>TABLE</b>	
2.2.1	Size of Clamping Surface / Table (L X B): Min. 1400 X 850 mm	Vendor to specify
2.2.2	Max. Weight of Work-piece:	1400 Kg
2.2.3	Details of T-Slots (No / Size / Pitch):	Vendor to specify
2.2.4	Load carrying capacity of Table:	Vendor to specify

Clause	PARTICULARS AND BHEL SPECIFICATION	BIDDER'S OFFER With Technical Details
2.2.5	Central Slot tolerance:	Vendor to specify
2.2.6	Lateral Slot size and tolerance:	Vendor to specify
2.2.7	Table surface and central slot should be accurately machined and they will be used as reference surfaces.	Vendor to confirm
2.3	<b>SPINDLE</b>	
2.3.1	Spindle Diameter:	Vendor to specify
2.3.2	Spindle Motor Power (AC Continuous Duty S1): The spindle drive and motor shall be of Fanuc / SIEMENS (Details of model, make, type etc. to be furnished in the offer)	Min. 18 KW Vendor to specify
2.3.3	Spindle Bearing Diameters (Radial & Axial):	Vendor to specify.
2.3.4	Taper in Spindle:	ISO # 50
2.3.5	Spindle speed range (Infinitely variable): 30 – 3000 RPM	Vendor to specify
2.3.6	No of speed ranges (Selectable through program):	Vendor to specify
2.3.7	Torque/Power/Speed diagram of spindle motor is to be submitted with the offer.	Vendor to submit
2.3.8	Minimum and maximum height from Spindle Face to Table Top	Vendor to specify
2.3.9	Minimum and maximum distance from Spindle Center to Table Center	Vendor to specify
2.3.10	Drilling capacity:	60 mm
2.4	<b>TRAVERSES</b>	
2.4.1	Longitudinal Travel of Table or column –X Axis: Min. 1500 mm	Vendor to Specify
2.4.2	Spindle Head Vertical Travel- Z Axis: Min. 1200 mm	Vendor to Specify
2.4.3	Table or Column Cross Travel- Y Axis: Min. 1000 mm	Vendor to Specify

Clause	PARTICULARS AND BHEL SPECIFICATION	BIDDER'S OFFER With Technical Details
2.5	<b>FEEDS AND DRIVE SYSTEM</b>	
2.5.1	Rapid Feed Rate in X, Y& Z Axes:	Vendor to specify
2.5.2	Feed Rate in X, Y& Z Axes (Infinitely variable):	Vendor to specify
2.5.3	Feed drive motors [AC servo motors] shall be digital type of Fanuc or Siemens. (Details of model, make, type etc. to be submitted with the offer)	Vendor to specify
2.5.4	Feed back system for X, Y & Z axes: Fanuc / Siemens / Heidenhain encoders (Details to be submitted with the offer.)	Vendor to specify
2.5.5	Mechanism for locking / clamping the axes:	Vendor to specify
2.5.6	<b>Type of power transmission:</b> Pre-loaded backlash-free re-circulating ball screw drive for feed drive axes. Detailed Specification for all ball screws used in the machine shall be submitted. The specification shall address the following points: (a) Diameter, (b) Pitch (c) Length (d) Make (e) Model	Vendor to specify
2.5.7	<b>Metallic Telescopic Covers</b> of rust resistant material shall be provided with wipers for guide ways of all axes. Provision should be made to avoid mixing of coolant & hydraulic oil.	Vendor to specify
2.6	<b>AUTOMATIC TOOL CHANGER</b>	
2.6.1	Type (Chain Type / Drum Type):	Vendor to specify
2.6.2	Tool selection method: Random & Shortest Path	Vendor to specify
2.6.3	Tool Taper:	ISO # 50
2.6.4	Number of Tools in the Magazine:	Around 25
2.6.5	Maximum Diameter of Tool: a) When all Pockets are filled: b) When adjacent Pockets are filled:	Vendor to specify

2.6.6	Max Length of Tool:	Vendor to specify	
<b>Clause</b>	<b>PARTICULARS AND BHEL SPECIFICATION</b>		<b>BIDDER'S OFFER With Technical Details</b>
2.6.7	Max Weight of Tool:	Vendor to specify	
2.6.8	Limitation regarding length & weight of tool / tool holder clamped in different tool holders for trouble free operation:	Vendor to specify	
2.6.9	Tool Change Time (Tool-to-Tool):	Vendor to specify	
2.6.10	The machine shall have provision for loading / unloading of tools through push buttons provided on machine as well as Auxiliary Hand pendant.	Vendor to specify	
2.6.11	The spindle taper and tool pocket at changer station will have the provision of cleaning by compressed air blow during ATC cycle. The spindle taper will also have the provision of compressed air blow through push button provided on machine for manual tool change.	Vendor to confirm	
2.6.12	Auxiliary Control, with suitable interlocks, for manual insertion / withdrawal of tool from the tool magazine shall be provided.	Vendor to confirm	
2.6.13	Suitable arrangement, Software custom screen based and manual key based pendant, should be provided to extract a tool trapped anywhere in the ATC cycle. Details of both the system to be provided along with the offer.	Vendor to confirm	
2.6.14	The Machine operation should be possible with or without referencing ATC.	Vendor to confirm	
2.6.15	One set of tool holder retention stud equal to number of stations in the Tool magazine shall be provided with the machine.	Vendor to confirm	
2.6.16	Working of Tool Changer arm should be explained in detail. Full ATC catalogue should be submitted.	Vendor to specify	

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Clause	PARTICULARS AND BHEL SPECIFICATION	BIDDER'S OFFER With Technical Details
2.7	<b>OPERATION AND CONTROL SYSTEM</b>	
2.7.1	<b>OPERATOR'S PANEL</b>	
2.7.1.1	Preferably Swiveling type operator's panel having complete CNC and machine control system with CRT of required configuration shall be provided at an ergonomically suitable location. All switches should be within reach of operator for easy & safe operation. All displays/indications should also be conveniently placed accordingly. Layout showing complete details should be submitted.	Vendor to submit
2.7.2	<b>CNC SYSTEM &amp; FEATURES</b>	
2.7.2.1	Make: Fanuc / Siemens	Vendor to specify
2.7.2.2	Type: PC based latest version (With Simultaneous interpolation of three axes)	Vendor to Confirm
2.7.2.3	Model: Suitable and Latest version, as available at the time of ordering, should be supplied.	Vendor to specify
2.7.2.4	Details of Standard features: List to be submitted by Vendor.	Vendor to specify
2.7.2.5	Details of optional features, recommended by vendor:	Vendor to specify
2.7.2.6	The system should have full alphanumeric keyboard, TFT colour display (preferably 17"), additional draw-out type QWERTY Key Board and mouse in suitable enclosure, RS232C serial interfaces, parallel interface for printer, COM port for telediagnosics, network ready for LAN, electronic hand wheels for all axes, CD/DVD drive unit with CD/DVD writer for data input/output, hard disk of sufficient capacity (not less than 80 GB), graphic simulation and preinstalled system software & other required software etc. (Details should be submitted by Vendor).	Vendor to confirm & submit details

Clause	PARTICULARS AND BHEL SPECIFICATION	BIDDER'S OFFER With Technical Details
2.7.3	<b>MANUAL CONTROL</b>	
2.7.3.1	Complete manual control of machine with required switches/ keys should be provided on operator's panel for selection of required axis, axis direction, cutting feed, table/ spindle speed, cutting feed on/off, display of axis position values etc. for manual operation without using CNC program, CNC option Manual Turn or MDI mode. Diagrams/ sketches for switches/ keys provided on operator pendent should be submitted.	Vendor to confirm
2.7.4	<b>HAND HELD UNIT:</b>	
2.7.4.1.	Hand Held unit along with sufficient length of interfacing cable for axis selection; axis movement with pulse generator, axis position display and emergency stop is to be offered with complete details. This is required for job setting.	Vendor to specify
2.7.5	<b>UPS FOR CNC SYSTEM</b>	
2.7.5.1	UPS of 30 minutes for CNC system with inbuilt cooling and charge status display	Vendor to specify
2.8	<b>MACHINE LIGHTS</b>	
2.8.1	Machine Lights for sufficient illumination of complete working area should be provided for clear visibility.	Vendor to confirm
2.8.2	A magnetic base portable spot-light with sufficiently long cable should also be provided.	Vendor to confirm
2.8.3	All light fittings, consumables, adapters/receptacles should have compatibility with Indian equivalents	Vendor to confirm
2.8.4	Flashing / rotary type End of Cutting and Program Stop Light.	Vendor to confirm
2.8.5	Voltage shall be 24V for the hand lamp	Vendor to confirm

Clause	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER With Technical Details
2.9	<p><b>AIR CONDITIONERS:</b> Air Conditioners with Dehumidifiers of suitable capacity to be provided for all Electrical / Electronic Panels / Cabinets including Operator's Panel considering specified ambient conditions. <b>Make:</b> Rittal / Warner &amp; Finley or any other reputed make acceptable to BHEL. Detailed specifications to be submitted.</p>	Vendor to Confirm & submit	
2.10	<b>HYDRAULIC SYSTEM:</b>		
2.10.1	Make: Rexroth / Vickers Sperry or any other reputed make acceptable to BHEL	Vendor to specify	
2.10.2	Hydraulic system should be centralized. Hydraulic Tank shall preferably be located at floor level All hydraulic pipelines to be neatly laid out. (Details should be furnished at contract stage)	Vendor to confirm	
2.10.3	Hydraulic circuits shall be designed with minimum number of control valves and to suit oil of ISO VG 46 or 68 only. Also minimum number of check- points to be provided wherever pressure is required to be measured for setting and trouble shooting. MINIMESS Pressure Gauge - 1 No with Connecting Hose to be provided.	Vendor to confirm	
2.10.4	The control voltage for all solenoid operated valves shall be 24V DC	Vendor to confirm	
2.10.5	Filtration System:	Vendor to specify	
2.10.6	Failure indication:	Vendor to specify	
2.10.7	Automatic shut off provision.	Vendor to submit	

Clause	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER With Technical Details
2.10.8	Refrigerated type cooling system of sufficient capacity to maintain complete Hydraulic System, including lubrication oil, hydrostatic oil and gearbox oil, etc. at a temperature not exceeding 50 °C irrespective of the ambient conditions. Vendor should submit complete details.	Vendor to specify	
2.10.9	Hydraulic pump capacity (flow / pressure):	Vendor to specify	
2.10.10	Each pump should have an independent motor.	Vendor to confirm	
2.11	<p><b>First filling of all required Oils &amp; Grease etc.</b> Should be supplied by vendor.</p> <p><b>Oil grade:</b> ISO VG46 or 68</p> <p><b>Grease:</b> Servo gem grade 2 (preferred.)</p> <p>Indigenous (Indian) source or Indian equivalent and specifications of oils/ greases are also to be provided by the vendor.</p>	Vendor to specify	
2.12	<b>COOLANT SYSTEM:</b>		
2.12.1	Coolant System with all accessories for following types shall be provided. Selection of required type shall be enabled through program as well as manual (by push buttons on the Operator's panel).	Vendor to confirm	
2.12.2	a) Re-circulating type Flood Coolant System.	Vendor to Confirm	
2.12.3	b) High Pressure Coolant system through Spindle.	Vendor to Confirm	
2.12.4	Coolant Pressure for each type to be furnished.	Vendor to Furnish	
2.12.5	Coolant flow rate for each type be furnished.	Vendor to Furnish	
2.12.6	All Spindle mounted tool holders, boring bars and adapters etc. shall have through tool coolant provision.	Vendor to Confirm	

Clause	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER With Technical Details
2.12.7	Coolant collection and recirculation system should be leak proof to avoid spillage on shop floor.	Vendor to Confirm	
2.12.8	<b>Coolant Filtration System:</b> Re-circulating type with suitable filtration unit. Vendor shall give details of offered filtration unit.	Vendor to submit	
2.12.9	Coolant flow diagram showing filters, pumps, valves, tanks etc. to be submitted with the offer.	Vendor to submit	
	Coolant pump & motor details for all types of coolant system are to be submitted with the offer.		
2.12.10	Coolant Tank Capacity:	Vendor to specify	
2.12.11	Coolant pump & motor details:	Vendor to specify	
2.12.12	The coolant tank should be fitted with skimmer for regular cleaning of coolant from contamination with tramp oil.	Vendor to Confirm	
2.13	<b>ELECTRICAL:</b>		
2.13.1	415V ± 10%, 50 HZ ±3 HZ, 3 Phase AC (3 wire system with out neutral) 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/control cabinets, shall be the responsibility of vendor. Requirement of grounding/earthing with required material details is to be informed by vendor well in advance so that the same could be incorporated during construction of foundation.	Vendor to Confirm	
2.14	<b>Tropicalisation:</b> All electrical / electronic equipment shall be tropicalized.	Vendor to Confirm	
2.14.1	All electrical & electronic control cabinets & panels should be dust and vermin proof and shall have IP 54 protection.	Vendor to Confirm	

