PART- A

CNC VERTICAL TURNING LATHE - TABLE Φ 4000mm

SECTION - I : QUALIFYING CRITERIA

The BIDDER has to compulsorily meet the following requirements to get qualified for considering the technical offer for the CNC VERTICAL TURNING LATHE-TABLE Φ4000 mm

SL NO	REQUIREMENTS	VENDOR'S RESPONSE
1.0	Only those vendors (OEMs) satisying the following criteria should quote: **a)** The vendor should have supplied and commissioned at least one CNC VERTICAL BORING MACHINE of same (Table diameter 4000mm, Load Capacity 80 tons & Max Turning Height 4000mm) or higher sizes for similar applications 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. 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. **b)** The vendor should have previous experience of supply of at least one CNC VTL **or** CNC LATHE **or** CNC HBM which operate on hydro-static guide-ways, in the past ten years (on the date of opening of the Tender) and the referred machine (s) is presently working satisfactorily. The following information should be submitted by the vendor about the companies where referred machines as at **a)** & **b)** have been supplied.	
The vendor should submit following information where similar machine has been supplied for qualification of their offer.		
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	Application for which the machine is supplied.	
1.6	Performance certificate from the customers regarding satisfactory performance of machine supplied to them (Original Certificate or Through e-mail directly from the customer. Refer Clause 10.0 below).	
1.7	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- II

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

SL NO	REQUIREMENTS	VENDOR'S RESPONSE
2.0	The BIDDER / VENDOR to furnish Reference List of Customers, with full address, details of contact person, where CNC VERTICAL TURNING LATHES have been supplied in the past.	

SL NO	REQUIREMENTS	VENDOR'S RESPONSE
3.0	Specify details of CNC VERTICAL TURNING LATHES supplied to other units of BHEL,if any. (Year of commissioning, Table size, Table Load Capacity, Max Turning Height etc.)	
4.0	Details on SERVICE-AFTER-SALES Set-up in India Including the Address of Agents / Service Centers in South India.	
5.0	Any Additional data to supplement the manufacturing capability of the BIDDER for the subject equipment.	
SECTION-III		
The BIDDER to note:		
SL NO	**REQUIREMENTS**	**VENDOR'S RESPONSE**
6.0	The BIDDER / VENDOR shall submit the offer in TWO PARTS. 1. Technical Offer [**with PART A & PART B**] 2. Commercial Offer.	
7.0	The Technical Offer shall contain a comparative statement of **Technical Specifications demanded by BHEL and Offer Details submitted by the Bidder,** against each clause.	
8.0	The Technical Offer shall be supported by product Catalogues & Data Sheets and also technical details of Bought- Out- Items with copies of Product Catalogue to the extent possible.	
9.0	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.	
10.0	For obtaining the performance certificate from the customer, a suggestive format is provided in **SECTION-IV**	
SECTION -IV		
The Performance certificate should be produced on **Customer's Letter Head.**		
PERFORMANCE CERTIFICATE FOR 1.0 (a)		
1	Supplier of the Machine	
2	Make & Model of the Machine	
3	Month & Year of Commissioning	
4	Application for which M/C is used	
5	Machine Details:	
5.1	Table size	
5.2	Weight carrying capacity	
5.3	Maximum Turning Height	
5.4	CNC system	
6	Performance of the Machine (Satisfactory/ Un-satisfactory)	
7	Any Other remarks	
	Date:	Signature & Seal of the Authority Issuing the performance Certificate
PERFORMANCE CERTIFICATE FOR 1.0 (b)		
1	Supplier of the Machine	
2	Machine type (CNC VTL/CNC HBM/ CNC LATHE)	
3	Month & Year of Commissioning	
4	Application for which M/C is used	

CNC VTL : TABLE DIA - 4000 MM

SL NO	REQUIREMENTS	VENDOR'S RESPONSE
5	Major machine parameters:	
5.1	Table size/Table Load capacity/Turning Height (in case of CNC VTL)	
5.2	Spindle dia/X-axis/Y-axis/Z-axis (in case of CNC HBM)	
5.3	Swing over bed/ Swing over carriage/ Admit between centers & Load between centers (in case of CNC LATHE)	
5.4	Details of hydro-static guide-ways	
5.5	CNC system	
6	Performance of the Machine (Satisfactory/ Un-satisfactory)	
7	Any Other remarks	
	Date:	Signature & Seal of the Authority Issuing the performance Certificate

PART - B : TECHNICAL SPECIFICATION

Heavy Power Equipment Plant **Bharat Heavy Electricals Limited,** Ramachandrapuram - 502032, Andhra Pradesh, INDIA.	Enquiry No. & Dt.: Due Date : Supplier's Ref.: Date :

Specification cum Compliance Certificate for CNC VERTICAL TURNING LATHE - φ 4000 mm (TOTAL QTY - 3 Nos)

NOTES:

1. The Column " VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS" of this format shall be filled in by the Vendor and 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.

2. The offer and all documents enclosed with offer should be in English language only.

3. TOTAL NO. OF MACHINES = 3 Nos

4. MACHINE No. 1 with component prove-out (Qty - 1 No. FOR BHEL, HARIDWAR)

5. MACHINE NO. 2 with component prove-out (Qty - 1 No. FOR GAS TURBINES DIVISION OF BHEL, HYDERABAD)

6. MACHINE NO. 3 without component prove-out (Qty - 1 No. FOR PULVERIZERS DIVISION OF BHEL, HYDERABAD)

7. Vendor to note that the THREE machines are to be supplied to different units of BHELin different cities and accordingly, the three machines shall be erected & commissioned separately i.e. ONE No. at the works of BHEL, Haridwar (Machine No. 1) and other TWO Nos at the works of BHEL, Hyderabad (Machine No. 2 & 3) respectively. All Features & Requirements specified below are for ONE machine and shall be applicable independently for each machine unless mentioned as " Clause No __ to __ Applicable only for MACHINE No __". Breakup prices are to be quoted by vendor for items mentioned as " Clause No __ to __ Applicable only for MACHINE No __"

Name & Address of the Supplier:	Name & Address of the Indian Agent:
Telephone No.	Telephone No.
Fax No.	Fax No.
e-mail :	e-mail :

Scope: Supply, Erection & Commissioning of CNC VERTICAL TURNING LATHE (φ4000 mm) complying with specification as below.

SL. NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
1	**PURPOSE & WORKPIECE MATERIAL**		
1.1	**PURPOSE/APPLICATION**: This machine is required to rough & finish machine components for Power Generation Industry demanding high accuracies & surface finish.	Vendor to note & accept	
1.2	**WORK PIECE MATERIAL**: Forgings / castings of Low alloy steels, Stainless Steel, Inconel, Nimonic, cast iron and similar other materials which are generally used in power producing equipments having hardness 150 to 500 BHN.	Vendor to note & accept	
2	**SPECIFICATION:**		
2.1	**MACHINE CONFIGURATION**		

SL. NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.1.1	Double Column CNC Vertical Borer with single ram	Vendor to offer	
2.2	**CAPACITY & SIZE**		
2.2.1	Maximum Height for Turning & Facing	4000 mm or more	
2.2.2	Maximum Turning Diameter	4500 mm or more	
2.2.3	Maximum Workpiece Weight	80000 Kg or more	
2.2.4	Maximum Swing Diameter	4500 mm or more	
2.2.5	Minimum Boring Diameter (using standard turning tool holder & tool clamped on the ram)	600mm or less	
2.3	**TABLE**		
2.3.1	Table Diameter	4000mm	
2.3.2	Load Capacity	80000Kg or more	
2.3.3	Table Speed (Infinitely Variable)	1 or less to 70 rpm or more	
2.3.3.1	No. of Speed Ranges	2 or more	
2.3.4	Power of Main motor (S1 - Continuous Rating) AC	100 kw or more	
2.3.5	Details of Main motor viz.Type, Make, Model etc.	Vendor to inform	
2.3.6	No. of Jaws/Vices	4	
2.3.6.1	Additional No. of Jaws/Vices as spares	4	
2.3.7	Maximum External Clamping Diameter	Vendor to inform	
2.3.8	Minimum External Clamping Diameter	1000mm or less	
2.3.9	Maximum Internal Clamping Diameter	Vendor to inform	
2.3.10	Minimum Internal Clamping Diameter	Vendor to inform	
2.3.11	Clamping Force of each Jaw.	Vendor to inform	
2.3.12	Positions and Dimensions of the Jaws on Table. Chucking Capacity Diagram should be submitted.	Vendor to inform & submit	
2.3.13	Type of Force Multiplier Mechanism used in Jaws should be explained and Drawings should be submitted.	Vendor to inform & submit	
2.3.14	Maximum permissible Cutting Force	Vendor to inform	
2.3.15	Maximum permissible Torque	Vendor to inform	
2.3.16	RPM at which Max. Torque is available.	Vendor to inform	
2.3.17	Table Torque - Speed diagram should be submitted.	Vendor to submit	
2.3.18	Type of Bearing for the Table (Details to be submitted)	Vendor to inform	
2.3.19	Size of T - slots, their position and accuracy. Drawing of Table showing details of the T - slots etc. should be submitted.	Vendor to submit	
2.3.20	Two perpendicular accurate Slots should be provided at the Center of the table to use for alignment purposes. Sizes (Width & Depth), accuracy etc. of these slots should be furnished along with a Drawing.	Vendor to inform & submit	
2.3.21	Table Loading Diagram should be submitted (Load v / s Distance from Table Center) for uniform as well as for eccentric loading.	Vendor to submit	
2.3.22	Diameter, Depth and Accuracy of Center Bore on Table Top Surface.	Vendor to inform	

SL. NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.4	**CROSS RAIL**		
2.4.1	Vertical Travel.	Vendor to inform	
2.4.2	Vertical Traverse Rate.	Vendor to inform	
2.4.3	No. of Positions.	Vendor to inform	
2.4.4	Distance between each Position/Step	250mm or less	
2.4.5	Distance of lowest Step from Table Top	Vendor to inform	
2.4.6	Distance of highest Step from Table Top	Vendor to inform	
2.4.7	Maximum Height of Cross Rail bottom from Table Top	Vendor to inform	
2.4.8	Minimum Height of Cross Rail bottom from Table Top	Vendor to inform	
2.4.9	Movement of Cross Rail : Through NC Program as well as manually by Push Buttons	Vendor to offer	
2.4.10	Machine Reference Point should be at Ram Reference Point and it should be updated automatically with movement of Cross Rail	Vendor to offer	
2.4.11	Details of crossrail movement/positioning/locking mechanism	Vendor to submit	
2.4.12	Current position of the cross rail to be displayed on main operating panel prominently	Vendor to confirm	
2.5	**TOOL HEAD and RAM**		
2.5.1	No. of Columns	2	
2.5.2	No. of Rams	1	
2.5.3	Cross - Section of Ram (It should be rigid enough for troublefree machining with maximum projection of ram)	Vendor to inform	
2.5.4	Thread Cutting Capacity - maximum Pitch	Vendor to inform	
2.5.5	Clamping details for mounting Turning Tool Holders/Attachments on ram, should be submitted.	Vendor to submit	
2.5.6	Mounting of Turning Tool Holders and Attachments should be automatic through Program as well as manually through push buttons.	Vendor to confirm	
2.6	**MAIN TRAVERSES**		
2.6.1	Vertical Travel of Ram (Z-Axis)	2600mm or more	
2.6.2	Horizontal Travel of Ram (+ve X-Axis)	Vendor to inform	
2.6.3	Horizontal Travel of Ram beyond Center of the Table (-ve X-Axis)	1000mm or more	
2.6.4	Maximum Distance between Table Top and Standard Turning Tool Holder with Tool.	Vendor to inform	
2.6.5	Minimum Distance between Table Top and Standard Turning Tool Holder with Tool.	Vendor to inform	
2.7	**MACHINE GUIDEWAYS**		
2.7.1	Width of Cross Rail guideways	Vendor to inform	
2.7.2	Width of column guideways	Vendor to inform	
2.7.3	X & Z guide ways should be hydrostatic (Details should be submitted)	Vendor to confirm	
2.7.31	Rotary guide ways for the table should be hydrostatic, details along with min. and max. dia of Hydrostatic bearing should be submitted.	Vendor to confirm	
2.7.4	Hardness of guideways	Vendor to inform	