Clause	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER With Technical Details
2.14.2	All electrical components in the cabinets should be mounted on DIN Rail	Vendor to Confirm	
2.14.3	All electrical and electronic panels including operator's panel should be provided with fluorescent lamps for sufficient illumination and power receptacles of 220Volts, 5/15 Amp AC. All adapters/receptacles should have compatibility with Indian equivalents.	Vendor to Confirm	
2.14.4	Motors shall conform to IEC or Indian Standards	Vendor to Confirm	
2.14.5	All cables moving with traversing axes should be installed in caterpillar / Drag chain. Additionally, all the cable trays required for laying of cables should be included in the offer.	Vendor to Confirm	
2.14.6	Vendor should ensure proper earthing for the machine and its peripherals.	Vendor to Confirm	
2.14.7	In-cycle hour counter with reset facility and digital energy meter shall be provided	Vendor to Confirm	
2.15	<b>SAFETY ARRANGEMENTS:</b>		
2.15.1	Machine should have adequate and reliable safety interlocks or devices to avoid damage to the machine, work piece 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	
2.15.2	A detailed list of all alarms / indications provided on machine should be submitted by the supplier.	Vendor to specify	
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 Confirm	

Clause	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER With Technical Details
2.15.4	All the rotating parts used on machine should be statically & dynamically balanced to avoid undue vibrations.	Vendor to Confirm	
2.15.5	Emergency Switches at suitable locations as per International Norms should be provided.	Vendor to Confirm	
2.15.6	Oil & water lines should not run with electrical cable in the same tray / trench.	Vendor to Confirm	
2.16	<b>ENVIRONMENTAL PERFORMANCE OF THE MACHINE:</b>		
2.16.1	Maximum noise level shall not exceed 85 dB(A) at normal load condition, 1 meter away from the machine.	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 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 peel off and mix up with coolant.	Vendor to Confirm	
2.17	<b>CHIP CONVEYOR</b>		
2.17.1	A chip conveyor to carry both short and curly chips efficiently and effectively to the chip bin on the floor, should be provided at the side of the machine. Two chip bins of appropriate size of Indian make, with wheels and handle for movement, should also be supplied.	Vendor to confirm	

Clause	PARTICULARS AND BHEL SPECIFICATION	BIDDER'S OFFER With Technical Details
2.17.2	Type of chip conveyor:	Vendor to specify
2.17.3	Width of conveyor	Vendor to specify
2.17.4	Elevation of chip conveyor for chip bin:	Vendor to specify
2.17.5	Material of chip conveyor	Vendor to specify
2.17.6	Provision for smooth flow of chips to the conveyor:	Vendor to specify
2.17.7	Operation of chip conveyor (forward & reverse) through push buttons on operator's panel and at Chip Conveyor should be possible.	Vendor to confirm
2.17.7	Layout showing location of chip conveyor should be submitted.	Vendor to submit
3.0	<b>SERVO VOLATGE STABILIZER:</b>	
3.1	Indian make Oil / Air Cooled servo Controlled Voltage Stabilizer suitable for complete machine, its drives, controls, PLC etc with no undesirable Harmonics in the stabilizer output.	Vendor to specify
3.2	Make. : NEEL / DELTA / AEI / POWER AID	Vendor to specify
3.3	Model & Rating (Suitable for the machine load. Vendor to specify the noise level also)	Vendor to specify
3.4	Spares Package for the Voltage Stabilizer for 2 years working should also be offered.	Vendor to Confirm
3.5	Catalogue of Voltage Stabilizer to be submitted.	Vendor to Submit
4.0	<b>ULTRA ISOLATION TRANSFORMER</b>	
4.1	Indian make Ultra Isolation Transformer suitable for complete machine, its drives, controls, PLC etc. shall be offered.	Vendor to confirm
4.2	Make: NEEL / DELTA / AEI / POWER AID	Vendor to specify
4.3	Model & Rating:.	Vendor to specify
4.4	Spares Package for the Ultra Isolation Transformer for 2 years working should also be offered.	Vendor to confirm

Clause	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER With Technical Details
4.5	Catalogue of the Ultra Isolation Transformer shall be submitted.	Vendor to submit	
5.0	<b>Compressed air points:</b>		
5.1	Compressed air at 60 to 70 psi will be made available at one point. The vendor shall indicate the inlet point for compressed air in the layout drawing of the machine.	Vendor to Confirm	
5.2	For work piece cleaning, Compressed Air Point with manual ON/ OFF Valve at a suitable location and flexible hose of suitable length shall be provided in the machine.	Vendor to Confirm	
6.0	<b>TOOLINGS</b>		
6.1	All supplied tool holders, Cutting Tools, adapters etc. shall have through coolant provision so that coolant is available directly on the cutting tip during all possible operations. Provision for external coolant shall also be provided.	Vendor to confirm	
6.2	<p><b>Adaptors for drilling:</b>                      The vendor shall supply the following tang end Morse taper drilling adaptors</p> <ul style="list-style-type: none"> <li>a) ISO # 50 - MT # 4 : 2 nos.</li> <li>b) ISO # 50 - MT # 3 : 2 nos</li> <li>c) ISO # 50 - MT # 2 : 2 nos</li> <li>d) ISO # 50 Collet Type: 2 nos.(with 2 set of collets range 6 mm to 32 mm)</li> </ul>	Vendor to confirm	

Clause	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER With Technical Details
6.3	<p><b>Adaptors for milling:</b>                      The vendor shall supply the following milling adaptors (Screwed end)</p> <ul style="list-style-type: none"> <li>a) ISO # 50 - MT # 4 : 2 nos.</li> <li>b) ISO # 50 - MT # 3 : 2 nos</li> <li>c) ISO # 50 - MT # 2 : 2 nos</li> <li>d) ISO # 50 Adaptors for face/shoulder mills with ID=22,27,32,40mm: each 1 no.</li> </ul>	Vendor to confirm	
6.4	All cutting tools, adaptors, sleeves & tool holders shall be supplied for machining of prove-out components:	Vendor to confirm	
6.5	<p><b>Tapping Attachment:</b>                      Vendor to supply tapping attachment for Thread Diameter Range: M16 to M56                      (Prove out also includes tapping of prove out jobs listed in Annexure- 1)</p>	Vendor to confirm	
7.0	<b>MEASURING SYSTEM:</b>		
7.1	Automatic job measuring system, comprising of Spindle Mounted Renishaw make Wireless system, with measuring cycles, calibration system and all types of probes/ stylii required for measuring all machined dimensions of the prove-out components. Vendor to furnish detailed description of the system along with offer.	Vendor to specify	

Clause	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER With Technical Details
8.0	<b>DIAGNOSTIC SYSTEM</b>		
8.1	<b>TELE-DIAGNOSTIC SERVICE</b>		
8.1.1	Tele-diagnostic service should be provided through International telephone lines along with required Hardware / Software package for the supplied CNC system for remote diagnosis and correction of the problems in both CNC System and PLC of the machine. This should be provided free of charge for the guarantee period. Vendor should inform terms and conditions for this service after guarantee period. Subsequently, it should be possible to use other platforms, such as Internet or ISDN, subject to their availability in future.	Vendor to confirm	
9.0	<b>FAULT DIAGNOSTIC SYSTEM</b>		
9.1	Supplier's own diagnostic system with required hardware and software should be supplied and installed on the CNC system. This should include standard auto-diagnostic system with supporting hardware and software which shows detailed cause and remedy for the fault on the display and supplier's smart diagnostic system for full video diagnostic help for faults related to mechanical and electrical maintenance.	Vendor to confirm	
9.1.1	Help guide should be provided to use both diagnostic systems		
10.0	<b>PORTABLE DATA LOADING DEVICE: (optional)</b> Portable Data loading device with sufficient length of interface cable, HDD of size not less than 40GB, CD Drive, TFT Display of size 14" and suitable preinstalled software for loading PLC program, RS 232 Port, Ethernet chord, USB port, Machine data and CNC part programs shall be supplied with the machine. Vendor should furnish details.	Vendor to specify	

Clause	PARTICULARS AND BHEL SPECIFICATION	BIDDER'S OFFER With Technical Details
11.0	<b>LEVELING &amp; ANCHORING SYSTEM</b>	
11.1	Complete anchoring system including foundation bolts, anchoring materials, fixators, leveling shoes etc should be supplied.	Vendor to confirm
12.0	<b>TOOLS FOR OPERATION &amp; MAINTENANCE</b>	
12.1	Necessary tools like Torque Wrench, Spanners, Keys, grease guns etc for operation and maintenance of the machine should be supplied. List of such tools should be submitted with offer.	Vendor to confirm Vendor to submit
13.0	<b>ACCESSORIES</b>	
13.1	VEE- VICE: Qty. 2nos. 1. Type: Heavy Duty 2. Holding Diameter Range: 30 to 110 mm 3. Job holding length of jaws: 200 mm	Vendor to confirm Vendor to specify
13.2	DIVIDING HEAD: Qty. 1 No. 1.Type: Universal, Heavy Duty. 2. Holding Diameter Range: 30 to 110 mm 3.Three jaw self centering chuck – hollow chuck suitable for dia110mm 4.Tail stock with centre.	Vendor to confirm Vendor to specify
13.3	MACHINE VICE: Qty. 1 No. 1. Type: Heavy Duty 2. Job holding length of jaws: 250 mm. 3. Maximum opening of jaws: 250 mm	Vendor to confirm Vendor to specify

Clause	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER With Technical Details
13.4	The following items shall be supplied for Job holding. a) Two Sets of Adjustable V Blocks (in pairs) to accommodate job diameters ranging from 125mm to 350mm. b) Two pairs of Clamping chains preferably with ratchet mechanism and tenons to suit the table T-Slots, for quick clamping.	Vendor to confirm	
14	<b>SPARES:</b>		
14.1	<p><b>1)</b> The Vendor shall recommend and submit list of spares required for the machine for two years of trouble free operation on three shifts /day basis under two headings as</p> <p>a) <b>Mechanical &amp; hydraulic spares</b> and</p> <p>b) <b>Electrical &amp; electronic spares.</b></p> <p>The list shall generally include the following items.</p> <p><b>a) Mechanical &amp; Hydraulic Spares:</b> All types of pumps, All types of Valves, All types of pressure switches / transducers, All types of filters, All types of seals</p> <p><b>b) Electrical &amp; Electronic Spares:</b> All types of Relays, Contactors, Proximity Switches, Push Buttons, Indicating Lamps, Semiconductor Fuses, Special Fuses, Circuit Breakers, Main Power Switch, Encoders, Scanning Heads for Linear Scales, MMC module, NCU module, Operator's panel with Display Unit, Floppy Disk Unit, I/O Cards for PLC, Servo Motors for Feed Drives, Power Module &amp; Control Cards for Main Drive as well as Feed Drives etc.</p> <p><b>c)</b> Un-priced list of spares with quantities, specified at <b>a&amp;b</b> above, should be submitted with this technical offer.</p> <p><b>d)</b> Unit Price of each item figuring in <b>c</b> shall be submitted with the price bid.</p>	Vendor to Submit	

Clause	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER With Technical Details
14.2	All types of spares for the total machine and its accessories should be available for minimum ten years, after supply of the machine. If any spares or controls are likely to become obsolete within this period, the vendor should inform BHEL and provide details of it's suppliers to enable BHEL to procure them in advance.	Vendor to Confirm	
14.3	In case of ordering, a complete list of spares for the machine and its accessories along with spares specification / type / model, and name & address of the spare supplier shall be submitted along with documentation while supplying the machine.	Vendor to confirm	
15.0	<b>DOCUMENTATION:</b>		
15.1	3 sets of following documents (3 Hard copies) in English language should be supplied along with the machine	Vendor to confirm	
15.2	Operating manuals of Machine & CNC system	Vendor to confirm	
15.3	Programming Manuals of Machine & CNC system	Vendor to confirm	
15.4	Detailed Maintenance manual of machine with all drawings of machine assemblies/sub-assemblies/parts including Electrical / Pneumatic/ Coolant / Hydraulic circuit diagrams.	Vendor to confirm	
15.5	Maintenance, Interface & commissioning manuals for CNC system, spindle & feed drives.	Vendor to confirm	
15.6	Manufacturing drawings for all supplied tool holders, coolant connections, adapters, sleeves, fixtures etc.	Vendor to confirm	
15.7	Catalogues / O&M Manuals of all bought out items.	Vendor to confirm	
15.8	Detailed specification of all rubber items and hydraulic/lube fittings	Vendor to confirm	

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Clause	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER With Technical Details
15.9	<b>Bearings:</b> Make & Specification for all bearings used in the machine.	Vendor to Specify	
15.10	<b>Ball Screws:</b> Detailed Specification for all ball screws used in the machine shall be submitted. The specification shall address the following points: (a) Diameter, (b) Pitch, (c) Length, (d) Make (e) Model	Vendor to specify	
15.11	Operating Manuals, Maintenance Manuals & Catalogues for Isolation Transformer and voltage stabilizer.	Vendor to confirm	
15.12	PLC program printouts (Ladder diagram & Statement list) with comments in English.	Vendor to confirm	
15.13	PLC program on CD, NC data & PLC data on CD.	Vendor to confirm	
15.14	Complete back up of hard disk on GHOST CD and clear written Instructions (1 copy) to take back up and reloading of a new hard disk.	Vendor to confirm	
15.15	The vendor shall submit complete Master List of parts used in the machine.	Vendor to Submit	
15.16	One additional set of all the above documentation on CD ROM, wherever possible.	Vendor to confirm	
16.0	<b>TRAINING:</b>		
16.1	The Vendor shall train Three BHEL Engineers in Operation and Maintenance (Mechanical, Electrical/ Electronics and CNC System) of the Machine at Vendor's works for a period not exceeding 5 working days.	Vendor to confirm	
16.2	Airfare, boarding & lodging for the BHEL Engineers shall be borne by BHEL		

Clause	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER With Technical Details
16.3	The Vendor shall impart training to BHEL's Machine Operators and Maintenance crew in Operation and Maintenance after the commissioning of the Machine at BHEL works for not less than 6 working days	Vendor to confirm	
16.4	Competent, English speaking experts shall be arranged by the vendor during training for satisfactory & effective training of BHEL personnel	Vendor to confirm	
16.5	Vendor to quote on the basis of per man per day for training at vendor's works.	Vendor to specify	
17.0	<b>FOUNDATION:</b>		
17.1	Vendor shall submit the preliminary layout drawing for getting BHEL's approval within one month from the date of Letter of Intent (LOI). Vendor shall submit complete foundation details including static and dynamic loads within three months after getting BHEL's approval. The layout should consist of all requirements pertaining to complete machine including space requirement for Voltage Stabilizer, Isolation Transformer, & any other accessories. BHEL shall construct complete foundation for the machine.	Vendor to confirm	
17.2	The Vendor shall indicate detailed specifications of grouting compound and Grouting procedure etc. for foundation bolts of the machine.	Vendor to Specify	

Clause	PARTICULARS AND BHEL SPECIFICATION	BIDDER'S OFFER With Technical Details
18.0	<b>ERECTION &amp; COMMISSIONING</b>	
18.1	<p>1.Supplier to take full responsibility for supervision of the erection. Start up, testing of machine, it's control system &amp; all types of other supplied equipment, machining of test pieces etc. are the responsibility of the supplier.</p> <p>2.Service requirement like power, air &amp; water shall be provided by BHEL at only one point to be indicated by supplier in their foundation/layout drawings.</p> <p>3.Other requirements like crane and helping personnel shall also be provided by BHEL, free of cost.</p>	Vendor to confirm
18.2	Erection & Commissioning of Voltage stabilizer, Isolation Transformer shall also be responsibility of the vendor.	Vendor to confirm
18.3	Successful proving of BHEL components by the supplier shall be considered as part of commissioning. All tests, mentioned under clause ( <b>Machine Acceptance</b> ) shall form part of the commissioning activity.	Vendor to confirm
18.4	Tools, Tackles, Test Mandrels, instruments and other necessary equipment including Laser equipment required to carry out all above activities should be brought by the supplier.	Vendor to confirm
18.5	The supplier shall arrange commissioning spares required for commissioning of the machine.	Vendor to confirm
18.6	Portion, if any, of the machine, accessories and other supplied items where paint has rubbed off or peeled during transit or erection should be repainted and merged with the original surrounding paint by the vendor. For this purpose, the vendor should supply sufficient quantity of touch-up paint of various colors of paint used.	Vendor to confirm

Clause	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER With Technical Details
18.7	Schedule of Erection and Commissioning shall be submitted with the offer.	Vendor to confirm	
18.8	Duration, terms & conditions for E&C should be furnished with this technical offer in detail.  Charges for the same shall be submitted with the price bid.	Vendor to confirm	
19.0	<b>ACCURACY TESTS:</b>		
19.1	<b>GEOMETRICAL ACCURACY:</b>		
19.1.1	Geometrical Accuracy Tests shall be in accordance with ISO 10791 standard or equivalent applicable standard. Detailed Test Charts for the same, clearly showing the accuracies to be achieved on the machine, shall also be submitted with the offer.	Vendor to confirm	
19.1.2	All the above accuracies to be demonstrated to BHEL engineers during pre-acceptance tests at Suppliers works and during Erection & Commissioning at BHEL Works.	Vendor to confirm	
19.2	Machine positioning accuracies & repeatability should be measured as per VDI/DGQ 3441 / ISO 230 – 2 (latest revision) using laser interferometer.	Vendor to confirm	
19.2.1	Positioning Accuracy on all traversing axes (Pa per 1000mm)	± 0.016 mm	
19.2.2	Repeatability on all traversing axes (Ps per 1000mm)	± 0.008 mm	
19.2.3	All the above accuracies to be demonstrated to BHEL engineers during pre-acceptance at Suppliers works and during Erection & Commissioning at BHEL Works	Vendor to confirm	

Clause	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER With Technical Details
20.0	<b>AMBIENT CONDITIONS &amp; THERMAL STABILITY:</b>		
20.1	Power Supply : AC 415 V ±10% Frequency : 50 Hz ±3HZ Phases : 3 phase 3 wire system Compressed air supply: 60-70 psi Ambient Temperature: max 45 °C Relative Humidity = 85% Vendor to confirm that machine is suitable for above conditions	Vendor to confirm	
20.2	Weather conditions are tropical. Atmosphere may be dust laden during some part of the year. Machine will be installed in the normal shop floor condition. Vendor to confirm that machine is suitable for above	Vendor to confirm	
20.3	Thermal Stability of the machine shall be good enough to withstand the specified ambient conditions in order to meet the accuracy requirements of BHEL components. Vendor to confirm for trouble-free operation of the machine.	Vendor to confirm	
20.4	The Vendor should confirm that the machine and its accessories is suitable for continuous operation at its full capacity for 24 hours a day and 7 days a week through out	Vendor to confirm	
21.0	<b>PROVEOUT OF BHEL COMPONENTS:</b>		
21.1	1. Drawings of prove-out components are enclosed. Please refer <b>Annexure 1</b> for prove out components List and operations. Material for the prove-out components will be provided by BHEL. 2. For machining of prove-out components, Job setting plan, Machining process plan and Requirement of tools etc. shall be discussed and agreed mutually. (Final prove out component drawing number may change,	Vendor to Confirm	

	<p>however, the machining features of the changed components shall be in line with the original component drawing.)</p> <p><b>3.</b> Using CNC programs of the vendor, Complete machining of prove-out components shall be done by vendor at BHEL works to the specified design accuracy and surface finish.</p> <p><b>4.</b> The vendor shall supply all cutting tools, job holding fixtures, tool holders, arbors, boring bars etc. necessary for machining of prove-out components.</p> <p><b>5.</b> Vendor shall submit final job setting plan, machining process plan, tool layout &amp; list with complete description, time studies etc. within two months of placement of order for the prove- out components. Vendor shall submit CNC Programs prior to start of erection of machine at BHEL Works.</p> <p><b>6.</b> Vendor shall be fully responsible for machining of prove-out components as per drawing and other requirements specified by BHEL. Clarifications regarding accuracy requirements of the prove-out components, whether specified or not, should be discussed by vendor during initial technical discussions.</p>	Vendor to Confirm	
		Vendor to Confirm	
22.0	<b>MACHINE ACCEPTANCE:</b> (Tests/Activities should be Performed by Vendor)		
22.1	<b>Tests/Activities should be carried out at supplier’s works on the machine before dispatch:</b>		
22.1.1	Geometrical accuracies as per test chart.		
22.1.2	Machine positioning accuracies & repeatability should be measured as per VDI/DGQ 3441 / ISO 230 – 2 (latest revision) using laser interferometer.	Vendor to confirm	
22.1.3	The machine should be tested for continuous running of 48 hrs. If any break down occurs during this test, the test should be repeated for 48 hrs from restarting.	Vendor to confirm	
22.1.4	Demonstration of all features of the machine, control system & accessories.	Vendor to confirm	

Clause	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER With Technical Details
22.1.5	Machining of test piece as per NAS/AFNOR/ISO. Vendor to supply test piece and tooling for it's machining.	Vendor to confirm	
22.2	<b>Tests/Activities should be carried out at BHEL works while commissioning the machine:</b>		
22.2.1	Geometrical accuracies as per test chart.	Vendor to confirm	
22.2.2	Machine positioning accuracies & repeatability should be measured as per VDI/DGQ 3441 / ISO 230 – 2 (latest revision) using laser interferometer.	Vendor to confirm	
22.2.3	Full load test to demonstrate the maximum power & cutting capacity of the machine.	Vendor to confirm	
22.2.4	The machine should be tested for continuous running of 48 hrs. If any break down occurs during this test, the test should be repeated for 48 hrs from restarting.	Vendor to confirm	
22.2.5	Demonstration of all features of the machine, control system & accessories to the satisfaction of BHEL for efficient and effective use of the machine	Vendor to confirm	
22.2.6	Prove-out machining.	Vendor to confirm	
22.2.7	Machining test piece as per NAS/AFNOR/ISO. Vendor to arrange Test pieces and tooling for it's machining.	Vendor to confirm	
23.0	<b>PACKING</b>		
23.1	Sea worthy & rigid packing for all items of complete machine, CNC System, all Accessories and other supplied items to avoid any damage/loss in transit. When machine is dispatched in containers, all small loose items shall be suitably packed in boxes.	Vendor to specify	
24.0	<b>GUARANTEE</b>		
24.1	24 months from the date of acceptance of the machine at BHEL.		

Clause	PARTICULARS AND BHEL SPECIFICATION	BIDDER'S OFFER With Technical Details
25.0	<b>GENERAL</b>	
25.1	Machine Model:	
25.2	Total connected load (KVA): Vendor to specify	
25.3	Floor area required (Length, Width, Height) for complete machine & accessories: Vendor to specify.	
25.4	Painting of Machine / Electrical Panels: RAL 6011 Apple Green (Polyurethane Paint)	
25.5	Total weight of the machine: Vendor to specify	
25.6	Weight of heaviest part of machine: Vendor to specify	
25.7	Weight of the heaviest assembly / sub-assembly of the Machine: Vendor to specify	
25.8	Dimensions of largest part/ sub-assembly/ assembly of the machine: Vendor to specify	

Annexure – 1: Table Showing Prove-out component list and operations.

Annexure – 2: Sketch showing approximate configuration of the machine.

**ANNEXURE - I****Prove out Job details for VMC**

<b>Sl. No</b>	<b>Job Description</b>	<b>Prove out Qty</b>	<b>Drawing No.</b>	<b>Title</b>	<b>Operations</b>
1	2 1/2" 2500 FV Body	1	2-V-L164-15332	<b>Body Assembly</b>	<b>Hinge pin Hole and arm pocket machining.</b>
			2-V-L164-15329	Body Rough	Reference drg
2	10" 1500 FV Body	1	2-V-L377-16077	<b>Body Assembly</b>	<b>Hinge pin Hole and arm pocket machining. Lifting hole drill and tap.</b>
			2-V-L377-16086	Body Rough	Reference drg
3	32" 150 GV STEM	1	3-V-N157-23562	<b>Stem</b>	<b>Head Milling</b>
			2-V-N826-08132	Stem Rough	Reference drg
4	2 1/2" 2500 GV Disc	1	3-V-W009-20086	<b>Disc</b>	<b>Guide and T-Slot milling. Radius and chamfer milling.</b>
			4-V-W009-18015	Rough Machining	Reference drg
5	20" 2750 GV Disc	1	3-V-W077-20104	<b>Disc</b>	<b>Guide and T-Slot milling</b>
			3-V-W077-20103	Rough Machining	Reference drg

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KPL

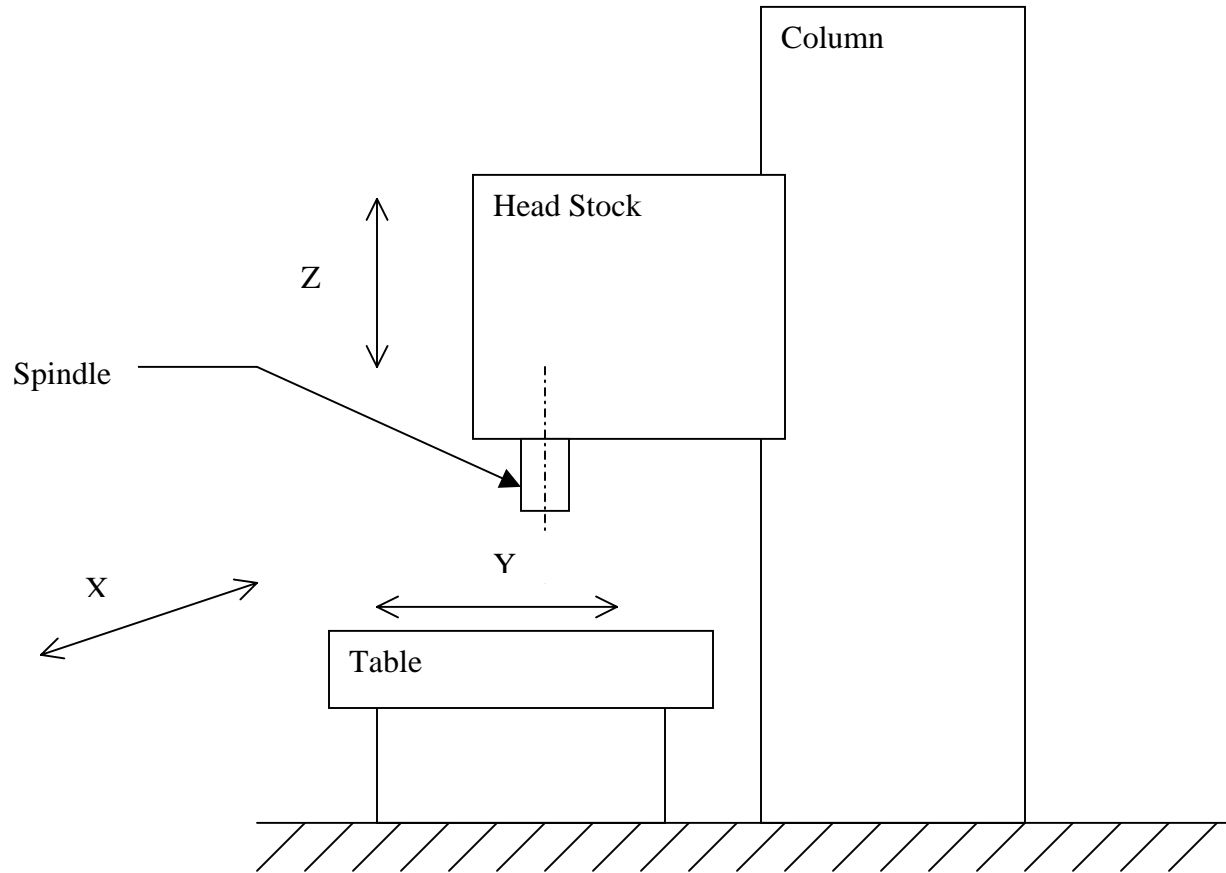
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**Annexure-2: Approximate Configuration of  
CNC Vertical Milling Machine**