SL. NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.7.5	Metallic Telescopic Covers: Waterproof Telescopic Covers of rust resistant steel should be provided with pads/wipers on both left and right sides of tool head on the crossrail and also above & below the crossrail on both columns covering the guide ways. Joints of telescopic covers should be sealed to avoid mixing of coolant & hydrostatic oil . The movement of telescopic covers should be troublefree and requiring minimum maintenance.	Vendor to offer	
2.8	**FEEDS AND DRIVE SYSTEM**		
2.8.1	Cutting feed in X & Z Axes (Infinitely Variable)	0 - 5000mm/min or more	
2.8.2	Rapid feed in X & Z Axes	5000mm/min or more	
2.8.3	Feed drives/motors X & Z axes [AC servo motors] of Siemens/Fanuc digital type (details of model, make, type, rating etc. should be submitted)	Vendor to offer	
2.8.4	Maximum cutting force permissible on Ram & at what extension	Vendor to inform	
2.8.5	Maximum permissible Cutting Force at Maximum Ram extension	Vendor to inform	
2.8.6	Permissible Cutting Force v / s Ram Projection - Diagram should be submitted.	Vendor to submit	
2.8.7	Feed back system for X & Z axes should be Heidenhain linear scales with pressurized compressed air cleaning. (Details should be submitted) The Air supply system shall have suitable drier, if required.	Vendor to offer	
2.8.8	Details of backlash free movement mechanism in X & Z axes should be submitted.	Vendor to submit	
2.8.9	Mechanism for locking X & Z axis	Vendor to inform	
2.9	**CONSTRUCTION**		
2.9.1	Vendor to furnish details of material, hardness & constructional details, including explanatory drawings, of various components/ assemblies like Column, Cross Rail, Ram head, Table, Guideways/slides, Feed Transmission system, Ram, Hydraulic and Lubrication system, Feedback system etc .of the machine.	Vendor to submit	
2.9.2	Video images on CD including hard copy explaining the technical features / Literature with photographs, drawings explaining the technical features should be enclosed with the offer.	Vendor to submit	
2.10	**OPERATION AND CONTROL SYSTEM**		
2.10.1	**OPERATOR'S PANEL**		
2.10.1.1	Swivellable type operator panel having complete CNC and machine control system with all displays of required configuration shall be provided on the Operator Platform for convenient, efficient & safe operation of the machine. All switches with suitable interlocks with table rotation should be within reach of operator of average Indian height for easy & safe operation. All displays /indications should also be conveniently placed accordingly. A protection cover made of steel sheet or equivalent should be provided above the operator's panel. Layout showing complete details should be submitted.	Vendor to offer	
2.10.2	**CNC SYSTEM & FEATURES :**	Vendor to note & accept	

SL. NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.10.2.1	Make	Siemens or Fanuc	
2.10.2.2	Type	PC based latest version	
2.10.2.3	Model: Latest version & model of CNC system, as available at the time of ordering, should be supplied.	Vendor to offer and submit details	
2.10.2.4	Details of Standard features	Vendor to submit	
2.10.2.5	Details of optional features such as parametric programming, copy & paste of programs and others recommended by vendor for proveout components for specified turning operations or foreseen as required keeping in view of offered accessories /systems & special features etc..	Vendor to submit	
2.10.2.6	The system should have Operator's Panel with TFT color display (15 inch or more), Machine Control Panel , Full CNC Keyboard and Mouse/Trackball, Communication Ports for data transfer, LPT1 Parallel Interface for Printer, VGA, MPI interface & USB, and Expansion slots. The CNC System shall also have Electronic hand wheels selectable for all axes, USB Port with 2 GB Pen drive for data input/output, Hard disk of 10 GB or higher, Graphic Simulation, COM port for telediagnostics, Network ready with LAN and preinstalled system software & other required softwares etc. (Details should be submitted by Vendor)	Vendor to offer and submit details	
2.10.2.7	In case of non-availability of COM port, LPT1 interface, etc. (if not provided by CNC system manufacturer at the time of supply), suitable separate ports for networking with LAN, data input/output, telediagnostics, printer shall be provided. In case only USB ports are provided, suitable hardware/connectors shall be provided to ensure above functionalities.		
2.10.2.8	Fast & user-friendly Graphic Simulation for checking of program prior to actual running & Block-Search with calculation while running the program should be pre-installed in the CNC system in addition to all other required/recommended features.	Vendor to offer	
2.10.2.9	Additionally, a QWERTY keyboard and optical mouse (or equivalent in case of Fanuc) should also be properly interfaced and suitably inhoused in the system's panel on covered sliding type tray for editing/input of programs by programmer.	Vendor to offer	
2.10.2.10	Provision of On-screen PLC logic display on the CNC System for diagnostic purposes.	Vendor to offer	
2.10.2.11	In-cycle hour counter with reset facility shall be provided.	Vendor to offer	
2.10.2.12	Power meter for indicating total energy consumption of the machine shall be provided.	Vendor to offer	
2.10.3	**HAND HELD UNIT:**		
2.10.3.1	Hand Held unit (auxiliary pendant) Type B-MPI of Siemens make or equivalent, with jog axes/spindle inching/ hand-wheel and sufficient length of interfacing cable, which can be taken near to the chuck for job setting and similar other purposes.	Vendor to offer	
2.10.4	**MANUAL CONTROL**		

SL. NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.10.4.1	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 rpm, cutting feed on/off, display of axis position values etc, for manual machining operations without using CNC program / MDI mode. Diagram / Sketches for switches / keys provided on operators pendant should be submitted.	Vendor to confirm. Layout of panel showing requisite switches to be submitted.	
2.10.5	**DIAGNOSTIC SYSTEMS**		
2.10.5.1	**TELE-DIAGNOSTIC SERVICE :** 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. Subsequently, it should be possible to use other platforms, such as Internet or ISDN, subject to their availability in future. Help guide should be provided for use of the system/service.	Vendor to offer & submit	
2.10.5.2	**FAULT DIAGNOSTIC SYSTEM**: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. Vendor should also offer a **PC NOTE BOOK** along with PLC software (licensed copy), necessary cables, required hardwares/Adaptors (for Communication with the CNC/PLC system). 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 logic should be available on the note book PC. Procedure of fault-diagnostic system and data transfer/PLC logic transfer between PC Notebook & CNC/PLC system should be demonstrated to BHEL during commissioning of the machine.	Vendor to offer & submit	
2.10.5.3	Separate Hand Held Pendent/suitable arrangement should be provided with individual steps to retrieve the ATC to it's initial position in case of interruption of ATC's positioning cycle due to alarm on the machine or power failure .	Vendor to offer	
2.10.5.4	Machine should have provision to switchover from direct position feedback system (linear scale/encoder) to indirect position feed back system (motor encoder) and vice-versa. (for troubleshooting & maintenance purposes)	Vendor to offer	
2.10.5.5	Help guide should be provided to use both diagnostic systems	Vendor to offer & submit	
2.10.6	**NETWORKING**		
2.10.6.1	Machine control should have necessary hardware and software for interfacing with Ethernet Local Area Network for NC program and other related data transfer. This network to be connected to wide area network/Internet/BHEL intranet. The networking should have following capabilities:	Vendor to offer	
2.10.6.2	The machine shall appear as a node in the Entire Network. (Network Neighbourhood)	Vendor to offer	

SL. NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.10.6.3	The program transfer shall be by simple copy and paste method provided sharing access is allowed between any PC and the machine across the network.	Vendor to offer	
2.10.6.4	The program transfer between CNC system and network should also be possible in CNC Mode.	Vendor to offer	
2.10.6.5	Portable Data Input-Output Device : PC Note book for bi-directional program & data transfer along with all the required hardware , software , interfaces, cables, protection cover etc		
2.10.7	**MACHINE MONITORING SYSTEM (MMS) SIGNALS**		
2.10.7.1	Following MMS signals would be made available on a specifically earmarked terminal strip. These MMS signals would be sourced from CNC system/PLC output card separately.	Vendor to offer	
2.10.7.2	Control ON	Vendor to offer	
2.10.7.3	Cycle ON	Vendor to offer	
2.10.7.4	Spindle Running	Vendor to offer	
2.10.7.5	Feed Active (Any of the axes moving)	Vendor to offer	
2.10.7.6	M30 (Program Stop)	Vendor to offer	
2.11	**UPS FOR CNC SYSTEM :**		
2.11.1	UPS of 30 minutes for CNC system with in-built cooling and charge status display (Battery charging /discharging time should be specified by vendor)	Vendor to offer	
2.12	**MACHINE LIGHTS**		
2.12.1	Machine Lights for sufficient illumination of complete working area including operator's panel should be provided for clear visibility.	Vendor to offer	
2.12.2	A magnetic base portable spot light with sufficiently long cable should also be provided.	Vendor to offer	
2.12.3	Any lights required in the foundation/ pit area shall also be foreseen and supplied by the vendor.	Vendor to offer	
2.12.4	All light fittings, consumables, adapters/receptacles should have compatibility with Indian equivalents	Vendor to offer	
2.12.5	Flashing/Rotary type light indicating end of cutting, program stop, alarm etc. at a easily visible &suitable place.	Vendor to offer	
2.13	**AIR CONDITIONERS**		
2.13.1	Independent air conditioners with Dehumidifiers of suitable & sufficient capacity to be provided for each Electrical / Electronic Panels / Cabinets including Operator’s Panel considering specified ambient conditions. Detailed specifications of the same are to be submitted.	Vendor to offer	

SL. NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.13.2	In case of order vendor shall provide following information about Air Conditioners and Chiller Unit (s) used in the machine: Type of Refrigeration/ Chiller unit. The 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	
2.14	**HYDRAULIC SYSTEM (DETAILS TO BE SUBMITTED BY THE VENDOR) :**		
2.14.1	The Hydraulic System shall be of Re-circulating Type. Hydraulic Tank should be preferably placed at shop floor.	Vendor to offer and confirm	
2.14.2	Pumps, Valves, Switches (Pressure & Flow) should be of Make : Rexroth / Vickers / Parker / Hawe.	Vendor to offer and confirm	
2.14.3	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	
2.14.4	Failure indication	Vendor to offer	
2.14.5	Automatic shut off provision, Details should be submitted.	Vendor to offer	
2.14.6	Refrigerated type cooling and electric heating (Electric heating, only if required) system of sufficient capacity to maintain complete Hydraulic System, including lubrication oil, hydrostatic oil and gearbox oil, etc. keeping in view the specified ambient conditions to be offered with complete details. The temperature of Hydraulic Oil should not go beyond 40 deg. C.	Vendor to offer & submit	
2.14.7	Hydraulic pump capacity (flow / pressure)	Vendor to inform	
2.14.8	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	
2.14.9	Complete hydraulic system should be designed to avoid any leakage or spillage.	Vendor to confirm	
2.14.10	Sufficient stages/nos. of filters should be used to avoid frequent clogging of the filters and other maintenance related problems.	Vendor to offer	
2.15	**FIRST FILLING OF OILS**		
2.15.1	First filling of all required Oils & Grease etc. for the machine, voltage stabilizer, isolation transformer & air-compressor etc. to be supplied by vendor. Indigenous (Indian) source or Indian equivalent and specifications of oils/ greases are also to be provided by the vendor.	Vendor to offer & submit	
2.16	**COOLANT SYSTEM**	Vendor to offer	

SL. NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.16.1	Coolant System with all accessories for following variants shall be provided. Selection of all the variants shall be through program and push buttons as well.	Vendor to offer	
	a) Recirculating Type Flood Coolant System	Vendor to offer	
	b) Air coolant system	Vendor to offer	
2.16.2	All attachments, tool holders, boring bars etc. shall have the provision so that coolant is available directly at the tool-cutting tip.	Vendor to offer	
2.16.3	Coolant collection and recirculation system should be leak proof & perfect to avoid any spillage on shop floor, trenches for cables & foundation pit of the machine etc. In case, any leakage is found, it shall be corrected by vendor. Additionally, suitable equipment should be provided at deepest point of foundation pit to pump out collected oil/coolant up to shop floor.	Vendor to offer & confirm	
2.16.4	**Coolant Filtration System**: Recirculating type coolant system with Vacuum Rotary drum type Coolant Filtration System and magnetic separator. The filtration system should be mounted at shop floor level, if possible with provision to avoid leakage/spillage of coolant.	Vendor to confirm and submit details.	
2.16.5	Coolant Flow Diagram showing filters, pumps, valves, tanks etc.	Vendor to submit	
2.16.6	Coolant pumps & motor details etc. for all types of coolant variants	Vendor to inform	
2.16.7	Coolant Tank Capacity	Vendor to inform	
2.16.8	Pressure & rate of flow of coolant for different coolant variants for turning operations should be furnished in the offer. The coolant should be able to reach tool tip at full pressure.		
2.16.9	All types of coolant variants should be switchable through program as well as manually by push buttons provided on the Operator's control panel.		
2.16.10	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 inform	
2.16.11	The coolant tank should be fitted with skimmer for regular cleaning of coolant from contamination with tramp oil.	Vendor to offer	
2.17	**ELECTRICAL :**		
2.17.1	415V + 10% / -10%, 50 Hz +/-3 Hz, 3 Phase AC (3 wire system without Neutral) Power Supply will be provided by BHEL at a single point near the machine, as per layout recommended by Vendor. All types of switches, cables, connections, circuit breakers etc. required for connecting BHEL's power supply point to different parts of the machine/control cabinets including Voltage Stabilizer, Isolation Transformer & Air Compressor etc., shall be supplied by the vendor.	Vendor to accept & offer	
2.17.2	Tropicalisation: All electrical / electronic equipment shall be tropicalized.	Vendor to offer	
2.17.3	All electrical & electronic control cabinets & panels should be dust and vermin proof.	Vendor to offer	
2.17.4	All electrical components in the cabinets should be mounted on DIN Rail.	Vendor to offer	