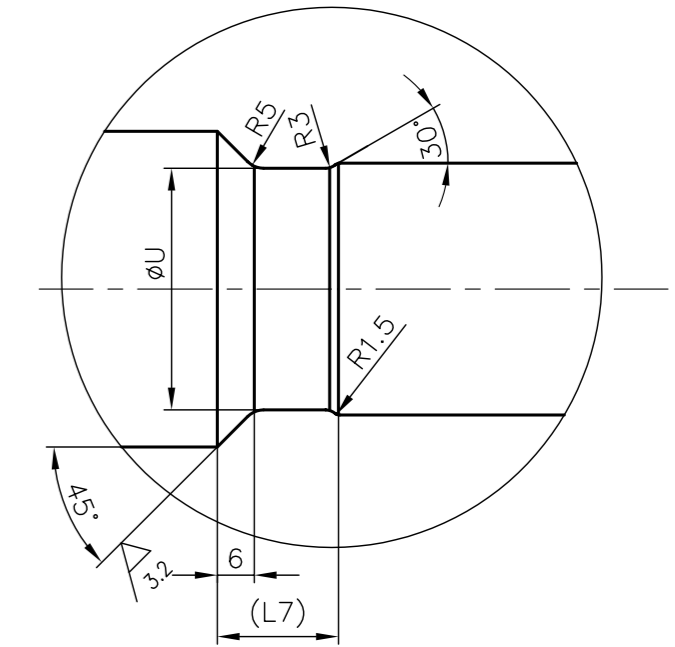


Sl. No.	DRAWING No.	COMP. CODE	MATL. SPECN.	SUGGESTED SIZE	MATL. CODE	MATL. MARK	GROSS Wt.(Kg)	$\phi D^{+0.2}_{+0.1}$	$\phi D2$	L	L1	L2	L3	L4	$\phi D1^{0}_{-0.1}$	$\phi U$	$\phi D3$	L6	(L7)	SCRAP SORT	NET Wt. (Kg)	SIZE/ RATING
01	2-V-N826-08132	93 109 727 6000	A182 F6a CL 3, NT, CERTIFY	$\phi 115 \times 2400$	-	F6a	195.7	76.2	91	2380	111	89	45	73	76.2	74.0	110	1095	15	40	86.8	32"-150C
02	2-V-N846-08132	93 109 761 6000		$\phi 125 \times 2600$	15 924 374	F6a	250.8	82.55	99	2570	125	100	50	79	82.55	80.5	125	1100	15	40	110.6	36"-150C
03	2-V-NE61-08132	93 201 046 6000		$\phi 115 \times 2470$	-	F6a	201.4	76.2	91	2450	111	89	45	73	76.2	74.0	110	1165	15	40	88.2	32"-150C

12.5 / 3.2

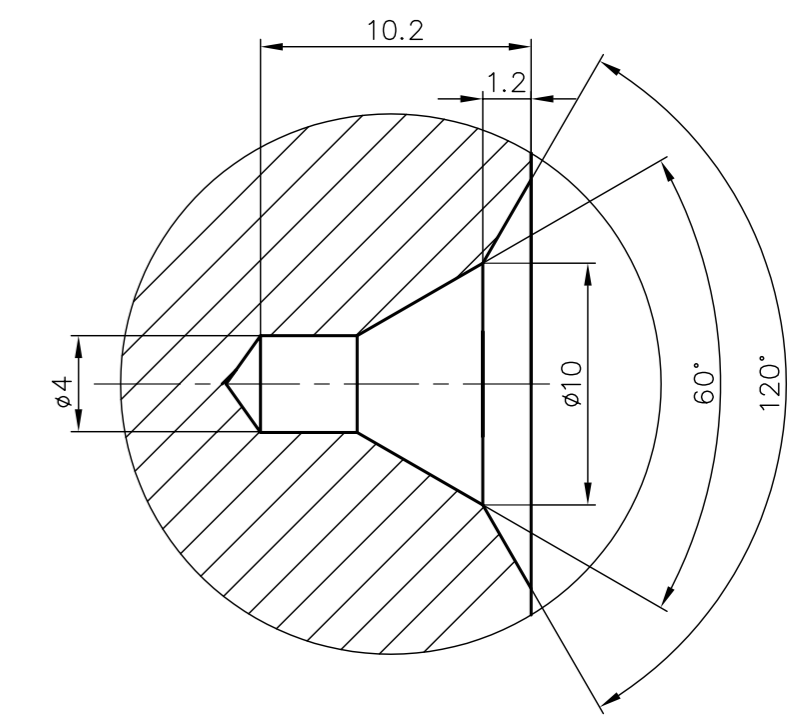
**DETAIL-B**

FOR RELIEF GROOVE

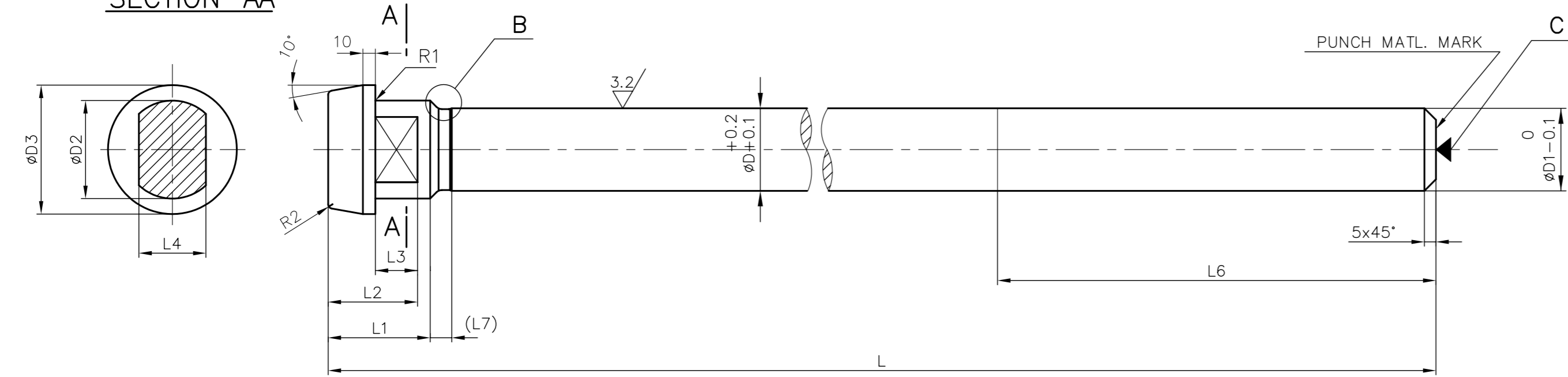


**DETAIL C**

FOR CENTER HOLE



**SECTION-AA**



No OFF	DESCRIPTION	MATL CODE	MATL SPECN	HEAT TREATMENT	SCRAP SORT	NET WT (kg)	GROSS WT (kg)	DRAWING No	ITEM No
-	-	-	-	-	-	-	-	-	-

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT		DRN	NAME	SIGN	DATE	NO. OF VAR.
BHARAT HEAVY ELECTRICALS LTD., UNIT: HIGH PRESSURE BOILER PLANT. TIRUCHIRAPALLI-620014.		V L	V. BAIRAVAN		09.10.99	
		CHD	R.L. NARAYANAN		20.10.99	
		APPD	M. RAJKUMAR		22.10.99	
DEPT	365-120	SCALE		WEIGHT (KG).		NO. OF ITEMS
CODE	320	NTS		REF. TABLE		
TITLE		CARD CODE	DRAWING NO.		REV	
STEM (ROUGH)		U 01	2-V-0000-08132		02	

REV	DATE	ALTERED	M.SRINIVASAN	REV	DATE	ALTERED	R.L.N
02	30.01.07	CHD & APPDP.	BOOMINATHAN	01	08.11.99	CHD & APPD	M.R.K
SL.No. 03 INCLUDED				SL.No.02 INCLUDED			

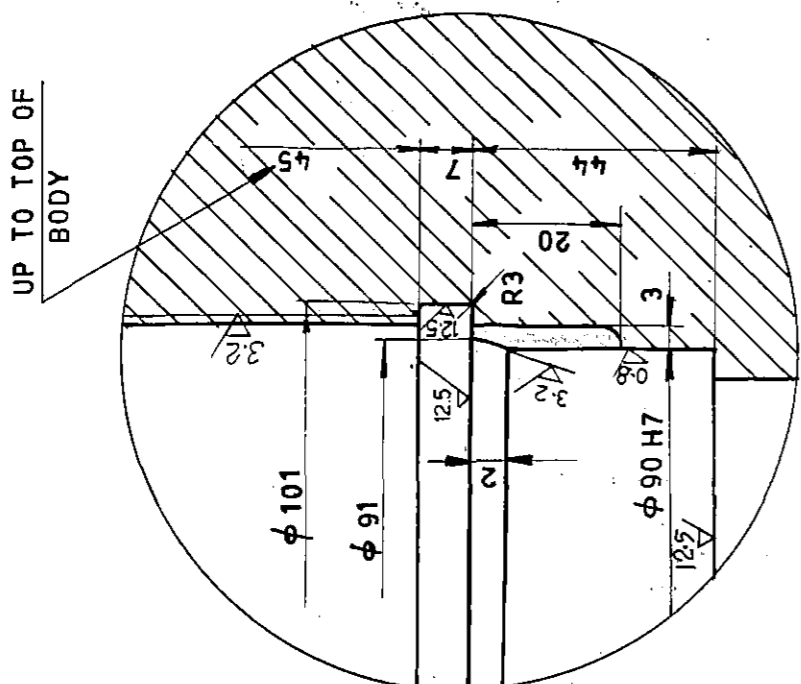
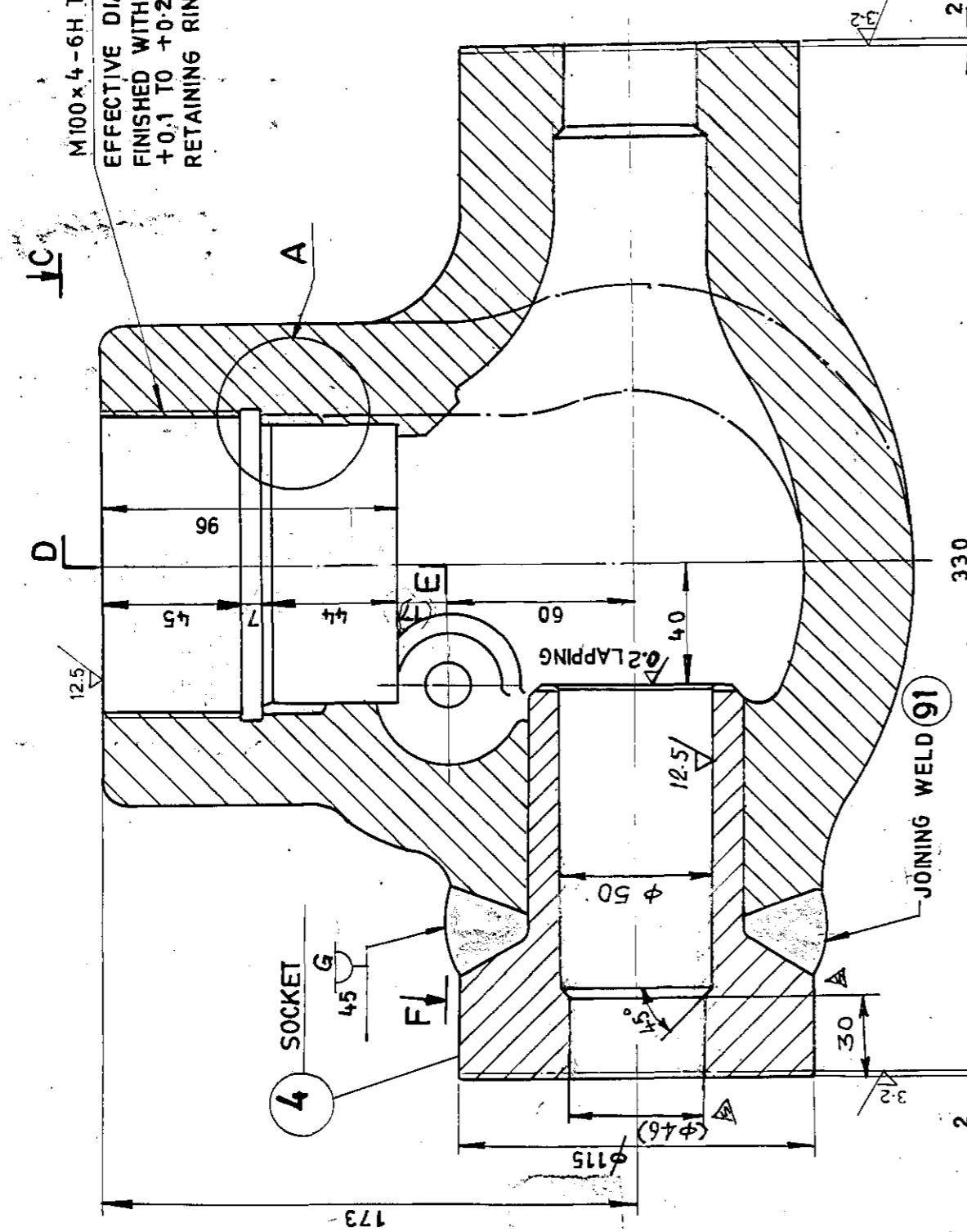
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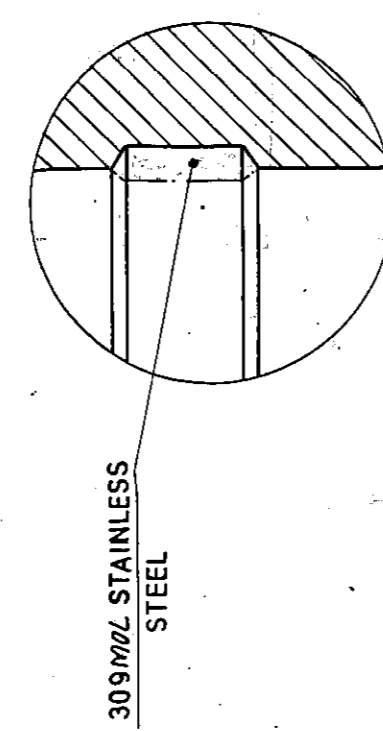
5/26851-0000-15332/V-2  
ON DRAWING

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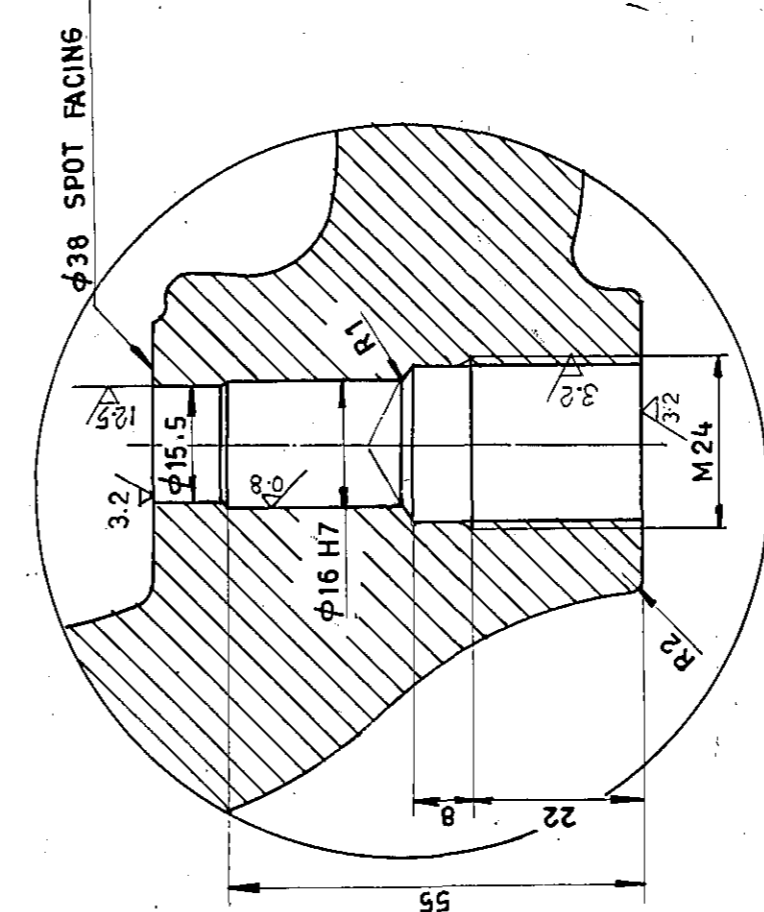
M100x4-6H THREADS  
EFFECTIVE DIA. SHOULD BE  
FINISHED WITHIN THE RANGE  
+0.1 TO +0.2MM FROM  
RETAINING RING.



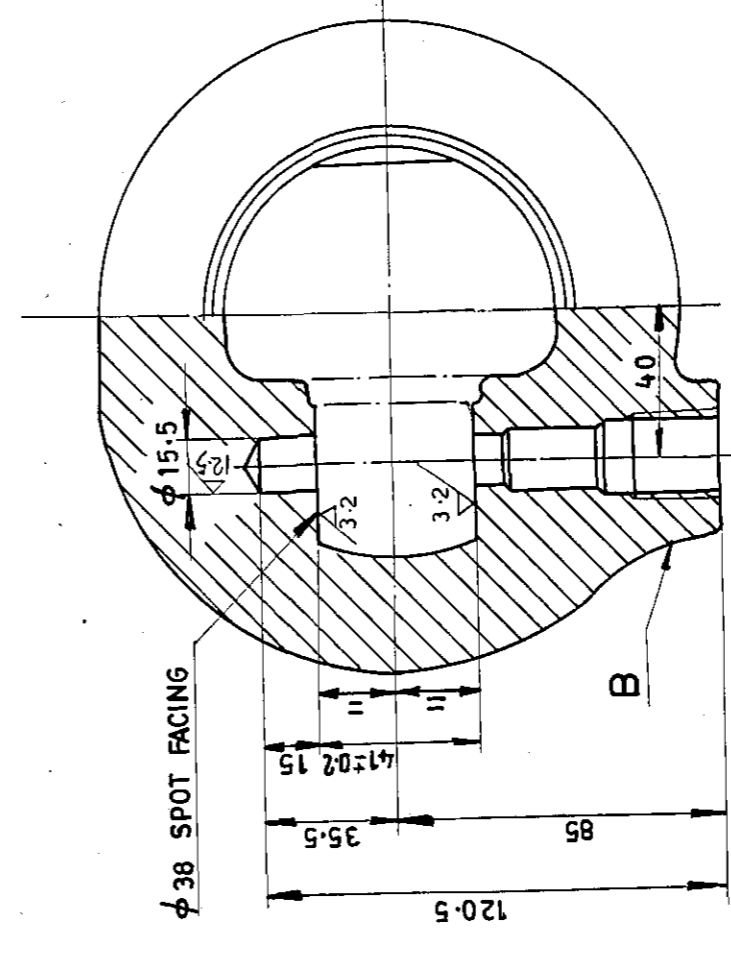
DETAIL - A  
AFTER MACHING



DETAIL - A  
AFTER WELDING



DETAIL - B



SECTION - CDEF

NOTES :-

- \* MARKED TYPES ARE SPECIAL CLASS RATINGS.
- LATEST APPLICABLE QUALITY PROCEDURE SHALL BE FOLLOWED IN ALL RESPECTS.
- EDGE PREPARATION SHALL BE AS PER SEPARATE INSTRUCTIONS.
- ALL IFR QUALITY REQUIREMENTS SHALL BE FOLLOWED.

φ90 H7	+0.035
φ16 H7	+0.018
	0

125/32/0.8/0.2

SL. NO.	CASTING DRG. No.	DRAWING No.	JOINING WELD	MATL. SPECN.	COMP. CODE	PART NO.	SCRAP	SOCKET DRG. No.	SOCKET DRG. No.
8	2-V-L168-15299R	E9018 B3, ATTEST	A217 WC9, ATTEST, NT	93 113 431 0000		91		4-V-L164-18102/6	20
7	2-V-L167-15299R	E9018 B2, ATTEST	A217 WC8, ATTEST, NT	93 113 430 0000		91		4-V-L164-18103/4	20
6	2-V-L166-15299R	E7018 A1, ATTEST	A216 WCC, ATTEST, AN	93 113 429 0000		91		4-V-L163-18102/05	10
5	2-V-L165-15332/5	E7018 A1, ATTEST	A216 WCC, ATTEST, AN	93 113 428 0000		91		4-V-L161-18102/05	10
4	2-V-L164-15299R	E9018 B3, ATTEST	A217 WC9, ATTEST, NT	93 113 427 0000		91		4-V-L164-18102/6	20
3	2-V-L163-15332/3	E9018 B2, ATTEST	A217 WC8, ATTEST, NT	93 113 426 0000		91		4-V-L163-18102/05	10
2	2-V-L162-15299R	E7018 A1, ATTEST	A216 WCC, ATTEST, AN	93 113 425 0000		91		4-V-L161-18102/05	10
1	2-V-L161-15299R	E7018 A1, ATTEST	A216 WCC, ATTEST, AN	93 113 424 0000		91		4-V-L161-18102/05	10

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT

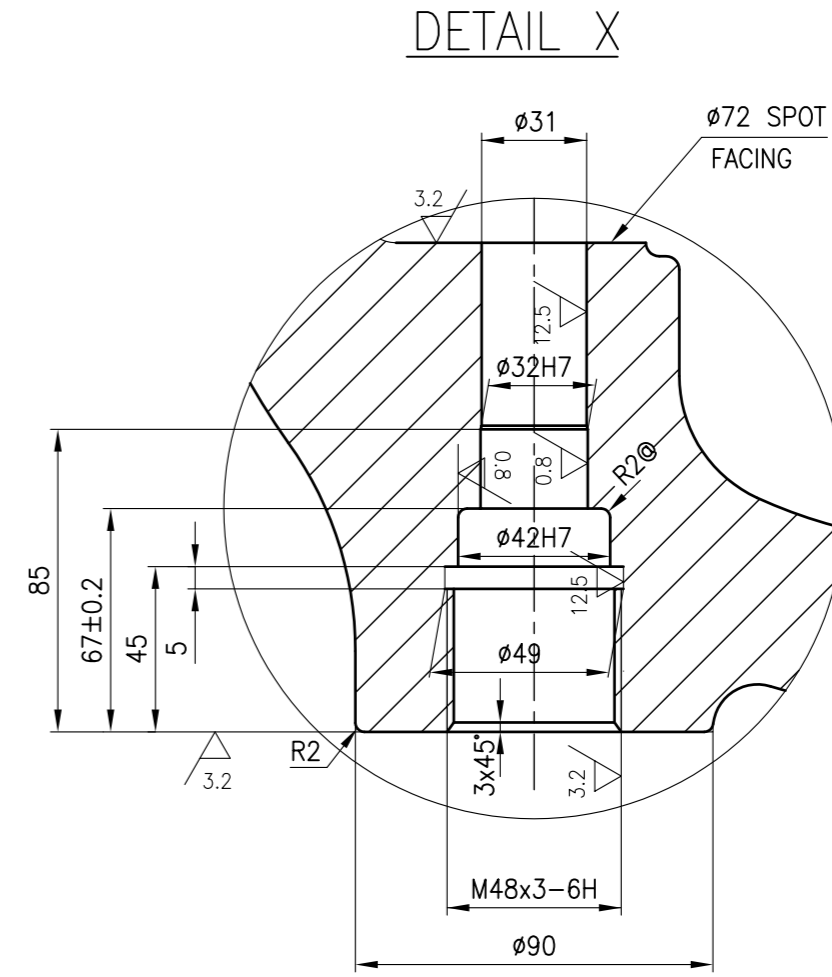
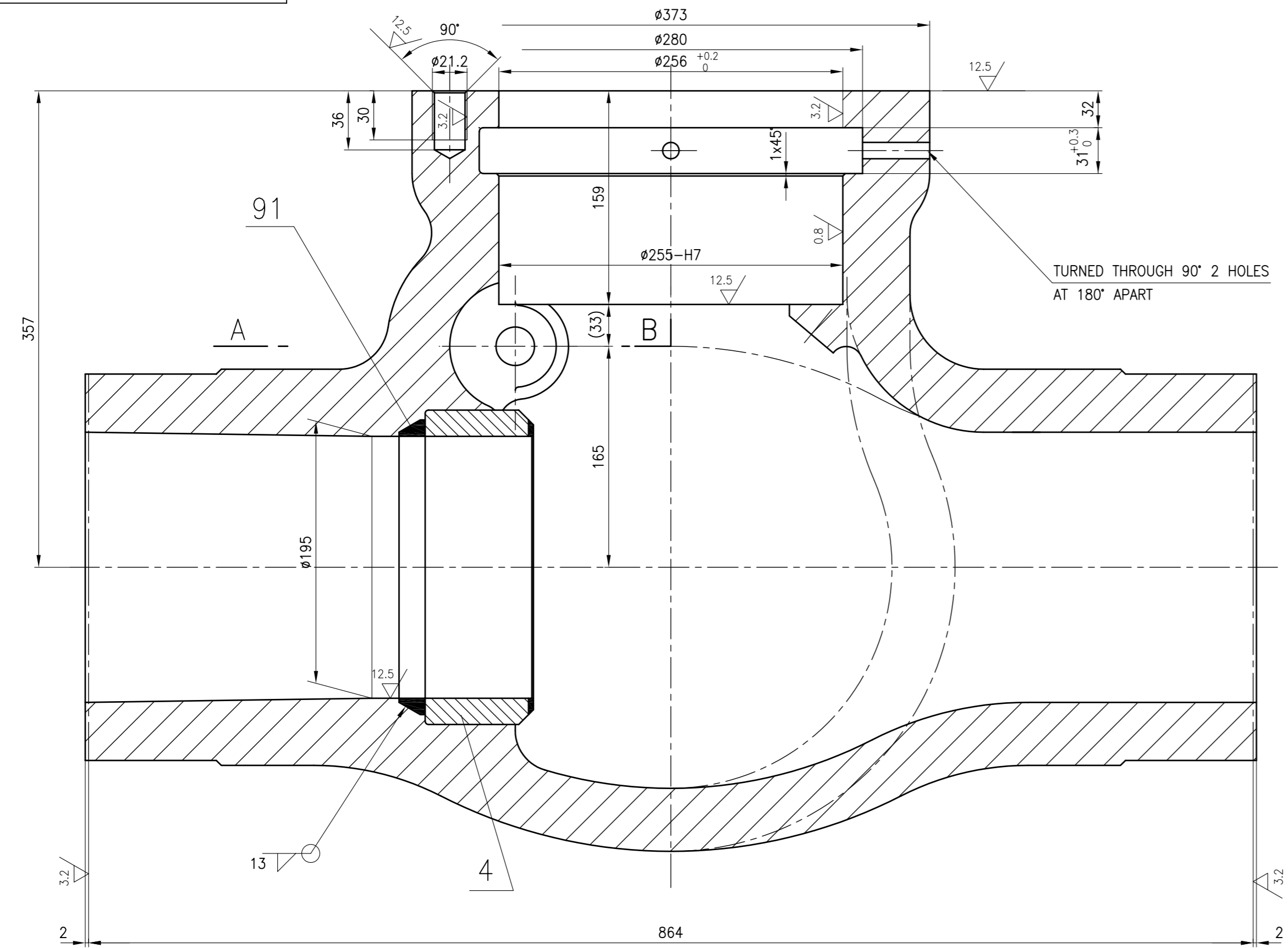