SL. NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.17.5	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 Indian or should have compatibility with Indian equivalents.	Vendor to offer	
2.17.6	All motors shall conform to IEC or Indian Standards	Vendor to offer	
2.17.7	All cables moving with traversing axes should be installed in Caterpillar/ Drag chain . Additionally, all the cable trays required for laying of cables should be included in the offer.	Vendor to offer	
2.17.8	Vendor should ensure the proper earthing for the machine and its peripherals/accessories. Any material requirement for the same should be informed with foundation design/drawings. The vendor can take earthing connection from the nearest column of the production shop.	Vendor to offer	
2.18	**SAFETY ARRANGEMENTS (FOLLOWING SAFETY FEATURES IN ADDITION TO OTHER STANDARD SAFETY FEATURES SHOULD BE PROVIDED ON THE MACHINE):**	Vendor to offer	
2.18.1	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 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 offer	
2.18.2	A detailed list of all alarms / indications provided on machine should be submitted by the supplier.	Vendor to submit	
2.18.3	All the pipes, cables etc. on the machine should be well supported and protected. These should not create any hindrance to machine operator's movement for effective use of machine.	Vendor to offer	
2.18.4	All the rotating parts used on machine should be statically & dynamically balanced to avoid undue vibrations & noise.	Vendor to confirm	
2.18.5	Emergency Switches at suitable locations as per International Norms should be provided.	Vendor to offer	
2.18.6	Oil & water pipe lines should not run with electrical cable in the same trench.	Vendor to offer	
2.19	**ENVIRONMENTAL PERFORMANCE OF THE MACHINE (THE MAHINE SHOULD CONFORM TO THE FOLLOWING FACTORS RELATED TO ENVIRONMENT) :**		
2.19.1	Maximum noise level shall be 85 dB(A) at normal load condition, 1 meter away from the machine with correction factor for back ground noise, if necessary. This will be measured as per international standards like DIN 45635-16, if required. Supplier to demonstrate compliance to noise level, if so required.	Vendor to confirm	
2.19.2	There shall not be any emissions from the machine except fumes of cutting fluid during machining.	Vendor to confirm	

SL. NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.19.3	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	
2.19.4	No hazardous chemicals shall be required to be used in the machine.	Vendor to confirm	
2.19.5	If any safety / environmental protection enclosure is required it should be built in the machine by the vendor.	Vendor to confirm	
2.19.6	Paint of the machine should be oil / coolant resistant and should not get peeled off and mixed up with coolant.	Vendor to confirm	
2.21	**CHIP CONVEYOR**		
2.21.1	An elevating type chip conveyor to carry both short and curly chips efficiently and effectively to the chip bin on shop floor (on left side of the machine) should be provided at appropriate location. Two Chip bins of appropriate size of Indian make, with wheels & handle for movement, should also be supplied. Drg. of chip bin showing its size/shape is to be submitted.	Vendor to offer	
2.21.2	Type of chip conveyor	Hinged type or superior	
2.21.3	Width of conveyor	Vendor to inform	
2.21.4	Elevation of chip conveyor for chip bin	Vendor to inform	
2.21.5	Material of chip conveyor (should be rust resistant)	Vendor to inform	
2.21.6	Provision for smooth collection of chips from all-around table to the conveyor and for avoiding clogging of chips should be provided. Removable Grill/Mesh type rigid covers should be provided above some portion of the chip conveyor, to enable machine operator's access to chip conveyor from shop floor for disposal of scattered chips on shop floor, if any, through chip conveyor. Details for the same should be submitted by vendor.	Vendor to offer	
2.21.7	Operation of chip conveyor (forward, reverse & inch) should be possible through push buttons on operator's panel and also near chips disposal point/chip bin.	Vendor to offer	
2.21.8	Layout showing location of chip conveyor should be submitted.	Vendor to submit	
2.22	**SERVO VOLTAGE STABILIZER**		
2.22.1	Indian make Oil / Air Cooled Servo Controlled Voltage Stabilizer suitable for complete machine, its drives, controls, PLC etc. for unbalanced load & supply conditions considering specified power supply & ambient conditions.	Vendor to offer	
2.22.2	Make (Neel or Servomax or Aplab or equivalent reputed Indian Manufacturer)	Vendor to inform	
2.22.3	Model, Rating & Input/Output Voltage etc.	Vendor to inform	
2.22.4	Catalogue of the Voltage Stabiliser shall be submitted with the offer.	Vendor to offer	
2.23	**ULTRA ISOLATION TRANSFORMER**		

SL. NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.23.1	Indian make Ultra Isolation Transformer suitable for complete machine , its drives, controls, PLC etc. for unbalanced load & supply conditions considering specified power supply & ambient conditions.	Vendor to offer	
2.23.2	Make (Neel or Servomax or Aplab or equivalent reputed Indian Manufacturer)	Vendor to inform	
2.23.3	Model, Rating & Input/Output Voltage etc.	Vendor to inform	
2.23.4	Catalogue of the Ultra Isolation Transformer shall be submitted with the offer.	Vendor to offer	
2.24	**AIR COMPRESSOR**		
2.24.1	Independent Air/Oil cooled, Screw Type Air Compressor (of reputed Indian make Elgi, Chicago Pneumatic or Ingersol Rand) with refrigerated type Dryer & Filter of suitable/sufficient capacity with all required accessories 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 so that BHEL compressed air supply (having pressure 5-6 bar with little moisture/dirt content) could be used as and when required. The compressor unit should be suitable for continuous duty considering specified power supply & ambient conditions..	Vendor to offer	
2.24.2	Make, Type & Model	Vendor to inform	
2.24.3	Capacity (Discharge Air Flow & Pressure, Motor Power etc.)	Vendor to inform	
2.24.4	Refrigerant used	Vendor to inform	
2.25	**COMPRESSED AIR POINTS**		
2.25.1	Compressed Air Point with connections for Air Coolant System mentioned at Sl. No. 2.16.1		
2.25.2	Suitably located Compressed Air Point near machine table with manually operated ON/ OFF Valve and flexible pipe of suitable length for cleaning of workpiece, tools and work area etc.	Vendor to offer	
2.26	**CHIP & SPLASH GUARD**		
2.26.1	Movable Chip / Splash Guards of sufficient height and made of rust resistant material, should be provided all around the Table(on front side of machine columns) to avoid spilling of Coolant and scattering of Chips on Operator's Panel and Shop Floor. Front part of splash guards should be provided with safety glass for clear visibility, if required.	Vendor to offer	
2.26.2	Additionally a fixed type of splash/ chip guard of atleast full turning height should be provided on rear side of machine i.e. around rear portion of table between columns .	Vendor to offer	
2.26.3	Opening of guards on front side of table should suit maximum possible size of the job which can be loaded on the table. The guards should not provide any hindrance with complete vertical movement of crossrail/ATC on both sides of the table.	Vendor to confirm	
2.26.4	Drawing of Chip/Splash Guards showing total height, layout and other details of the same should be submitted.	Vendor to submit	
2.27	**OPERATOR'S PLATFORM**		

SL. NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.27.1	It is should be independent motorized type, movable / adjustable in vertical and horizontal directions. It should be able to reach almost to center of the Table in horizontal direction. Interlocks should be provided for its horizontal / downward movement against rotating Table and against the job (rotating or stationary) to avoid collision / accident. Positions of the gates provided in the platform for Operator's convenience should be informed by the Vendor . Drawing / Details of the Operator's Platform should be submitted. A 15 Amp. Plug Point with ON/ OFF switch is also to be provided on the Platform.	Vendor to offer	
2.27.2	Horizontal movement of complete Platform.	Vendor to inform	
2.27.3	Vertical movement of complete Platform to cover total turning height.	Vendor to inform	
2.27.4	Height of Platform Railing.	Vendor to inform	
2.27.5	Weight Capacity of the Platform.	Vendor to inform	
2.27.6	Minimum Position of Platform from Shop Floor.	Vendor to inform	
2.28	**ACCURACIES**		
2.28.1	**GEOMETRICAL ACCURACIES**		
2.28.1.1	Geometrical Accuracy Tests shall be in accordance with relevant & prevailing international standards viz. DIN 8609 / ISO 3655 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 offer	
2.28.1.2	Table Flatness	Vendor to inform	
2.28.1.3	Table Radial Runout	Vendor to inform	
2.28.1.4	Table Axial Runout	Vendor to inform	
2.28.1.5	Cylindricity of turning	Vendor to inform	
2.28.1.6	True roundness of turning	Vendor to inform	
2.28.1.7	Facial run-outs	Vendor to inform	
2.28.1.8	All other accuracies to conform to specified standard (Latest Revision) or Suppliers Test chart whichever is finer and more accurate.	Vendor to inform	
2.28.1.9	All the Geometrical accuracies including test pieces machining for turning operations etc. should be demonstrated to BHEL engineers during pre-acceptance at Suppliers works and again during Erection & Commissioning at BHEL Works. Test pieces are to be supplied by vendor for test pieces machining both at vendor's works & at BHEL's works. Drawings of test pieces to be submitted with the offer.	Vendor to offer, confirm & submit	
2.28.2	**MACHINE POSITIONING & REPEATABILITY ACCURACIES : SHOULD BE MEASURED AS PER VDI/DGQ 3441 (LATEST REVISION) USING LASER INTERFEROMETER.**		
2.28.2.1	Positioning accuracy in X axis (Pa) per 1000 mm	0.01mm	
2.28.2.2	Positioning accuracy in Z axis (Pa) per 1000 mm	0.01mm	
2.28.2.3	Repeatability in X axis (Ps)	0.008mm	

SL. NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.28.2.4	Repeatability in Z axis (Ps)	0.008mm	
2.28.2.5	Positioning accuracy over entire traverse in X axis (Pa)	Vendor to inform	
2.28.2.6	Positioning accuracy over entire traverse in Z axis (Pa)	Vendor to inform	
2.28.2.7	Total positioning error along X & Z axes per 1000 mm (P)	Vendor to inform	
2.28.2.8	Total positioning error along X & Z axes over entire traverse (P)	Vendor to inform	
2.28.2.9	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 offer	
3	**TOOLING / LEVELLING & ANCHORING SYSTEM**		
3.1	**STANDARD TOOLINGS FOR MACHINE NO. 1** **(NOTE: INDIVIDUAL PACKAGE PRICES AGAINST EACH SL. NO SHALL BE QUOTED BY THE VENDOR.)**	**Vendor to offer** **" Clause 3.1.1 to 3.2.4 Applicable only for MACHINE NO. 1 "**	
3.1.1	**TOOL HOLDERS** All tool holders & boring bars shall be available on ATC for direct clamping in ram through ATC cycle. All tool holders & boring bars should have holes for lifting by suitable eye-bolts. Each tool holder/boring bar is to be offered complete with clamping screws, eye-bolt for lifting and packing plate (for clamping of 32x32mm shank tool instead of 40*40mm tool), as applicable. Final drawings for offered items shall be submitted by vendor to BHEL after PO, in case of order, for BHEL's approval prior to their manufacturing & supply. (LH - Left Hand / RH - Right Hand)		
3.1.2	Tool holder for external turning having provision for rigid cassette type clamping. Qty 2 no.		
3.1.3	Tool holder for internal turning having provision for rigid cassette type clamping. Qty 2 no.		
3.1.4	Tool holder, having provision for both LH and RH facing using rigid cassette type clamping. Qty 1 no.		
3.1.5	Standard (Conventional) tool holder for 40*40mm tool shank with direct clamping of tools for internal / external turning and LH/RH facing operations with provision for clamping 32*32mm shank tools with packing pieces. Qty 1 no.		
3.1.6	Eccentric Boring Bar dia. 250 boring bar with length. 500mm with cassette type of tool holding for 40*40mm shank tools and with provision of 32*32mm shank tool both for turning and facing positions. Qty 1 no.		
3.1.7	Centric Boring Bar dia. 250 boring bar with length. 500mm with conventional type of tool holding for 40*40mm shank tools and with provision of 32*32mm shank tool both for turning and facing positions. Qty 1 no.		
3.1.8	General adapter for turning with flange type clamping or equivalent so that special tool holders manufactured by BHEL could be clamped for use in future. Qty 1 no.		

SL. NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
3.1.9	Tool Storage Cabinets (set of four nos.) of reputed (Indian) make having covered heavy duty drawers of suitable sizes with lock facility to store offered tooling items etc.		
3.2	**PRESETTABLE CASSETTES (to suit above cassette type holders).** Drg. No. R6300-0965 of RH Cassette is enclosed for vendor's reference. Each cassette is to be offered complete with clamping screws and packing plate (for clamping of 32x32mm shank tool instead of 40*40mm tool), as applicable. Final drawings for offered items shall be submitted by vendor to BHEL after PO, in case of order, for BHEL's approval prior to their manufacturing & supply. (LH - Left Hand / RH - Right Hand)		
3.2.1	LH cassette for 40*40mm tool shank, Length approx. 230 mm, with provision for clamping 32*32mm shank tools also with packing pieces. Qty 2 nos.		
3.2.2	RH cassette for 40*40mm tool shank, Length approx. 230 mm, with provision for clamping 32*32mm shank tools also with packing pieces. Qty 2 nos.		
3.2.3	LH long cassette for 40*40mm tool shank, Length approx. 430 mm, with provision for clamping 32*32mm shank tools also with packing pieces. Qty 2 nos.		
3.2.4	RH long cassette for 40*40mm tool shank, Length approx. 430 mm, with provision for clamping 32*32mm shank tools also with packing pieces. Qty 2 nos.		
3.3	**TOOLING FOR MACHINING OF PROVE-OUT COMPONENT FOR MACHINE NO. 1**	**Vendor to offer " Clause 3.3.1 to 3.3.4 Applicable only for MACHINE NO. 1 "**	
3.3.1	**TOOLS FOR MACHINING OF PROVE-OUT COMPONENT (AT SL.NO. 16.2) - HP INNER CASING :** Package, as specified below at Sl.No. 3.3.2 Vendor shall submit final list of offered items against Sl.Nos. 3.3.2 & 3.3.3 within two months after PO, in case of order. In case of any addition/change in offered items after order or during actual proveout (in case of order), the total requirement shall be replenished by vendor without any financial implications to BHEL.		
3.3.2	All types of cassettes, tools, inserts, holders, etc. in sufficient quantity, as recommended & required by vendor for carrying out all types of turning, grooving, boring operations for complete machining of proveout component as per its drawing to meet required drawing accuracy & surface finish. The package should include all types of cassettes required for proveout machining in addition to cassettes offered at Sl.Nos. 3.2.1 to 3.2.4. Tool holders & boring bars offered at Sl.Nos. 3.1.1 to 3.1.7 need not to be offered here again, if required to be used. In case, any other type of tool holders, different from tool holders at Sl.Nos. 3.1.1. to 3.1.7 are required to be used, same should be included in package offered here.		

SL. NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
3.3.3	Complete fixture & set of required clamping elements & fasteners, in sufficient quantity, with setting scheme as recommended & required by vendor for clamping/setting of component on machine table in different setups and for carrying out complete machining of proveout component as per Sl.No. 16.2		
3.3.4	Four Nos. of Extension Blocks of height 1200mm for 4 vices/jaws, with set of all required fasteners, in addition to items offered at Sl.No. 3.3.3 . The extension blocks shall be directly clamped on machine table using T-slots provided for vices/jaws and the vices/jaws shall be clamped on the top faces of these extension blocks which shall have matching T-slots.		
3.4	**STANDARD TOOLING FOR MACHINE NO. 2 & 3 (NOTE: INDIVIDUAL PACKAGE PRICES AGAINST EACH SL. NO SHALL BE QUOTED BY THE VENDOR.)**	**Vendor to offer " Clause 3.4.1 to 3.4.12 Applicable only for MACHINE NO. 2 &3 "**	
3.4.1	12 Nos of Ram mounted standard Tool Holders for 40x40mm shank with provision for through coolant to be offered.		
3.4.2	1 No of each of the following boring bars: 1)φ80x400 2) φ80x600 3)φ100x500 4)φ120x600 5)φ160x800 for Direct Ram mounting with provision for through coolant for 32x32 shank to be offered.		
3.4.3	Manufacturing drawings of tool holders & boring bars to be provided along with the offer		
3.4.4	Cutting tool holders & inserts as per **ANNEXURE-I** to be offered for normal operation of the machine		
3.4.5	All supplied tool holders, boring bars shall have built in system for the coolant so that coolant is available directly on the cutting tip during all possible operations like deep grooving, turning etc. Provision for external coolant shall also be provided.		
3.4.6	In case of order, manufacturing drgs., catalogues & source of all tooling items should be submitted by vendor.		
3.4.7	Extension blocks of sufficient height to clamp the work piece at a height of 300mm, 500mm & 800mm from table top using 4 nos. of supplied vices/jaws. Manufacturing drawing of the same should be supplied.		
3.4.8	8 Nos each of Job mounting parallels of 100, 150 & 200 mm heights shall be offered		
3.4.9	8 Nos each of Adjustable work supports & Clamp supports of height range 300 to 500mm, 500 to 800mm and 800 to 1200mm shall be offered.		
3.4.10	Tool Storage Cabinets (2 nos.) of reputed Indian make having covered heavy duty drawers of suitable sizes with lock facility to store offered tooling items etc.		
3.4.11	1 No of Work bench along with 2 chairs of reputed Indian make		
3.4.12	1 No of Godrej Storwel Almirah or equivalent		

SL. NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
3.5	**TOOLING FOR COMPONENT PROVE-OUT ON MACHINE NO.2 (AS PER CLAUSE 7.0)**	**Vendor to offer " Clause 3.5.1 to 3.5.2 Applicable only for MACHINE NO. 2 "**	
3.5.1	All cutting tool holders, inserts and job holding fixtures etc required for machining of prove out components to be supplied. Supplier should offer all tools & inserts with latest cutting geometries & grades to achieve high productivity and cutting parameters.		
3.5.2	In case of order, manufacturing drgs., catalogues & source of all tooling items should be submitted by vendor.		
3.6	**GENERAL TOOLING REQUIREMENTS**		
3.6.1	Mounting details of each type of toolings.	Vendor to submit	
3.6.2	Offered tooling system to be rigid to carryout machining without undue vibration, which can effect job accuracy and surface finish in extreme machining conditions like max. overhang of ram etc. .	Vendor to confirm	
3.6.3	In case of order, manufacturing drgs., catalogues & source of all tooling items (Tool Holders, Cassettes, Extension Blocks etc.) should be submitted by vendor.	Vendor to confirm	
3.6.4	Supplier should offer all tools & inserts with latest cutting geometries & grades to achieve high productivity and cutting parameters.	Vendor to confirm	
3.6.5	All supplied tool holders, boring bars, cassettes etc. shall have built in system for the coolant so that coolant is available directly on the cutting tip during all possible operations like grooving, turning etc. Provision for external coolant should also be provided.	Vendor to offer	
3.7	**TOOLS FOR ERECTION, OPERATION & MAINTENANCE**		
3.7.1	Tools and Equipment required for erection of the machine shall be brought by the vendor. Necessary tools like Torque Wrenches, Set of job clamping accessories (T-nuts, Studs, Clamp supports), Spanners, Keys, grease guns etc. for operation and maintenance of the machine should be supplied by the vendor. List of such tools should be submitted with offer.	Vendor to offer	
3.7.2	Set of Test Mandrels/Cylindrical Bars for checking table run-out & alignment of ram etc. should be supplied with protection boxes.	Vendor to offer	
3.8	**LEVELING & ANCHORING SYSTEM**		
3.8.1	Complete set of anchoring materials including foundation bolts, nuts, washers, fixators, leveling shoes etc for alignment of table/ram and to fix the machine to the foundation should be supplied. Details to be submitted.	Vendor to offer	
4	**ACCESSORIES :**		
4.1	**AUTOMATIC TOOL CHANGER**	Vendor to offer	
4.1.1	Type	Vendor to inform	
4.1.2	No. of storage locations (to suit all the offered tool holders and boring bars)	12 or more	

SL. NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
4.1.3	Tool selection method - Random	Vendor to confirm	
4.1.4	Maximum permissible weight in each pocket.	Vendor to inform	
4.1.5	The Machine operation should be possible with or without referencing ATC.	Vendor to confirm	
4.1.6	ATC Drawing should be submitted with the offer.	Vendor to submit	
4.1.7	Provision for loading/unloading of different holders on ATC using overhead crane, if required.	Vendor to offer	
4.2	**AUTOMATIC TOOL OFFSET MEASURING SYSTEM:**		
4.2.1	Automatic Tool Offset measuring system with measuring cycles, calibration system etc suitable for all types of tools recommended for prove-out components. The system shall be capable of measuring tool lengths loading these values into tool offset memory of the machine. The system shall be such that the measurement should be with an accuracy of 10 microns or less. .Vendor to furnish detailed description of the system along with offer.	Vendor to submit	
4.2.2	During proveout, all tools shall be set & checked by supplied Automatic tool offset Measuring System using required program supplied by vendor.	Vendor to accept & offer	
4.2.3	Spares Package for the Automatic Tool Offset Measuring system for 2 years trouble free working should also be offered.	Vendor to offer with list.	
4.2.4	Operating Manuals, Maintenance Manuals & Catalogues for offered Automatic Tool Offset Measuring System.	Vendor to offer	
4.3	**AUTO FOCUS VIDEO CAMERA**		
4.3.1	Complete system having Auto Focus Video Camera with zoom facility & its accessories & connections is to be offered. The camera, mounted inside its enclosure, shall be mounted on the ram or tool holders (Sl.No.3.1) with internally connected & concealed electrical connections. In case, the mounting on tool holders is offered, all tool holders/boring bars (at Sl.No. 3.1) should have provision for the same and suitable electrical connections. Freely hanging or unsupported/unprotected cables are to be avoided. Color monitor should be suitably located on operator's panel to view tool while machining and also as an aid for setting of casings/long cylindrical jobs using dial indicator. Camera eyes/lens and connecting cables shall be safe guarded against heat, chips, coolant, dust etc. to maintain clear visibility of the tool in these conditions. Suitable sockets for power connections shall be provided for both positions(ram and tool holders). Clamping details of camera on different tool holders shall be shown on drawings of tool holders.	Vendor to offer	
4.3.2	**Spare Package for Video Camera System (Sl.No. 4.3) :** Complete System, as offered against Sl.no. 4.3, in spare.	Vendor to offer	
5	**SPARES :**		

SL. NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
5.1	Itemized breakup of mechanical, hydraulic, electrical and electronic spares used on the machine in sufficient quantity as per recommendation of Vendor for 2 years of trouble free operation on three shifts continuous running basis should be offered by vendor. The list to include following, in addition to other recommended spares: (Unit Price of each item of spare should be offered)	Vendor to offer	
5.1.1	**MECHANICAL & HYDRAULIC SPARES: FOLLOWING SPARES ARE TO BE OFFERED**	Vendor to offer	
5.1.1.1	All types of Pumps used on machine i.e. Hydraulic, Hydrostatic, Lubrication, coolant and oil cooling system (1 no. each type)	Vendor to offer	
5.1.1.2	All types of Pressure control valves, Pressure reducing valves, Flow control valves & Direction control valves used in Hydraulic, Lubrication, Pneumatic & Coolant circuit. (1 no. of each type)	Vendor to offer	
5.1.1.3	All types of pressure switches, pressure transducers, flow switches and float switches used in Hydraulic, Lubrication, Pneumatic & Coolant circuit. (1 no. of each type)	Vendor to offer	
5.1.1.4	Pump - motor couplings (1 no. of each type)		
5.1.1.5	All types of Filter Cartridges of regenerative type (5 nos. of each type)	Vendor to offer	
5.1.1.6	All types of Filter Cartridges of disposal type (10 nos. each type)	Vendor to offer	
5.1.1.7	One set of belts (including timing belt) used in the machine.	Vendor to offer	
5.1.1.8	One set of seal kits used in different hydraulic & pneumatic cylinders in the machine.	Vendor to offer	
5.1.1.9	All types of Wipers & O-rings (5 nos. of each type) used in the machine.	Vendor to offer	
5.1.2	**ELECTRICAL/ELECTRONIC/CNC SPARES : FOLLOWING SPARES ARE TO BE OFFERED**	Vendor to offer	
5.1.2.1	Relays (2 Nos each type)	Vendor to offer	
5.1.2.2	Contactors (2 Nos each type)	Vendor to offer	
5.1.2.3	Temperature sensing devices (1 No each type)	Vendor to offer	
5.1.2.4	Proximity Switches (2 Nos each type)	Vendor to offer	
5.1.2.5	Limit Switches & Micro Switches (2 Nos each type)	Vendor to offer	
5.1.2.6	Push Buttons (10 Nos each type)	Vendor to offer	
5.1.2.7	Indicating Lamps (10 Nos each type)	Vendor to offer	
5.1.2.8	Semiconductor Fuses (1 No each type)	Vendor to offer	
5.1.2.9	Special Fuses (10 Nos each type)	Vendor to offer	
5.1.2.10	Circuit Breakers (2 Nos each type)	Vendor to offer	
5.1.2.11	Main Power Switch (1 No each type)	Vendor to offer	
5.1.2.12	Encoders (1 No each type)	Vendor to offer	
5.1.2.13	Scanning Head Unit for Linear Scales (1 No each type)	Vendor to offer	
5.1.2.14	Spare Hard disk loaded with Ghost of the machine after final commissioning	Vendor to offer	
5.1.2.15	I/O Modules of PLC (1 No each type)	Vendor to offer	
5.1.2.16	Power Module & Control Cards for Main Drive as well as Feed Drives (1 No each type)	Vendor to offer	