**Bharat Heavy Electricals Ltd.,**  
BOILER PLANT UNIT  
TIRUCHIRAPALLI-620 014

DEPT. V.L.	320	SCALE	NTS	WEIGHT (KG)	40.8	TOA DRG. NO.	3-E04534 (2030)
REV. DATE	01/18/87	REV. DATE	17.6.89	REV. DATE	10.7.92	REV. DATE	28.01.97
REV. DATE	01/18/87	REV. DATE	17.6.89	REV. DATE	10.7.92	REV. DATE	28.01.97
REV. DATE	01/18/87	REV. DATE	17.6.89	REV. DATE	10.7.92	REV. DATE	28.01.97
REV. DATE	01/18/87	REV. DATE	17.6.89	REV. DATE	10.7.92	REV. DATE	28.01.97

**BODY ASSY**  
2 1/2" / 2500 CLASS

**2-V-0000-15332**



Ø30-50 H7	+0.025
	0
Ø255 H7	+0.052
	0

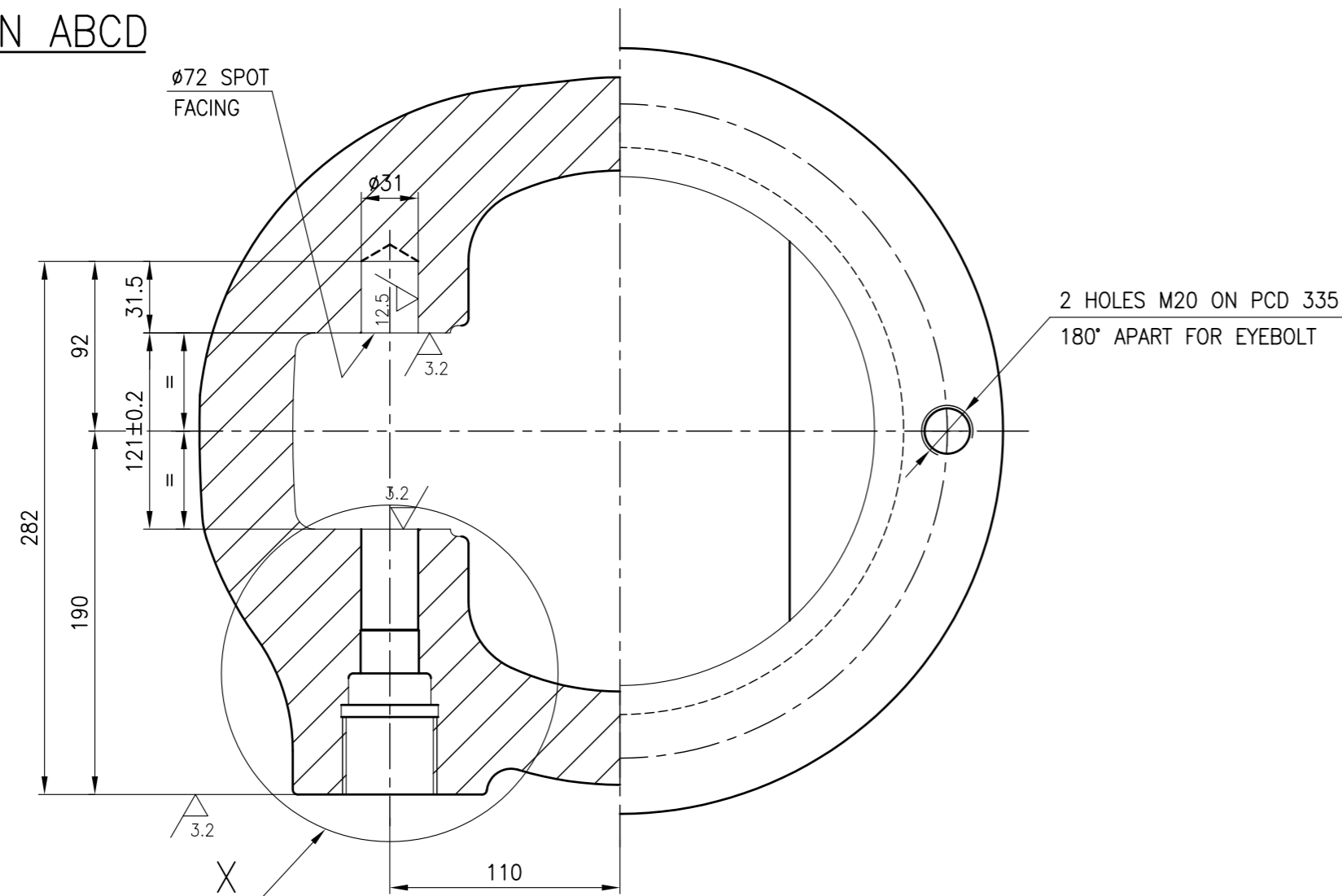
NOTES:

- \* MARKED TYPES ARE SPECIAL CLASS RATINGS.
- LATEST APPLICABLE QUALITY PROCEDURE SHALL BE FOLLOWED IN ALL RESPECTS.
- EDGE PREPARATION SHALL BE AS PER SEPERATE INSTRUCTION.
- ©IMPORTANT RADIUS FOR SEALING

REDRAWN WITH REV.2 ON 25.02.08

SL No.	DRAWING No.	CASTING DRAWING No.	MATERIAL SPECN.	COMP. CODE	PART No.	JOINING WELD DETAIL	SCRAP SORT
*08	2-V-L384-16077/2	2-V-L384-16069R	A217 WC9,NT, ATTEST	93 119 338 0000	91	E9018 B3, ATTEST	20
*07	2-V-L383-16077/2	2-V-L383-16069R	A217 WC6,NT, ATTEST	93 119 337 0000	91	E8018 B2, ATTEST	20
*06	2-V-L382-16077/2	2-V-L382-16069R	A216 WCC,AN, ATTEST	93 119 336 0000	91	E7018 A1, ATTEST	10
*05	2-V-L381-16077/2	2-V-L381-16069R	A216 WCB,AN, ATTEST	93 119 335 0000	91	E7018 A1, ATTEST	10
04	2-V-L380-16077/2	2-V-L380-16069R	A217 WC9,NT, ATTEST	93 119 334 0000	91	E9018 B3, ATTEST	20
03	2-V-L379-16077/2	2-V-L379-16069R	A217 WC6,NT, ATTEST	93 119 333 0000	91	E8018 B2, ATTEST	20
02	2-V-L378-16077/2	2-V-L378-16069R	A216 WCC,AN, ATTEST	93 119 332 0000	91	E7018 A1, ATTEST	10
01	2-V-L377-16077/2	2-V-L377-16069R	A216 WCB,AN, ATTEST	93 119 331 0000	91	E7018 A1, ATTEST	10

SECTION ABCD



REV 2	DATE 25.02.08	ALTERED VB
ZONE	CHD & APPD KRS & MRK	
SEAT CONFIGURATION CORRECTED.		
DCP No.800801		

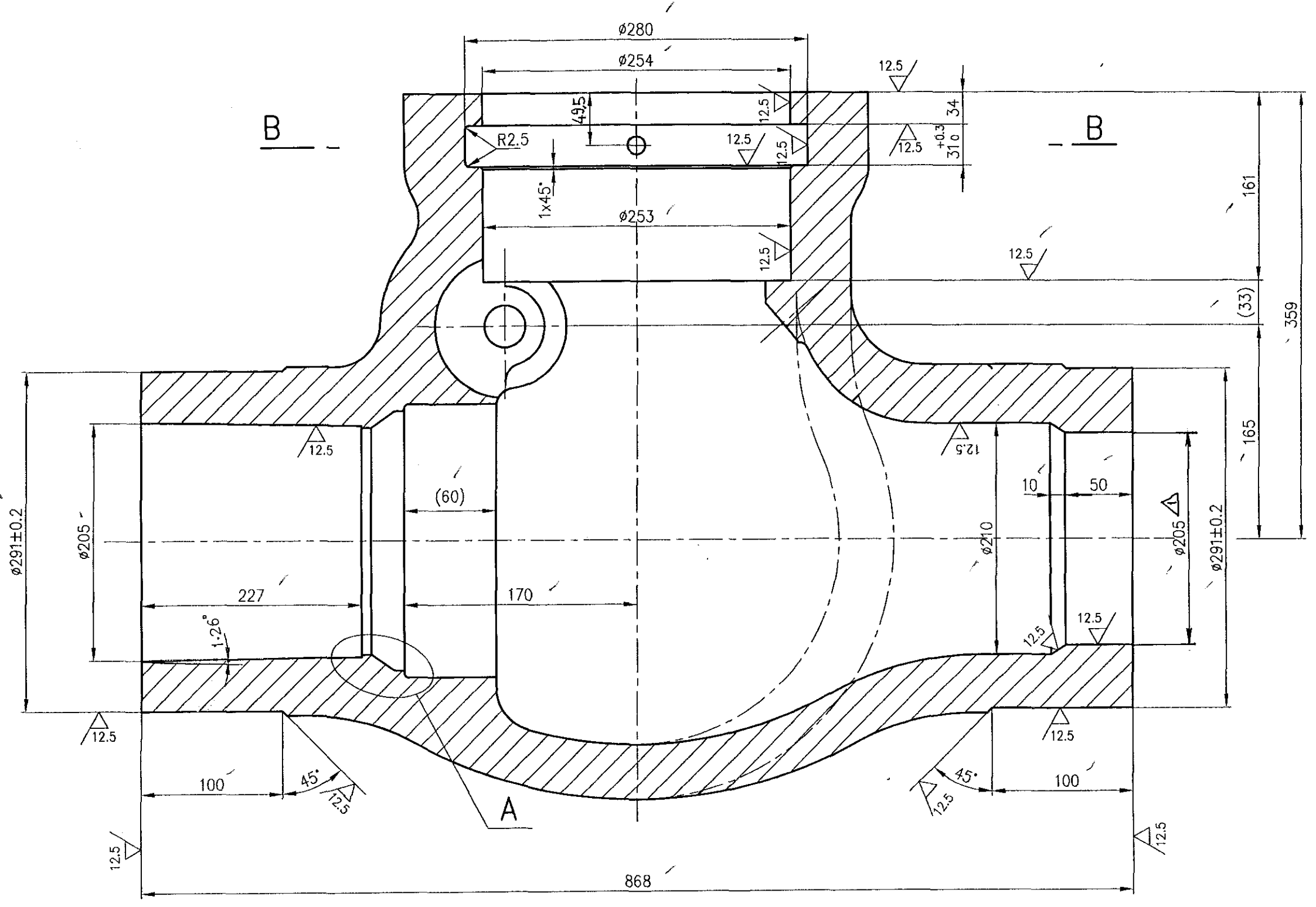
No OFF	DESCRIPTION	MATL CODE	MATL SPECN	HEAT TREATMENT	SCRAP SORT	NET WT (kg)	GROSS WT (kg)	DRAWING No	ITEM No
	TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT	TA							
	<b>BHARAT HEAVY ELECTRICALS LTD.,</b> UNIT: HIGH PRESSURE BOILER PLANT. TIRUCHIRAPALLI - 620014.	DRN	NAME V.BAIRAVAN	SIGN	DATE 25.02.08	NO.OF VAR.			
		CHD	K.RAJASEKARAN		25.02.08				
		APPD	M.RAJAKUMAR		25.02.08				
	DEPT VL	365-120	SCALE	WEIGHT (KG).	REFERENCE INFORMATIONS				
	CODE 320		N T S	368					
	TITLE	BODY ASSEMBLY			CARD CODE	DRAWING NO.	REV		
		10*/1500 CLASS			U 01	2-V-0000-16077	REFER TABLE		

CAUTION: The information on this document is the property of BHARAT HEAVY ELECTRICALS LTD. It must not be used directly or indirectly in any way detrimental to the interest of the company.

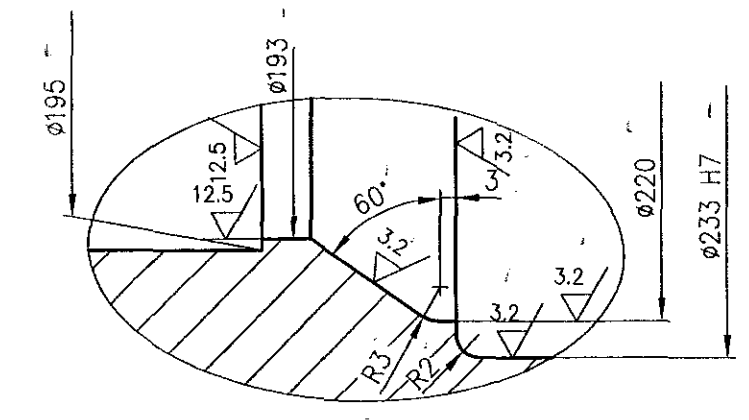
1/98091-000-V-2  
DRAWING NO.

1  
12.5  
3.2

Ø233H7	+0.046
	0



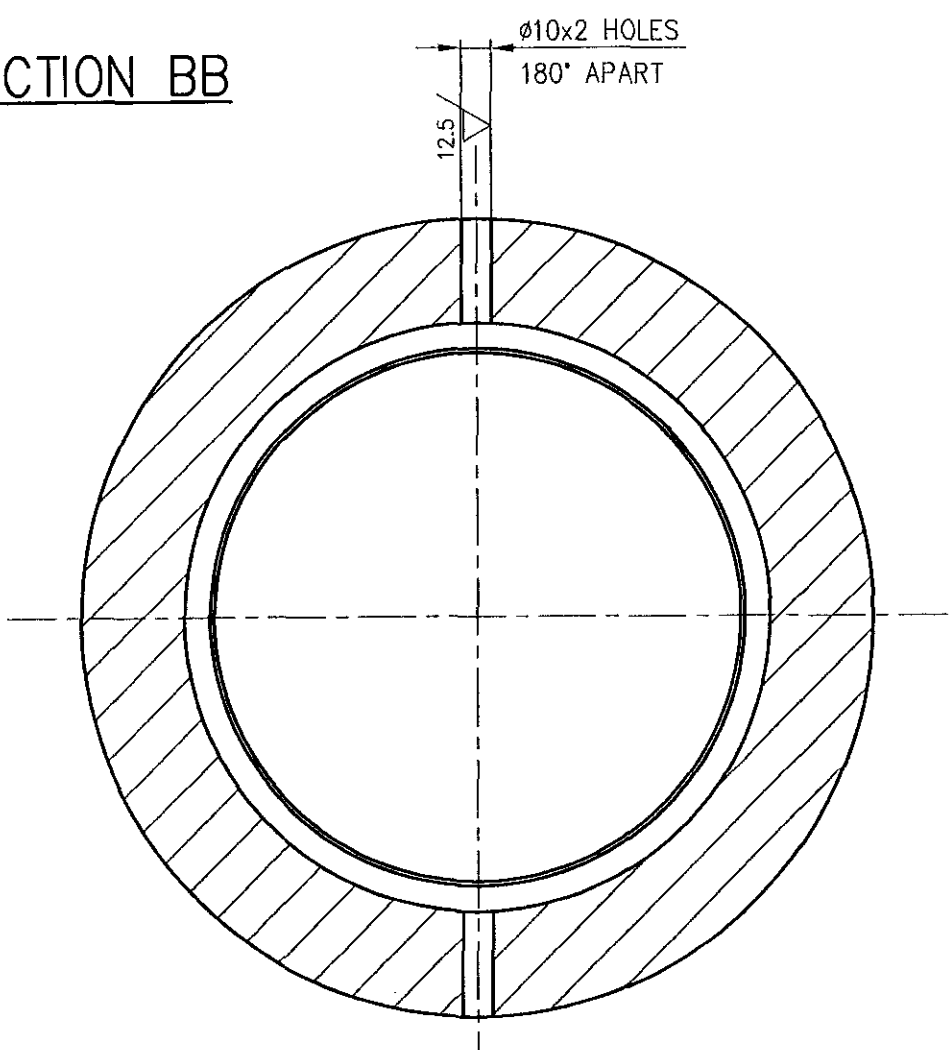
DETAIL A



NOTES:

- 1. \* MARKED TYPES ARE SPECIAL CLASS RATINGS.
- 2. LATEST APPLICABLE QUALITY WORK INSTRUCTION SHALL BE FOLLOWED IN ALL RESPECTS.

SECTION BB



*08	2-V-L384-16086/1	A217 WC9,NT, ATTEST	93 119 338 8000		20
*07	2-V-L383-16086/1	A217 WC6,NT, ATTEST	93 119 337 8000		20
*06	2-V-L382-16086/1	A216 WCC,AN, ATTEST	93 119 336 8000		10
*05	2-V-L381 16086/1	A216 WCB,AN, ATTEST	93 119 335 8000		10
04	2-V-L380-16086/1	A217 WC9,NT, ATTEST	93 119 334 8000		20
03	2-V-L379-16086/1	A217 WC6,NT, ATTEST	93 119 333 8000		20
02	2-V-L378-16086/1	A216 WCC,AN, ATTEST	93 119 332 8000		10
01	2-V-L377-16086/1	A216 WCB,AN, ATTEST	93 119 331 8000		10
SL No.	DRAWING No.	MATERIAL SPECN.	COMP. CODE		SCRAP SORT

No OFF	DESCRIPTION	MATL CODE	MATL SPECN	HEAT TREATMENT	SCRAP SORT	NET WT (kg)	GROSS WT (kg)	DRAWING No	ITEM No
--------	-------------	-----------	------------	----------------	------------	-------------	---------------	------------	---------

TYPE OF PRODUCT  
OR NAME OF  
CUSTOMER/PROJECT

TA

	BHARAT HEAVY ELECTRICALS LTD. UNIT: HIGH PRESSURE BOILER PLANT. TIRUCHIRAPALLI-620014.		DRN	R.KALYAN	SIGN	R.Kalyan	DATE	22.12.98	NO. OF VAR.	
	CHD	M.RAJASEKARAN	APPD	M.RAJAKUMAR	DATE	20/02/08				
	DEPT	V L	SCALE	NTS	WEIGHT (KG)	368	REFERENCE INFORMATIONS			
CODE	320	TITLE	BODY (ROUGH) 10"/1500 CLASS		CARD CODE	U 01	DRAWING NO.	2-V-0000-16086	REV	1

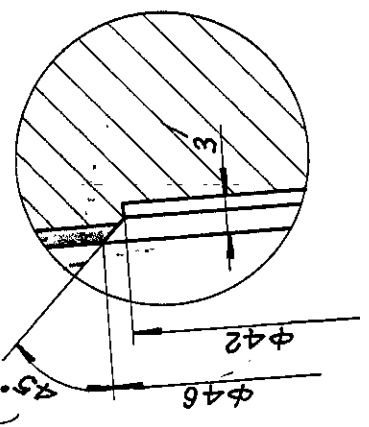
REV	1	DATE	24.12.02	ALTERED VS	CHD & APPD KRS kpr
ZONE		DIMENSION LINE CORRECTED.			
		NOTES UPDATED.			
		DCP No. 80047			

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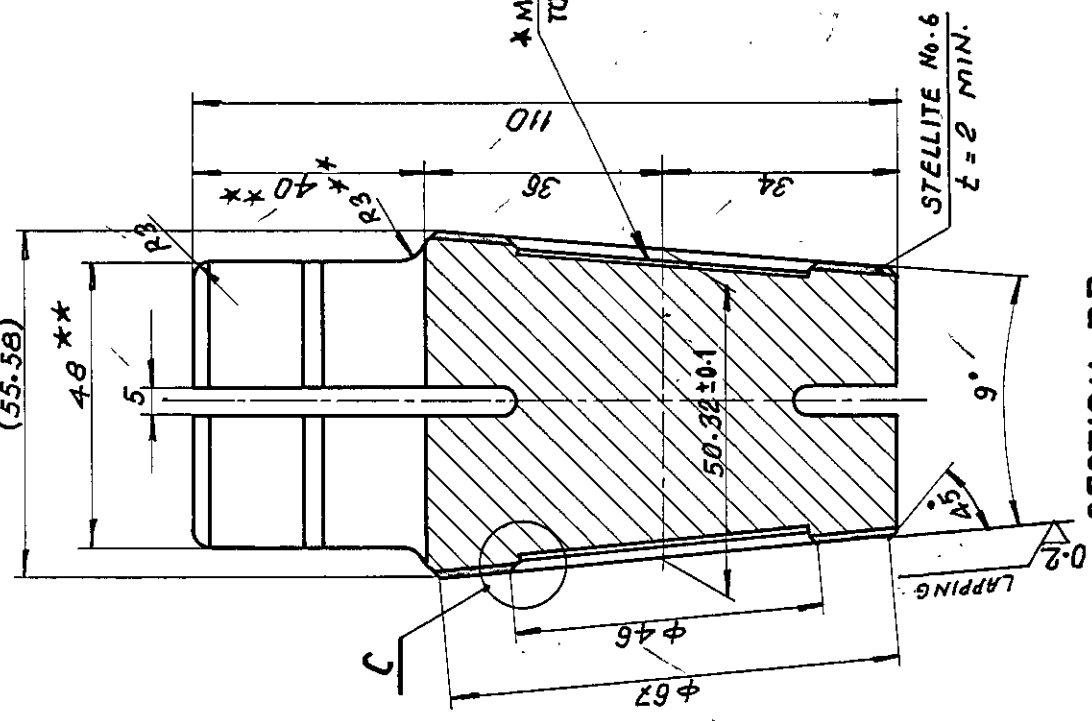
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FIRST ANGLE PROJECTION (ALL DIMENSIONS IN MILLIMETRES)

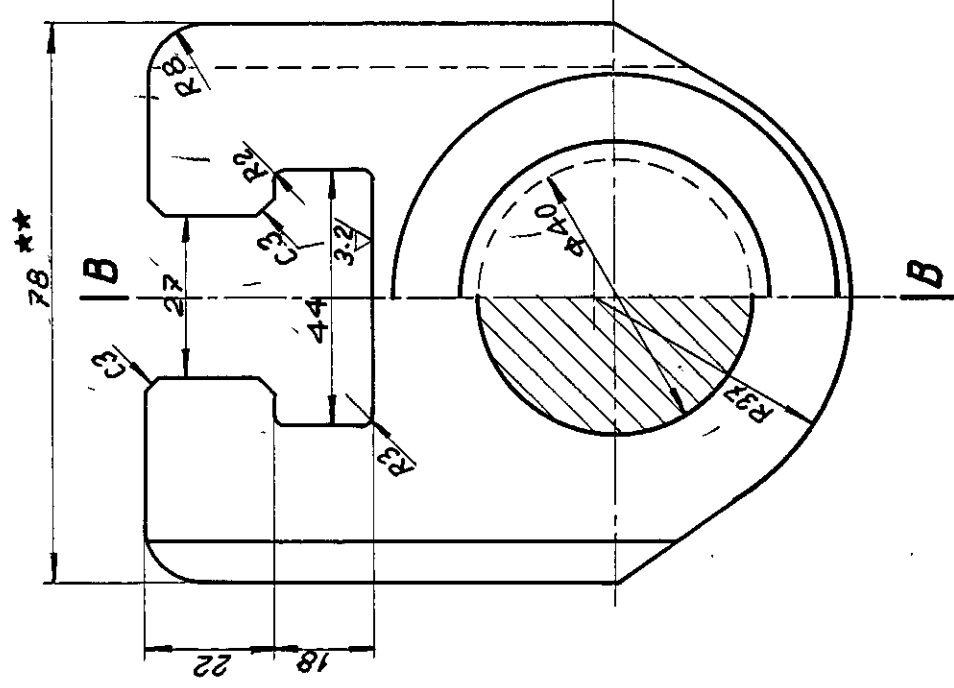
3  
12.5 / 3.2 / 0.2



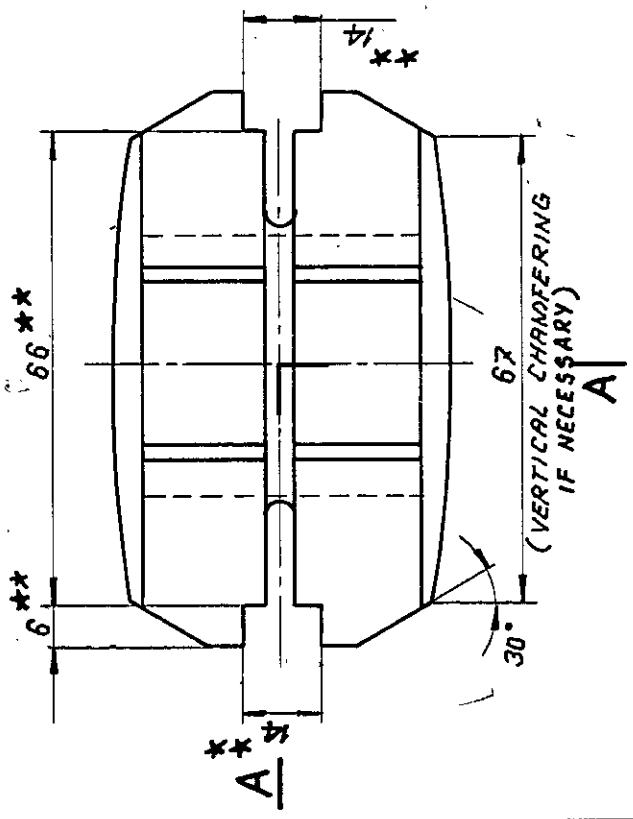
DETAIL - C



SECTION - BB



SECTION - AA



SECTION - AA

UNSPECIFIED TOLERANCES

BREAK CORNERS : 0.3 HAX

REF. TO THE STD : AS 6259793

SIZE	ABOVE	0.5	0.3	0.15	0.1	0.05	0.02	0.01
UP TO AND INCLUDING	0	0.30	0.15	0.075	0.0375	0.01875	0.009375	0.0046875
OVER	± 0.1	± 0.07	± 0.03	± 0.015	± 0.0075	± 0.00375	± 0.001875	± 0.0009375

NOTE:

1. QCP 2:7:352 SHALL BE FOLLOWED IN ALL RESPECTS.  
 \*\* MARKED DIMENSIONS ARE ALREADY COMPLETED IN ROUGH MACHINING STAGE. IT IS GIVEN FOR INFORMATION.