SL. NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
5.1.2.17	NCU module	Vendor to offer	
5.1.2.18	Hand held unit	Vendor to offer	
5.1.2.19	Memory cards with loaded data (1 No each type)	Vendor to offer	
5.2	All types of spares for total machine and accessories should be available for at least 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	
5.3	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	
6	**DOCUMENTATION : THREE SETS OF FOLLOWING DOCUMENTS (HARD COPIES & SOFT COPIES) IN ENGLISH LANGUAGE SHOULD BE SUPPLIED ALONG WITH THE MACHINE**	Vendor to confirm	
6.1	Operating manuals of Machine & CNC system	Vendor to offer	
6.2	Programming Manuals of Machine & CNC system	Vendor to offer	
6.3	Detailed Maintenance manual of machine and supplied systems.	Vendor to offer	
6.4	Maintenance Interface & commissioning manuals, PLC programming manual for CNC system, Interface & commissioning manuals for spindle ,feed drives and auxiliary drive.	Vendor to offer	
6.5	Manufacturing drawings for all supplied clamping jaws and its lead screws, tool holders, coolant connections, fixtures etc.	Vendor to offer	
6.6	Catalogues, Operation & Maintenance Manuals of all bought out items including drawings, wherever applicable.	Vendor to offer	
6.7	Detailed specification of all rubber items and hydraulic/lube fittings	Vendor to offer	
6.8	Operating Manuals, Maintenance Manuals & Catalogues for supplied accessories viz. Voltage Stabilizer, Isolation Transformer, Air-Compressor, etc.	Vendor to offer	
6.9	Program print-outs (hard copy) for PLC of main machine and auxiliary systems (if used) alongwith Comments, cross reference list and Input/Output list in English.	Vendor to offer	
6.10	PLC programs, NC data, PLC data, Alarms & messages and all the data backup (which is required in the event of total data loss) shall be supplied on CD.	Vendor to offer	
6.11	Complete ghost back-up of hard disk on CD and clearly written Instructions of taking back-up and reloading on new hard disk.	Vendor to offer	
6.12	Complete list of parts/items(Bill of materials) used in the machine in English language along with Make, Specifications, Type No. and Supplier's Address.	Vendor to offer	
6.13	Electrical Schematic Diagrams, Wiring Diagrams, Junction Box Layouts, Connector Diagrams and Cable Layouts of the machine in English.	Vendor to offer	
6.14	Drawings of machine assemblies/sub-assemblies/parts including Pneumatic/ Coolant / Hydraulic circuit diagrams. All Assembly/ Sub Assembly Drawings shall be supplied with the part list marked on it in English.	Vendor to offer	

SL. NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
6.15	One additional set of all the above documentation on CD.	Vendor to offer	
7	**PROVE-OUT MACHINING OF BHEL COMPONENTS**		
7.1	**GENERAL REQUIREMENTS**	Vendor to accept	
7.1.1	Drawings of proveout component are enclosed. Job Setting & Machining Process Plan & Requirement of Tools etc. for machining of proveout component shall be finally mutually agreed with vendor after the order, in case of order, without any financial implications. Final proveout component drawing no. may change, however, the machining features shall be in line with the original component drawing. Complete machining of prove out component shall be done by Vendor at BHEL works to the specified design accuracy and surface finish, using cutting tools & CNC programs to be provided by the vendor to prove the machine after complete erection, tests & test piece machining etc. Material for the proveout component shall be provided by BHEL. Vendor shall submit final job setting plan, machining process plan, tool layout & list with complete description, time study etc. for the proveout machining within three months of placement of order, in case of order. Vendor shall submit CNC programs prior to start of erection of Machine at BHEL works.	Vendor to accept & offer	
7.1.2	Vendor shall be responsible, financially or otherwise, for any deviation/ rejection in proveout component to the extent of cost of Casting/Forging, 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.. Against the cost of such deviation / rejection, if any, vendor shall be responsible as per respective commercial condition specified in tender documents.	Vendor to accept & confirm	
7.1.3	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	
7.2	**PROVE-OUT MACHINING OF ONE COMPONENT - HP INNER CASING : as per Sl.No. 7.1 FOR MACHINE NO. 1**	**Vendor to offer " Clause 7.2.1 to 7.2.4 Applicable only for MACHINE NO. 1 "**	

SL. NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
7.2.1	The proveout component shall be one HP Inner Casing as per following drawing nos. or similar. The drawings are enclosed. 1. H.P. Inner Casing - Drg.No. 01050209000 (2 sheets) 2. Groove Plan for H.P. Inner Casing - Drg.No. 91010741051 3. T-Groove for H.P. Inner Casing - Drg.No. 4101-0741012 4. T-Groove for H.P. Inner Casing - Drg.No. 41010741013 5. T-Groove for H.P. Inner Casing - Drg.No. 41010741014 6. Casting for H.P. Inner Casing - Drg.No. 01050209901 Above drawings should be treated as BHEL property. Strict confidentiality is to be maintained and under no circumstances these drawings or copy of these must be transferred to third party without permission of BHEL. These drawings must not be used directly or indirectly in any way detrimental to the interest of the BHEL.	Vendor to accept & offer	
7.2.2	**Material of H.P. Inner casing :** CREEP RESISTANT ALLOY STEEL CASTING WITH IDENTIFICATION NUMBER FOR INTERNAL COMPONENTS(G17CRMOV510) TEMPERATURE >540 <566DEG.C	Vendor to accept	
7.2.3	Prove out machining shall include all types of turning, grooving & boring operations as per different drawings of H.P.Inner Casing (at Sl.no. 16.2.1) including its groove plan. Groove Plan drawing shows both rotor and casing parts out of which only casing part is to be considered. All operations in proveout machining shall be performed using CNC Programs supplied by vendor. The CNC Programs should preferably consist of generalised parametric subroutines for repetitive type of operations like different operations of T-grooves etc. so that these subroutines could be adopted for other similar casing by using different parameter's values and calling same subroutines in other main-program.	Vendor to accept & offer	
7.2.4	During proveout, all tools should be preset by using supplied Tool offset Measuring System (Sl.No.30.3) and measurement of machined dimensions of the respective proveout components for each machine shall be done by supplied Job Measuring System (Sl.No.30.1).	Vendor to accept & offer	
7.3	**PROVE-OUT MACHINING OF BHEL COMPONENT - FRAME 6 COMPRESSOR DISCHARGE CASING : as per Sl.No. 7.1 FOR MACHINE NO. 2**	**Vendor to accept & offer "Clause No 7.3.1 to 7.3.3 Applicable only for MACHINE NO. 2 "**	

SL. NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
7.3.1	Rough & Finish turning of faces,outer diameters, bores & blade grooves of prove out component detailed at Clause No 7.3.3 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. Material for the proveout components in ready to turn condition shall be provided by BHEL. 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. Vendor shall submit CNC programs prior to start of erection of Machine at BHEL works.		
7.3.2	During proveout, all tools should be preset by using supplied Tool offset Measuring System.		
7.3.3	Component Name : Frame-6 GT Compressor Discharge Casing Machining Drawing : 0-35105-61004-01 Forging Drawing : 0-35105-67003-01 Raw Material : Grey Cast Iron (ASTM-A395)		
8	**TRAINING & PRE-DISPATCH INSPECTION :**		
8.1	Four BHEL Persons should be trained at vendor's works for the area & period given below: (a) CNC Programming for the machine, measuring system, etc. (Period 3 weeks) (b) Electrical, Electronic & CNC maintenance for machine & other supplied equipments (Period 2 weeks) (c) Mechanical & Hydraulic maintenance of the machine & other supplied equipments (Period 2 weeks) (d) Operation of the machine & other supplied equipments (Period 2 weeks) Pre-dispatch inspection (ref. Sl.No. 12.1) of the machine shall also be carried out by the team during their stay at vendor's works for the training. Vendor may specify days required for pre-dispatch inspection. BHEL reserves the right to choose no. of persons, field & period of training, out of above, while deputing their engineers for training.	Vendor to offer	
8.2	Air-fare, boarding & lodging for the trainees shall be borne by BHEL.	For vendor's information.	
8.3	Competent, English speaking experts shall be arranged by the vendor for satisfactory & effective training of BHEL personnel.	Vendor to accept & confirm	
8.4	Vendor should commit & offer to organize training of Electronics Engineer and Programmer at the CNC System Manufacturer's works/training school for advanced features and specialized training, if so required by BHEL.	Vendor to offer	
8.5	Training charges, if any, for training requirement at Sl.No. 8.1 & 8.4 should also be quoted on per Man-day basis so that training charges can be derived for the agreed period & persons, in case of any change.	Vendor to offer	
9	**FOUNDATION**		

SL. NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
9.1	**FOUNDATION REQUIREMENTS FOR MACHINE NO.1**	**Vendor to offer " Clause 9.1.1 to 9.1.2 Applicable only for MACHINE NO. 1 "**	
9.1.1	Vendor shall submit the preliminary layout drawings 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 compressor, Chip Bin & all other accessories/ attachments/ offered items. BHEL shall construct complete foundation for the machine under supervision of supplier and at vendor's responsibility. Vendor should arrange equipments required for the testing of foundation, if required by the vendor. The vendor shall also indicate detailed specifications/requirement of earthing material, grouting compound and grouting procedure etc. for foundation bolts of the machine.	Vendor to accept & offer	
9.1.2	Tentatative Soil condition data at BHEL, HYDERABAD is as detailed below: Based on the Block Resonance Test, the Dynamic Soil Parameters may be taken as below: (i) Cu = 4.937 kg/cubic cm (for block size of 1.5m x 1m x 1m) Cu = 1.667 kg/cubic cm (for foundation size of 10square M or more, (ii) CΦ = 9.70 kg/cubic cm (iii) CΨ = 4.20 kg/cubic cm Bearing Capacity: Depth : 5 M From Shear consideration : 39 Tons/SquareM From Settlement consideration : 9-10 Tons/SquareM Recommended Bearing Capacity : 9 Tons/SquareM	For vendor's information.	
9.2	**FOUNDATION REQUIREMENTS FOR MACHINE Nos : 2 & 3**	**Vendor to accept & offer "Clause No 9.2.1 Applicable only for MACHINE NO. 2 & 3 "**	

SL. NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
9.2.1	Vendor shall submit the preliminary General Arrangement Drawing & Layout Drawing for getting BHEL's approval within two months from the date of Letter of Intent (LOI) / P.O. Complete Foundation details viz. static / dynamic load details etc. and Final Layout drawings shall be submitted by the supplier within two months after getting BHEL's approval. The layout should consist of all reqirements pertaining to complete machine including space requirement for Voltage Stabilizer, Isolation Transformer, Air compressor, Chip Bin & all other accessories/ attachments/ offered items.BHEL shall design & construct complete foundation for the machine as per Final Layout & other details provided by vendor. The vendor shall also indicate detailed specifications of grouting compound and grouting procedure etc. if any specifically desired for foundation bolts of the machine.	Vendor to accept & offer	
10	**ERECTION & COMMISSIONING**		
10.1	**Machine no. 1 to be erected and commissioned at Haridwar as per clause nos. 10.3 to 10.11. Break up price to be quoted For machine no. 1.**	**Vendor to accept & quote " Clause 10.1 Applicable only for MACHINE NO. 1 "**	
10.2	**Machine no. 2 & 3 to be erected and commissioned at Hyderabad as per clause nos. 10.3 to 10.11. Break up price to be quoted For machine no. 2 & 3.**	**Vendor to accept & quote "Clause No 10.2 Applicable only for MACHINE NO. 2 & 3 "**	
10.3	Supplier to take full responsibility for carrying out the erection, start up, testing of machine, it's control system & all types of other supplied equipment, machining of test pieces etc. Service requirement like power, air & water shall be provided by BHEL at only one point to be indicated by supplier in their foundation/layout drawings. Other requirements like crane and helping personnel shall also be provided by BHEL. Details of these requirements should be informed by vendor in advance. The available crane capacity at the proposed location of the machine will be 80 Ton. The vendor will ensure to make requisite arrangement for lifting of heavier consignment/ items/ assembly of the machine not getting covered by this capacity.	Vendor to accept.	
10.4	Erection & Commissioning of Voltage stabilizer, Isolation Transformer , Air Compressor and other accessories/attachments with all electrical & mechanical connections shall also be responsibility of the vendor.	Vendor to offer	
10.5	Successful proving of BHEL components by the supplier shall be considered as part of commissioning for the machine . All tests, as mentioned at Sl. No. 12 (Machine Acceptance) and testing/demonstration of tele-diagnostic service etc. shall also be part of the commissioning activity.	Vendor to offer	
10.6	Tools, Tackels, Test Mandrels, instruments and other necessary equipment including Laser equipment required to carry out all erection & commissioning activities should be arranged and brought by the supplier.	Vendor to accept	