REV	DATE	ALTRD. K.R.S.K. 2-1-92
03	9-3-93	CHD. S.K. 80
LAPPING FINISH 0.2 WAS 0.8		
DCN No. TA0245		

REV	DATE	ALTRD. K.R.S.K. 2-1-92
02	15-10-92	CHD. S.K. 80
DISC TOP MACHINING (DIMENS. 48, 40 AND R3) TRANSFERRED TO ROUGH MACHINING STAGE.		
DCN No. TA0203		

REV	DATE	ALTRD. R.L. 08-10-93
01	4-3-89	CHECKED V.B. 80
GUIDE GROOVE MACHINING TRANSFERRED TO ROUGH MACHINING STAGE.		
DCN No. TA 0071.		

2	3-V-W009-20086	93 111 860 0000	A 182 F22, NT, PRODUCT ATTEST	F22	20	2.05	
1	3-V-W001-20086	93 111 859 0000	SA 105, NR, PRODUCT ATTEST	A105	10	2.05	
Sl. No.	DRAWING No.	COMPONENT CODE	MATL. SPECN.	* MATL. MARK	SCRAP SORT	GROSS WT (kg)	NET WT (kg)

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT

**Bharat Heavy Electricals Ltd.,**  
BOILER PLANT UNIT  
TIRUCHIRAPALLI-620 014

DEPT. V/S  
CODE 320

GRADE OF UNTOLO. DIM  
S/M/A

SCALE N.T.S

WEIGHT (KG) 2.05

REF. TO DRG. 7- E46551 (0055)

DRN R. Natarajan  
CHD M. R. K.  
APPD V. B.

DATE 22/10/92

ITEM NO.

CARD CODE U 01

DRAWING NO. 3-V-0000-20086

TITLE DISC A5128 - 6-

REV 03





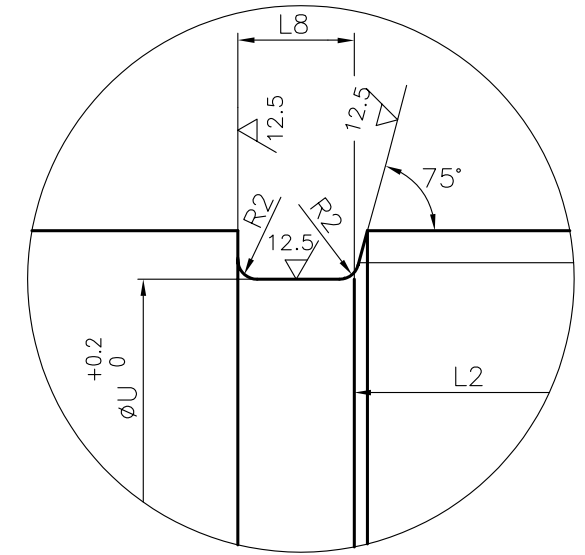
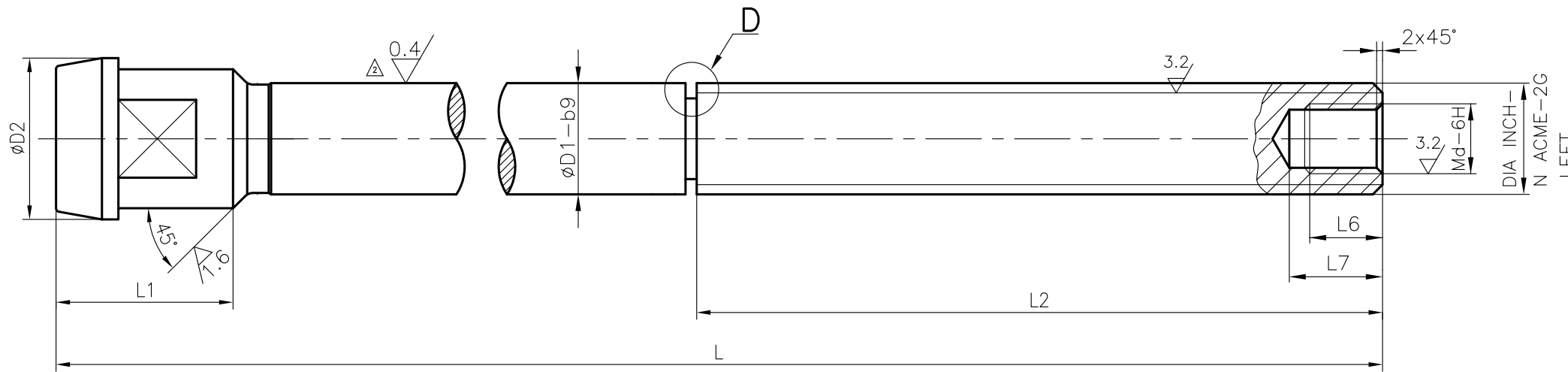
DRAWING NO. 3-V-0000-23562/03

SL. NO.	DRAWING NO.	COMP. CODE	MATL. SPECN.	∅D1 b9	∅D2	L	L1	L2	∅U	DIA INCH-N ACME,2G-LEFT	L6	L7	L8	Md-6H	SCRAP SORT	NET WT(Kg.)	REMARKS
01	3-V-N846-23562/01	931097610000	A182 F6a CL.3,NT,CERTIFY	82.55	125	2570	125	1100	68.0	3.25"-2ACME	20	27	18	M20	40	110.6	36"/150CL
02	3-V-N157-23562/01	931105340000		76.2	110	2380	111	1095	61.3	3"-2ACME	20	27	18	M20	40	86.8	32"/150CL
03	3-V-NE61-23562	932010460000		76.2	110	2450	111	1165	61.3	3"-2ACME	20	27	18	M20	40	88.2	32"/150CL

✓ / 12.5 / 3.2 / 1.6 / 0.4

∅50-65 b9	-0.190
	-0.264
∅65-80 b9	-0.200
	-0.274
∅80-100 b9	-0.220
	-0.307

**DETAIL-D**



DRAWING RETRACED WITH REV.02 ON 01.08.03

**NOTES:-**

1. HARDNESS 250 TO 300BHN FOR A182-F6a cl.3

NO OF	DESCRIPTION	MATL CODE	MATL SPECN	HEAT TREATMENT	SCRAP SORT	NET WT (kg)	GROSS WT (kg)	DRAWING No	ITEM No
-	-	-	-	-	-	-	-	-	-

REV	DATE	ALTERED	M.SRINIVASAN	REV	DATE	ALTERED	VB
03	30.01.07	CHD & APPD	P.Boomnathan	02	01.08.03	CHD & APPD	MRK

SL.No. 03 INCLUDED

SURFACE FINISH  $\nabla_{0.4}$  WAS  $\nabla_{0.8}$

DCP. No.800219

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TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT

**BHARAT HEAVY ELECTRICALS LTD.**  
UNIT: HIGH PRESSURE BOILER PLANT.  
TIRUCHIRAPALLI\_620014.

DRN	NAME	SIGN	DATE	NO.OF VAR.
	V.BAIRAVAN		01.08.03	
	R.L.NARAYANAN		01.08.03	
	M.RAJAKUMAR		01.08.03	

DEPT VL 365-121

SCALE NTS.

WEIGHT (KG) -

REFERENCE INFORMATION CAD:C323562

TITLE **STEM**

CARD CODE U 01

DRAWING NO. **3-V-0000-23562**

REV **03**

FIRST ANGLE PROJECTION. (ALL DIMENSIONS IN MILLIMETRES)

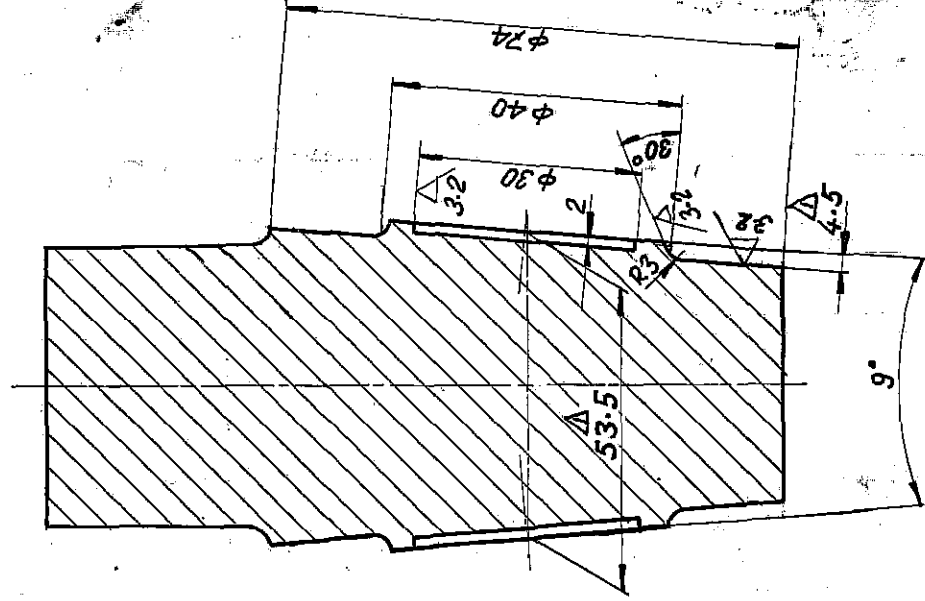
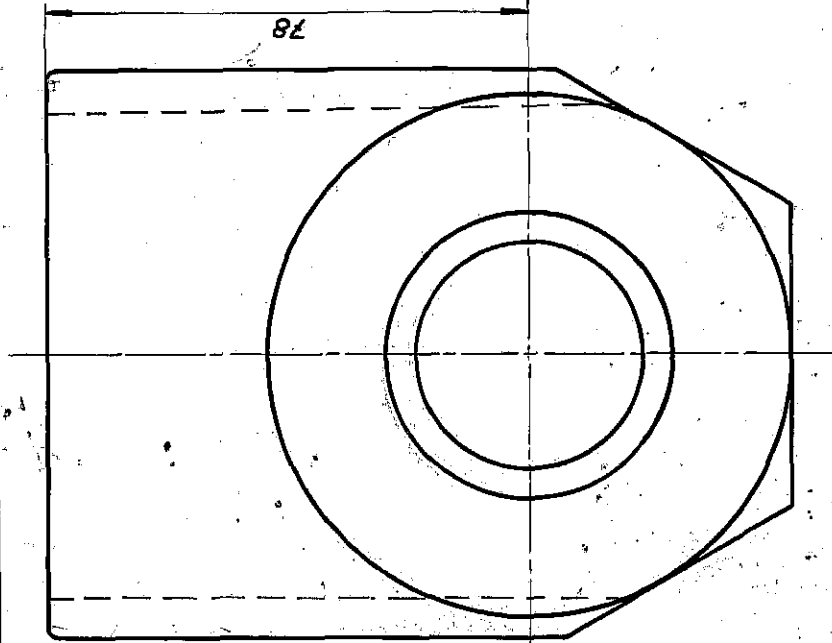
REV 01	DATE 18.4.91	ALTERED R.L. Debnath	REV 02	DATE 13.1.93	ALTERED K.R.S. Kalyan
DIMS. 53.5 & 4.5 WERE 50.5 & 3.5 RESP.		DCN No. TA0147	CHECKED S.K. Jha		DCN No. TA0222
REV 5	DATE 27.7.00	ALTERED & APPD KRS Kalyan	TOP SIDE CONFIGURATION CHANGED. DIMENSION 2.5 & RADIUS 2.5 ELIMINATED.		
NOTE UPDATED.		DCN NO. 1092			

REV 02	DATE 13.1.93	ALTERED K.R.S. Kalyan
TOP SIDE CONFIGURATION CHANGED. DIMENSION 2.5 & RADIUS 2.5 ELIMINATED.		
DCN NO. TA0222		

3

12.5/3.2

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NOTE:

1. LATEST APPLICABLE QUALITY WORK INSTRUCTIONS SHALL BE FOLLOWED IN ALL RESPECTS.



MF 757482

2.	4-V-W009-18015/3	93 III 860 8000	A 182 F22, NT, PRODUCT ATTEST	20
1.	4-V-W001-18015/3	99 III 859 8000	SA 105, NR, PRODUCT ATTEST	10
SL No.	DRAWING NO.	COMP. CODE	MATL. SPECN.	SCRAP SORT



**Bharat Heavy Electricals Ltd.**  
BOILER PLANT UNIT  
TIRUCHIRAPALLI-620 014

DRN	NAME	SIGN	DATE
CHD	M. R. K.	M. R. K.	29/10/84
APPD	V. BABU	V. BABU	30/7/84

DEPT. VS	GRADE OF UNTOOL DIM	SCALE	WEIGHT (kg)	ITEM NO.
CODE 320	AM/19	A. T. S	REF. TOP DRG. No. 4-552246 (0054)	

TITLE	CARD CODE	DRAWING NO.	REV
DISC (FOR STL WELDING) (ROUGH MACHINING DRG) 65/2700	U 01	4-V-0000-18015	3