SL. NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
10.7	Commissioning spares, required for commissioning of the machine within stipulated time, shall be brought by the supplier on returnable basis.	Vendor to accept	
10.8	All cover plates, plates for chutes for chips flow etc., required for the machine and its peripherals/accessories shall be supplied by the vendor.	Vendor to accept	
10.9	Schedule of Erection and Commissioning shall be submitted with the offer.	Vendor to submit	
10.10	Terms & conditions for Erection & Commissioning should be furnished in detail separately by vendor along with offer.	Vendor to submit	
10.11	Portion, if any, of the machine, accessories/attachments and other supplied items where paint got rubbed or peeled off during transit or erection should be re-painted 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 offer	
11	**AMBIENT CONDITIONS & THERMAL STABILITY**		
11.1	Total machine including all supplied items should work trouble free and should give specified accuracies under existing power supply and ambient operating conditions, as mentioned below at Sl. Nos. 11.2	Vendor to accept & confirm	
11.2	Ambient Operating Conditions: Temperature = 5 to 45 degree Celsius Relative Humidity = 95% max. 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 without any temperature controlled enclosure/shop. Max. temperature variation is 25 deg Celsius in 24 hours.	Vendor to accept	
11.3	Thermal Stability: Thermal Stability of the complete machine and all supplied items keeping in view the specified Ambient Conditions, accuracies, requirements of BHEL components and trouble free operation of the machine should be ensured by vendor. Since the machine shall be installed in shop with operating conditions as per Sl.No. 11.2, the vendor shall ensure achieving the drawing accuracies on the job throughout the year. Vendor to confirm that machine is suitable for above and details of provisions on the machine for the suitability should be furnished by Vendor.	Vendor to offer & confirm	
11.4	The machine should be suitable for continuous operation to its full capacity for 24 hours a day and 7 days a week throughout year. Vendor to ensure and confirm the same.	Vendor to offer & confirm	
12	**MACHINE ACCEPTANCE (TESTS/ACTIVITIES TO BE PERFORMED & DEMONSTRATED BY THE VENDOR)**	Vendor to note	
12.1	**TESTS/ACTIVITIES TO BE CARRIED OUT AT VENDOR'S WORKS ON THE MACHINE BEFORE DISPATCH :**	Vendor to note	
12.1.1	Demonstration of specified/offered Geometrical accuracies as per clause 2.27.1	Vendor to accept & confirm	
12.1.2	Demonstration of specified/offered Positioning accuracies as per clause 2.27.2	Vendor to accept & confirm	

SL. NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
12.1.3	The machine should be tested for continuous running of 48 hrs. If any break down occurs during this test, the test should be repeated for 48 hrs from that time.	Vendor to accept & confirm	
12.1.4	Demonstration of all features of the machine, control system & accessories and troubleshooting	Vendor to accept & confirm	
12.1.5	Machining of test piece as per AFNOR/ISO/NAS for turning operations etc. Vendor to supply test pieces.	Vendor to accept & confirm	
12.2	**TESTS/ACTIVITIES TO BE CARRIED OUT AT BHEL WORKS WHILE COMMISSIONING THE MACHINES:**	Vendor to note	
12.2.1	Demonstration of specified/offered Geometrical accuracies as per clause 2.27.1	Vendor to accept & confirm	
12.2.2	Demonstration of specified/offered Positioning accuracies as per clause 2.27.2	Vendor to accept & confirm	
12.2.3	Full load test to demonstrate the maximum power & cutting capacity of the machine.	Vendor to accept & confirm	
12.2.4	The machine should be tested for continuous running of 48 hrs. If any break down occurs during this test, the test should be repeated for 48 hrs from that time.	Vendor to accept & confirm	
12.2.5	Demonstration of all features of the machine, control system & accessories, and troubleshooting to the satisfaction of BHEL for efficient and effective use of the machine.	Vendor to accept & confirm	
12.2.6	Demonstration by actual use of all supplied accessories to their full capacity for required applications.	Vendor to accept & confirm	
12.2.7	Machining of test piece as per AFNOR/ISO/NAS for turning operations etc. Vendor to supply test pieces.	Vendor to accept & confirm	
12.2.8	Successful machining of proveout components to required drawing accuracies as per Sl. No. 7.0	**Vendor to accept & confirm " Applicable only for MACHINE NO. 1 & 2 only "**	
12.2.9	Two weeks of supervision by Vendor of independent operation of machine by BHEL after job proveout.	**Vendor to accept & confirm " Applicable only for MACHINE NO. 1 & 2 only "**	
12.2.10	Supervision by vendor expert for independent operation of machine by BHEL personnel for machining one component or till all features of the machine are proven.	**Vendor to accept & confirm " Applicable for MACHINE NO.3 only .**	
12.2.11	Training of BHEL machine operators in operation of complete machine & accessories etc by the supplier's experts / engineers during their stay at BHEL works.	Vendor to accept & confirm	
13	**PACKING**		

SL. NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
	Sea worthy & rigid packing for machine, control and all other supplied items to avoid any damage/loss in transit. All small loose items should be suitably packed in boxes.	Vendor to offer & confirm	
14	**GUARANTEE**		
	Guarantee for complete machine and all supplied systems/accessories / attachments /equipments/items for 24 months from the date of acceptance of the machine.	Vendor to offer	
15	**GENERAL**		
15.1	Machine Model No.	Vendor to inform	
15.2	Total connected load (KVA)	Vendor to inform	
15.3	Total Space required (Length, Width, Height) for complete machine, accessories/attachments and other supplied items like Voltage Stabilizer, Isolation Transformer & Air compressor etc.	Vendor to inform	
15.4	Painting of Machine / Electrical Panels : Colour as per vendor standard	Vendor to inform	
15.5	Total weight of the machine	Vendor to inform	
15.6	Weight of heaviest part of machine	Vendor to inform	
15.7	Weight of the heaviest assembly of the Machine	Vendor to inform	
15.8	Dimensions of largest part of the machine	Vendor to inform	
15.9	Vendor to submit reference list of customers where similar machines have been supplied mentioning broad specifications of the supplied machine i.e. Model, CNC System, Table Dia, Max. Turning Dia, Max. Turning Height, RPM, Load Carrying Capacity, Main Drive Rating and detail of accessories/attachments, if any, etc.	Vendor to submit	
15.10	Detailed catalogues, sketches/drawings/photographs pertaining to the offered machines and accessories/attachments/items should be submitted with the offer.	Vendor to submit	
15.11	Hydraulic, Pneumatic & Oil pipings should be preferably metallic except places where flexible pipings are essential. All the pipes required for the same shall be supplied by the vendor.	Vendor to confirm	
15.12	All Cables and Hoses etc. should be well supported & protected in trays/brackets/drag chains etc.	Vendor to confirm	
15.13	Total Height of the machine when ram is at Z home and cross rail is set for facing on maximum height 4000mm.	Vendor to inform	
15.14	Ladder is to be provided to access the machine elements located at the top of the column for maintainance purpose	Vendor to offer & confirm	
16.0	**OPTIONAL ITEMS: (VENDOR TO NECESSARILY QUOTE)**		

SL. NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
16.1	**AUTOMATIC JOB MEASURING SYSTEM:** Automatic job measuring system with measuring cycles, calibration system and all types of probes / styli required for measuring dimensions of the prove-out components. Vendor to furnish detailed description of the system along with offer. The measurement system shall be customised so that the measured result file shall be genarated in the CNC System only and shall contain all relevant information such as nominal values, measured values, tolerances along with project details of measured component as per sample format at Annexure-I. Further , all the measurements done on the component shall appear in a single file in the above sample format. The selected probing results output file shall be printable from the CNC screen of the machine on a printer through a single key command/soft Key. Supply should include all necessary hardware, software, Printer (A4 size), all types of cables, communication software, CNC features required for above mentioned setup.	Vendor to offer with details.	
16.2	**Spares Package for the Automatic Job Measuring System** for 2 years trouble free working should also be offered. The spares should include Tool Probes, Interface Unit & Special Tips if any.	Vendor to offer with list.	

ANNEXURE - I

TOOLING LIST FOR VERTICAL LATHE - TABLE DIA: 4000MM

SNO	DESCRIPTION OF TOOL	QTY	DESCRIPTION OF INSERT	QTY
EXTERNAL TURNING HOLDERS WITH RHOMBIC INSERTS				
1	PCLNL4040S19	2	CNMG 19 06 12 of Grade GC 4030 & GC 3040 of Sandvik or equivalent grade of other reputed suppliers	50 EACH
2	PCLNR4040S19	2		
3	PCLNL3232P19	2		
4	PCLNR3232P19	2		
EXTERNAL TURNING HOLDERS WITH DIAMOND INSERTS				
1	PDJNL3232P15	2	DNMG 15 06 08 of Grade GC 4030 & GC 3040 of Sandvik or equivalent grade of other reputed suppliers	50 EACH
2	PDJNR3232P15	2		
3	PDJNL2525M11	2	DNMG 11 04 08 of Grade GC 4030 & GC 3040 of Sandvik or equivalent grade of other reputed suppliers	
4	PDJNR2525M11	2		
EXTERNAL TURNING HOLDERS WITH ROUND INSERTS				
1	PRGNL4040S25	2	RNMG 25 09 00 of Grade GC 4030 & GC 3040 of Sandvik or equivalent grade of other reputed suppliers	50 EACH
2	PRGNR4040S25	2		
3	PRGNL3232P19	2	RNMG 19 06 00 of Grade GC 4030 & GC 3040 of Sandvik or equivalent grade of other reputed suppliers	50 EACH
4	PRGNR3232P19	2		
5	PRGNL2525M12	2	RNMG 12 04 00 of Grade GC 4030 & GC 3040 of Sandvik or equivalent grade of other reputed suppliers	50 EACH
6	PRGNR2525M12	2		
EXTERNAL TURNING HOLDERS WITH SQUARE INSERTS				
1	PSBNL4040S19	2	SNMG 19 06 12 of Grade GC 4030 & GC 3040 of Sandvik or equivalent grade of other reputed suppliers	50 EACH
2	PSBNR4040S19	2		
3	PSBNL3232P19	2		
4	PSBNR3232P19	2		

NOTE: ALL TOOLING SHALL BE OF REPUTED INTERNATIONAL BRANDS LIKE SANDVIK, ISCAR, SECO OR EQUIVALENT ONLY

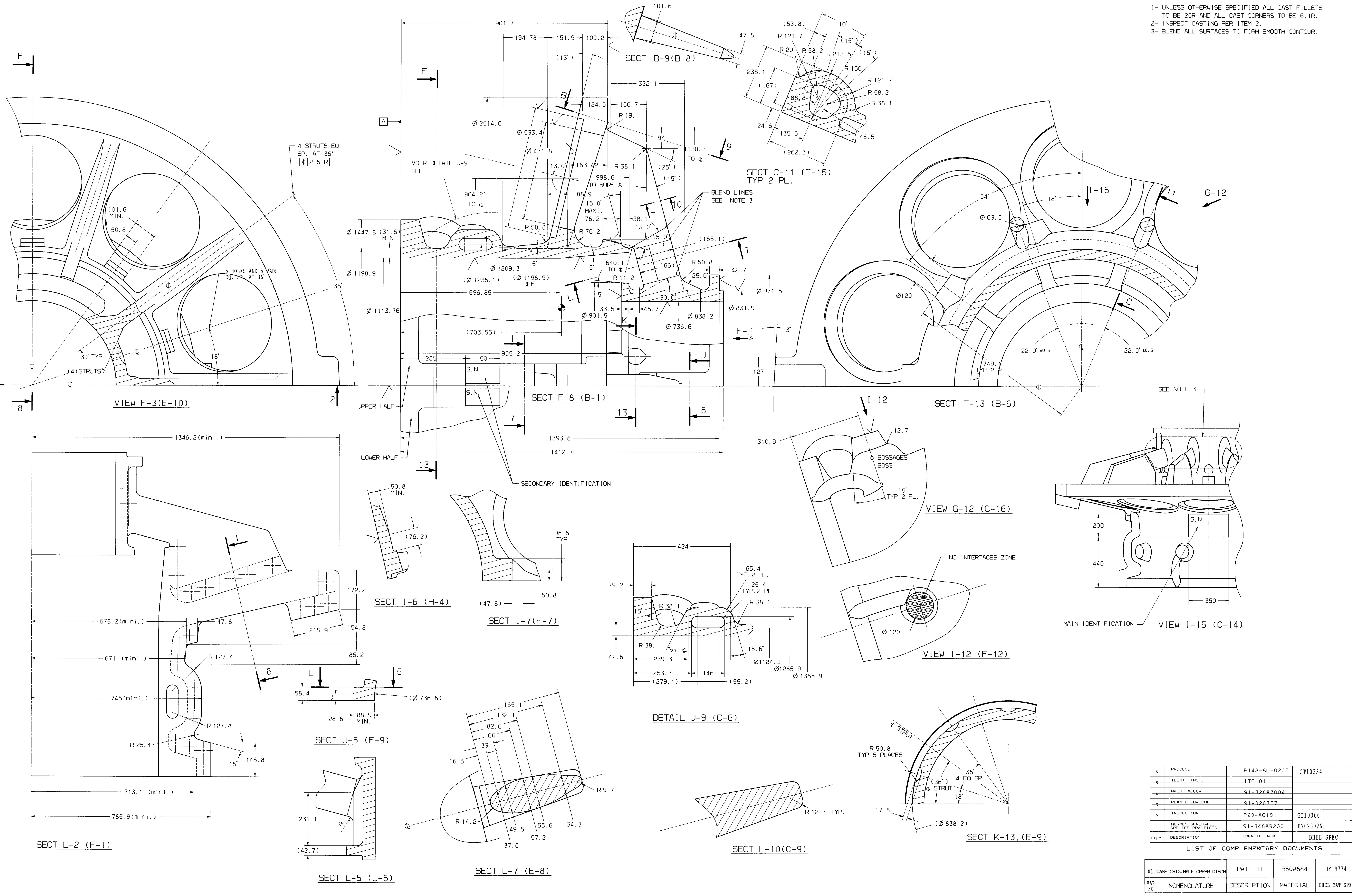
FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. 0-351-05-67003 SH. 01 OF 01

NOTES

1- UNLESS OTHERWISE SPECIFIED ALL CAST FILLETS TO BE 25R AND ALL CAST CORNERS TO BE 6.1R.
2- INSPECT CASTING PER ITEM 2.
3- BLEND ALL SURFACES TO FORM SMOOTH CONTOUR.



6	PROCESS	P14A-AL-0205	GT10334
~~5~~	IDENT. INST.	~~ITC 01~~	
~~4~~	MACH. ALLOW	~~91-328A7004~~	
~~3~~	PLAN D'EBAUCHE	~~91-026757~~	
2	INSPECTION	P29-AG191	GT10066
1	NORMES GENERALES APPLIED PRACTICES	91-348A9200	HY0230261
ITEM	DESCRIPTION	IDENTIF NUM	BHEL SPEC

LIST OF COMPLEMENTARY DOCUMENTS

01	CASE CSTG.HALF CPRSR DISCH	PATT H1	B50A684	HY19774
VAR NO	NOMENCLATURE	DESCRIPTION	MATERIAL	BHEL MAT SPEC

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT

BHARAT HEAVY ELECTRICALS LIMITED
HYDERABAD

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	SCS		13.02.01	NA
CHD.	NVS	[signature]	13.02.01	
APPD.	KMM	[signature]	13.02.01	

DEPT. / DEPT. CODE	UNTOL. DIMS. GR.	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
	¢/M/ƒ	NTS	2900		NA	NA

TITLE
CASE CSTG HALF-CPRSR DISCH

CARD CODE N.A.

DRAWING NO. 0-351-05-67003 REV. 00
SHT. No 01 NO. OF SHT. 01

REV.	DATE	ALTERED	CHD/APPD	ZONE

THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.

GENERAL DIMENSIONAL LIMITS,FITS & TOLERANCES AS PER HY0230261

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

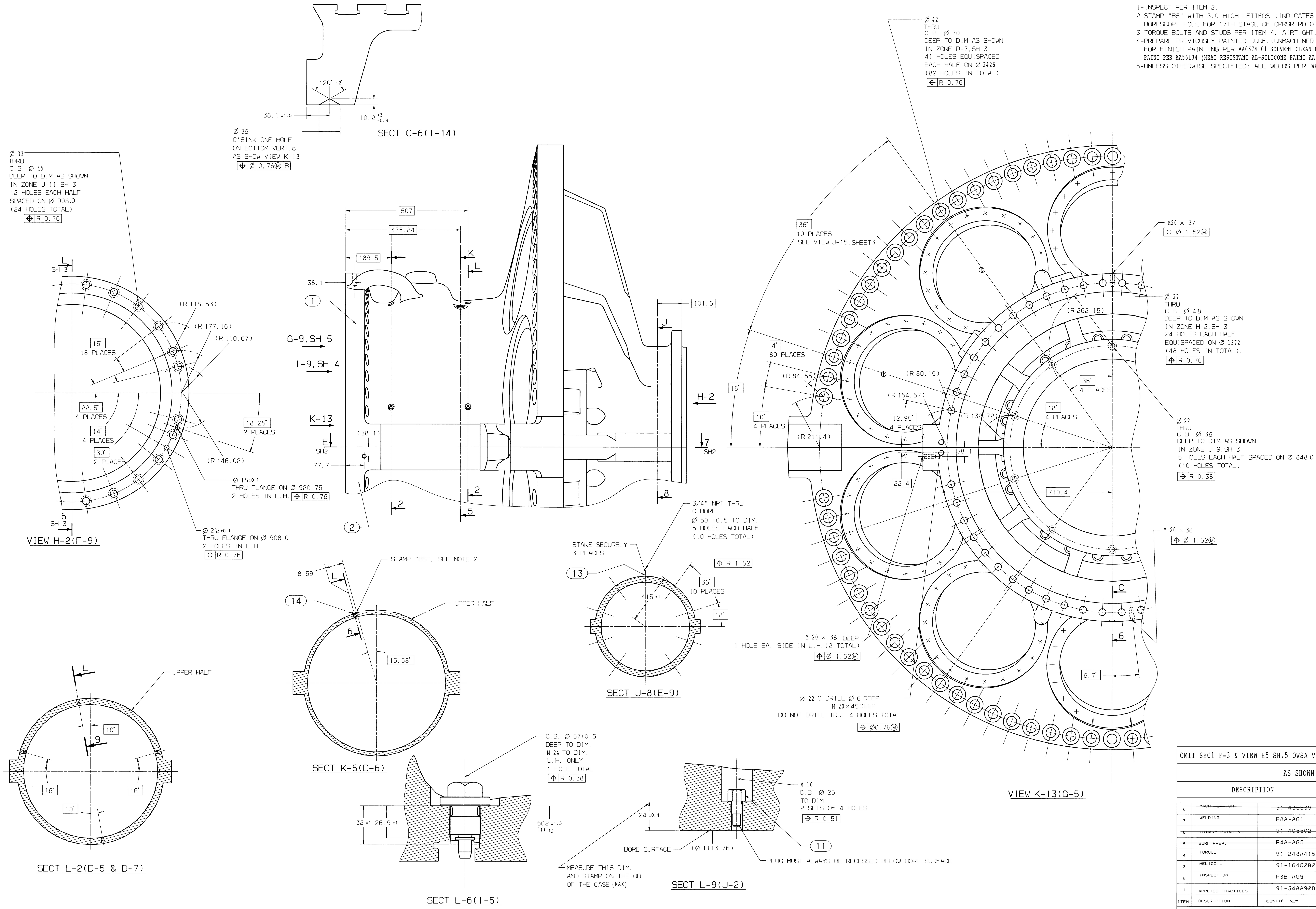
DRG. NO. 0-351-05-61004 SH. 01 OF 05

THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.

GENERAL DIMENSIONAL LIMITS,FITS & TOLERANCES AS PER HY0230261

NOTES

1-INSPECT PER ITEM 2.
2-STAMP "BS" WITH 3.0 HIGH LETTERS (INDICATES BORESCOPE HOLE FOR 17TH STAGE OF CPRSR ROTOR).
3-TORQUE BOLTS AND STUDS PER ITEM 4, AIRTIGHT.
4-PREPARE PREVIOUSLY PAINTED SURF.(UNMACHINED SURF.) FOR FINISH PAINTING PER AA0674101 SOLVENT CLEANING. PAINT PER AA56134 (HEAT RESISTANT AL-SILICONE PAINT AA5610034547).
5-UNLESS OTHERWISE SPECIFIED; ALL WELDS PER WPS/WE006.



DESCRIPTION	VAR
OMIT SEC1 F-3 & VIEW H5 SH.5 OWSA VAR 01	02
AS SHOWN	01

LIST OF COMPLEMENTARY DOCUMENTS

ITEM	DESCRIPTION	IDENTIF NUM	BHEL SPEC
8	~~MACH. OPTION~~	~~91-436639~~	
7	WELDING	P8A-AG1	GT54031
6	~~PRIMARY PAINTING~~	~~91-405502~~	
5	~~SURF. PREP.~~	~~P4A-AG5~~	
4	TORQUE	91-248A4158	GT10001
3	HELICOIL	91-164C2823	13511361002
2	INSPECTION	P3B-AG9	GT10066
1	APPLIED PRACTICES	91-348A9200	———

REV.	DATE	ALTERED / CHD/APPD	ZONE	DESCRIPTION
02	19/11/05	ALTERED / CHD/APPD (signed)	B-3	HELICOIL SIZE M33 SHOWN IN VIEW C2 DCA No GT 1663 (SHEET 2)
01	4.6.04	ALTERED / CHD/APPD (signed)		GENERALLY REVISED DCA NO. 1585

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT

BHARAT HEAVY ELECTRICALS LIMITED
HYDERABAD

	NAME	SIGN.	DATE
DRN.	SCS		13.03.04
CHD.	NVS	(signed)	13.03.04
APPD.	SSR	(signed)	13.03.04

NO. OF VAR.: NA

DEPT.	UNTOL. DIMS. GR.	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEMS
	¢/M/f	NTS	5448		NA	NA

TITLE: CASE MACH-CPRSR DISCH

CARD CODE: N.A.

DRAWING NO. 0-351-05-61004 REV. 02

SHT. No 01 NO. OF SHT. 05

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. 0-351-05-61004 SH. 02 OF 05

SECT C-2(E-9)
3 PLACES
EACH SIDE
6 PLACES TOTAL
Ø 36
THRU U.H.
C.B. Ø 55
DEEP TO DIM IN U.H.
MACH. & ASM. HELICOIL M33
UPPER HALF
LOWER HALF
AFTER BOLTING HALVES TOGETHER BLEND LEADING
EDGES OF STRUTS IN GAS PATH AT HORIZ. JOINT TO A 3.0 MAX.
STEP TO IMPROVE CONTOUR.
SECT E-7(G-5, SH 1)
R 152.4 ±25.4 (TYP)
THIS SURFACE IS UNDERCUT 0.38 MAX. BOTH SIDE IN UH & LH
Ø 36
THRU U.H. & L.H.
C.B. Ø60
DEEP TO DIM IN U.H. & L.H.
Ø 34
CDRILL × 11.45 ±1.25 DEEP.
M 33x56 DEEP.
SEE H10
DO NOT DRILL THRU.
TYP. 4 PLACES
SECT I-2(H-11)
1 PLACE EACH SIDE
2 PLACES TOTAL
Ø 36
THRU. U.H.
LAMAGE/C.B. Ø 55
DEEP TO DIM IN U.H.
MACH. & ASM. OF HELICOIL M33 PER ITEM 3 VAR 36
CORPS SUP.
UPPER HALF
CORPS INF.
LOWER HALF
SECT H-6(B-13)
4 HOLES EACH SIDE
(8 HOLES TOTAL)
DETAIL I-15
R 20 ±0.5
2 PLACES
PROF. 11 ±
DEEP.
1335 ±0.2
TO ¢
2 PLACES
50 ±1
2 PLACES
DETAIL I-15(J-11)
Ø 36
THRU. U.H. & L.H.
C.B. Ø 61
DEEP TO DIM IN U.H. & L.H.
SECT L-2 (C-7)
8 HOLES EACH SIDE MARKED "B"
(16 HOLES TOTAL)
Ø 35
THRU L.H.
Ø 36 H7
THRU U.H. AND TO DIM IN L.H.
Ø 61 CBORE TO DIM IN U.H. & L.H.
SECT L-4 (C-8)
3 HOLES EACH SIDE MARKED "C"
(6 HOLES TOTAL)
M 39
THRU. U.H. & L.H.
Ø 42 CDRILL
PROF. SVT. DIM DANS SUP.ET INF.
DEEP TO DIM. IN L.H & U.H.
C.B. Ø 61
DEEP TO DIM IN U.H. & L.H.
SECT L-6 (C-8)
3 HOLES EACH SIDE MARKED "A"
(6 HOLES TOTAL)
Ø 36
THRU. U.H. & L.H.
C.B. Ø 61
DEEP TO DIM IN U.H. & L.H.
SECT L-8 (C-8)
1 HOLE EACH SIDE
(2 HOLES TOTAL)
Ø 36
SPOT FACE END OF C.B. Ø54
8 HOLES EACH SIDE (16 HOLES TOTAL)
MACH. & ASM. OF HELICOIL PER PRATICE
5 HOLES EACH SIDE IN L.H. MARKED "D"(10 HOLES TOTAL)
MACH. & ASM. OF HELICOIL M 33 PER PRATICE
3 HOLES EACH SIDE IN L.H. MARKED "E"(6 HOLES TOTAL)
SECT K-13(C-10;H-10)

THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.

GENERAL DIMENSIONAL LIMITS, FITS & TOLERANCES AS PER HY0230261

REF. DRG. NO. 91-026767.TIF

COMPUTER FILE NAME 0351056100

REV.	DATE	ALTERED	CHD/APPD	ZONE
02	19/11/05	HELICOIL SIZE M33 SHOWN IN VIEW C2 DCA No GT 1663		B-3
01	4-06-04	DCA NO. 1585		

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT

BHARAT HEAVY ELECTRICALS LIMITED
HYDERABAD

	NAME	DATE
DRN.	SCS	13.03.04
CHD.	NVS	13.03.04
APPD.	SSR	13.03.04

NO. OF VAR.: NA
SCALE: NTS
WEIGHT (KG): 5448
ITEM NO.: NA
NO. OF ITEMS: NA

TITLE: CASE MACH-CPRSR DISCH

DRAWING NO. 0-351-05-61004 REV. 02

SHT. No 02 NO. OF SHT. 05

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

STAGE	"B"
S11-S12	34.21 ±0.05
S13 A S17	30.33 ±0.05
EGV-1 & EGV-2	38.53 ±0.05

REV.	DATE	ALTERED	CHD/APPD	ZONE
02	19/11/05	HELICOIL SIZE M33 SHOWN IN VIEW C2 DCA No GT 1663 (SHEET 2)		B-3
	4/06/04	GENERALLY REVISED GT 1585		

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT

BHARAT HEAVY ELECTRICALS LIMITED HYDERABAD

	NAME	DATE
DRN.	SCS	22.10.01
CHD.	NVS	22.10.01
APPD.	KMM	22.10.01

SCALE NTS — WEIGHT (KG) 5700.0 — ITEM NO. NA — NO. OF VAR. NA — NO. OF ITEMS NA

TITLE: CASE MACH-CPRSR DISCH

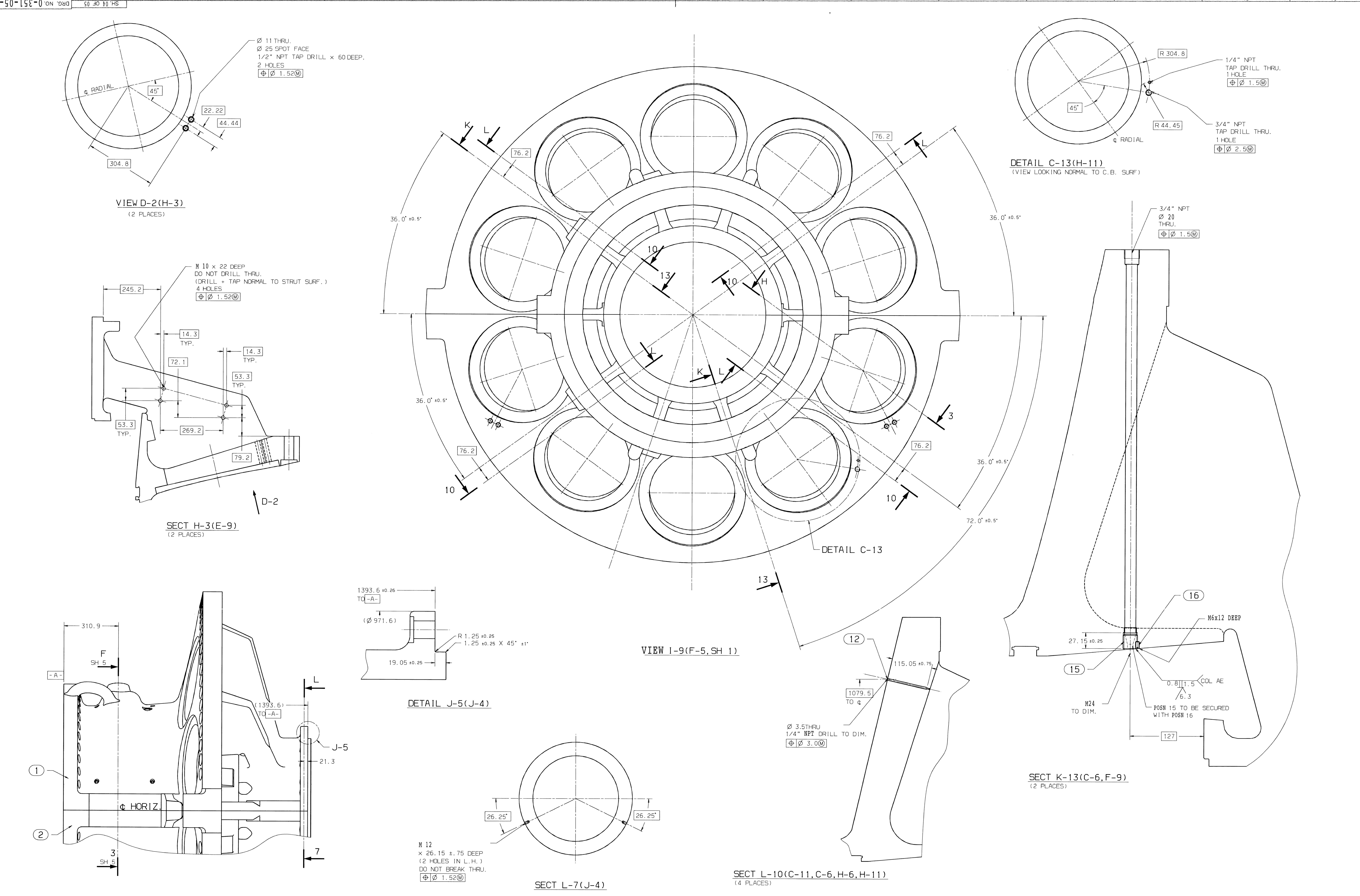
DRAWING NO. 0-351-05-61004 — REV. 02

SHT. No 03 — NO. OF SHT. 05

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. 0-351-05-61004 SH. 04 OF 05



GENERAL DIMENSIONAL LIMITS,FITS & TOLERANCES AS PER HY0230261

REF. DRG. NO. 91-026767.TIF

COMPUTER FILE NAME 035105610004-004-R00.TIF

REV.	DATE	ALTERED	CHD/APPD	ZONE
02	19/11/05	HELICOIL SIZE M33 SHOWN IN VIEW C2 DCA No GT 1663 (SHEET 2)		B-3
01	4-06-04	GENERALLY REVISED DCA NO. 1585		

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT

BHARAT HEAVY ELECTRICALS LIMITED HYDERABAD

	NAME	SIGN.	DATE
DRN.	SCS		03.03.04
CHD.	NVS		03.03.04
APPD	SSR		03.03.04

NO. OF VAR. NA

SCALE NTS

WEIGHT (KG) 5448

ITEM NO. NA

NO. OF ITEMS NA

TITLE CASE MACH-CPRSR DISCH

DRAWING NO. 0-351-05-61004

REV. 02

SHT. No 04 NO. OF SHT. 05

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

STAGE	Ø "D"
S11-S13 S16-S17 EGV-1 & EGV-2	25.1 ±0.1
S14-S15	20.1 ±0.1

GENERAL DIMENSIONAL LIMITS, FITS & TOLERANCES AS PER HY0230261

REF. DRG. NO. 91-026761.TIF

COMPUTER FILE NAME 0351056100401-001-000.TIF

DRG. NO. 0-351-05-61004 SH. 05 OF 05

REV.	DATE	ALTERED / CHD/APPD	ZONE	
02	19/11/05	HELICOIL SIZE M33 SHOWN IN VIEW C2 DCA No GT 1663 (SHEET 2)	B-3	
01	4.6.04	GENERALLY REVISED DCA NO. 1585		

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT

BHARAT HEAVY ELECTRICALS LIMITED HYDERABAD

	NAME	DATE
DRN.	SCS	13.03.86
CHD.	NVS	13.03.86
APPD	SSR	13.03.86

NO. OF VAR. NA

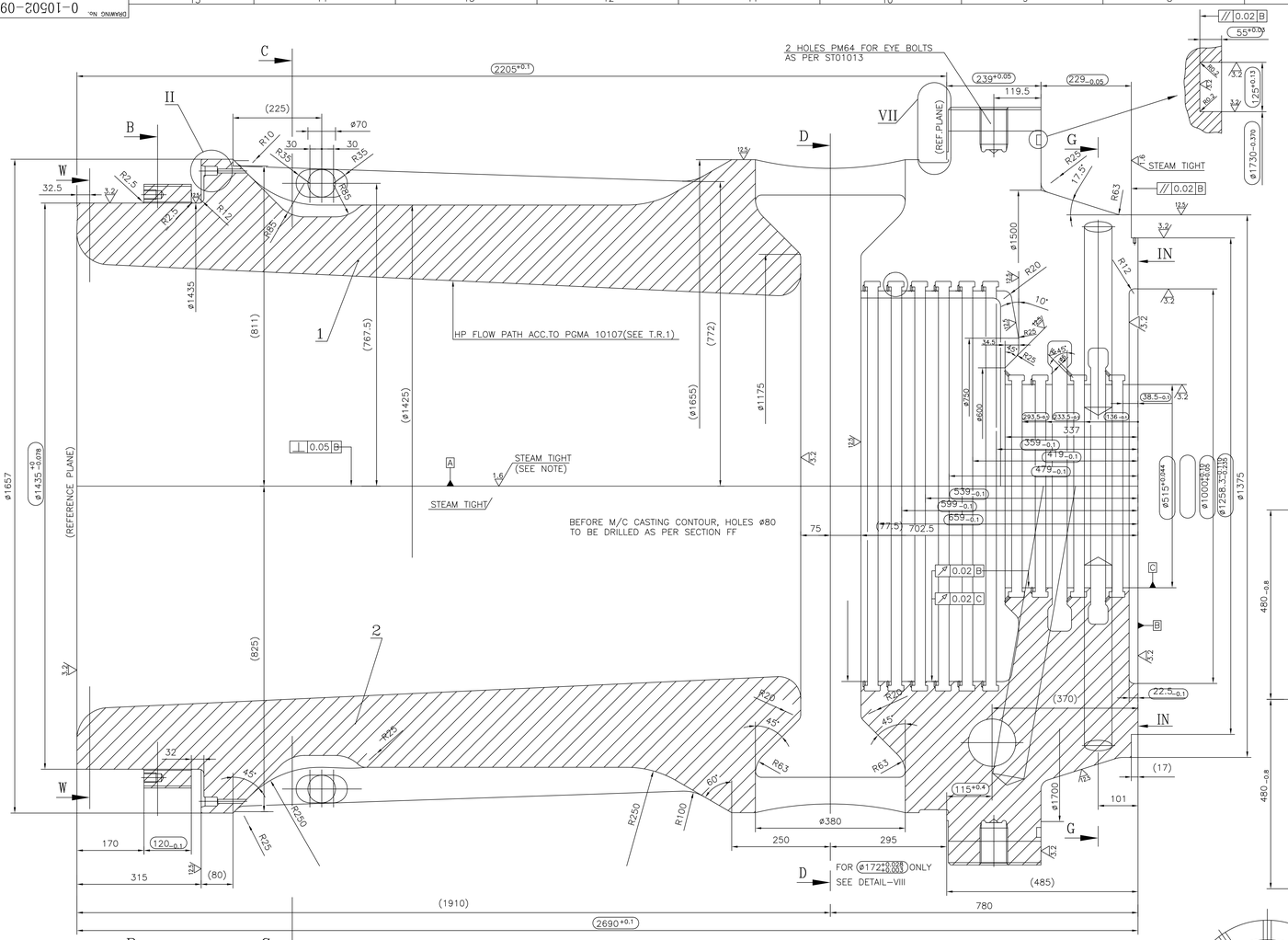
SCALE NTS · WEIGHT (KG) 5448 · ITEM NO. NA · NO. OF ITEMS NA

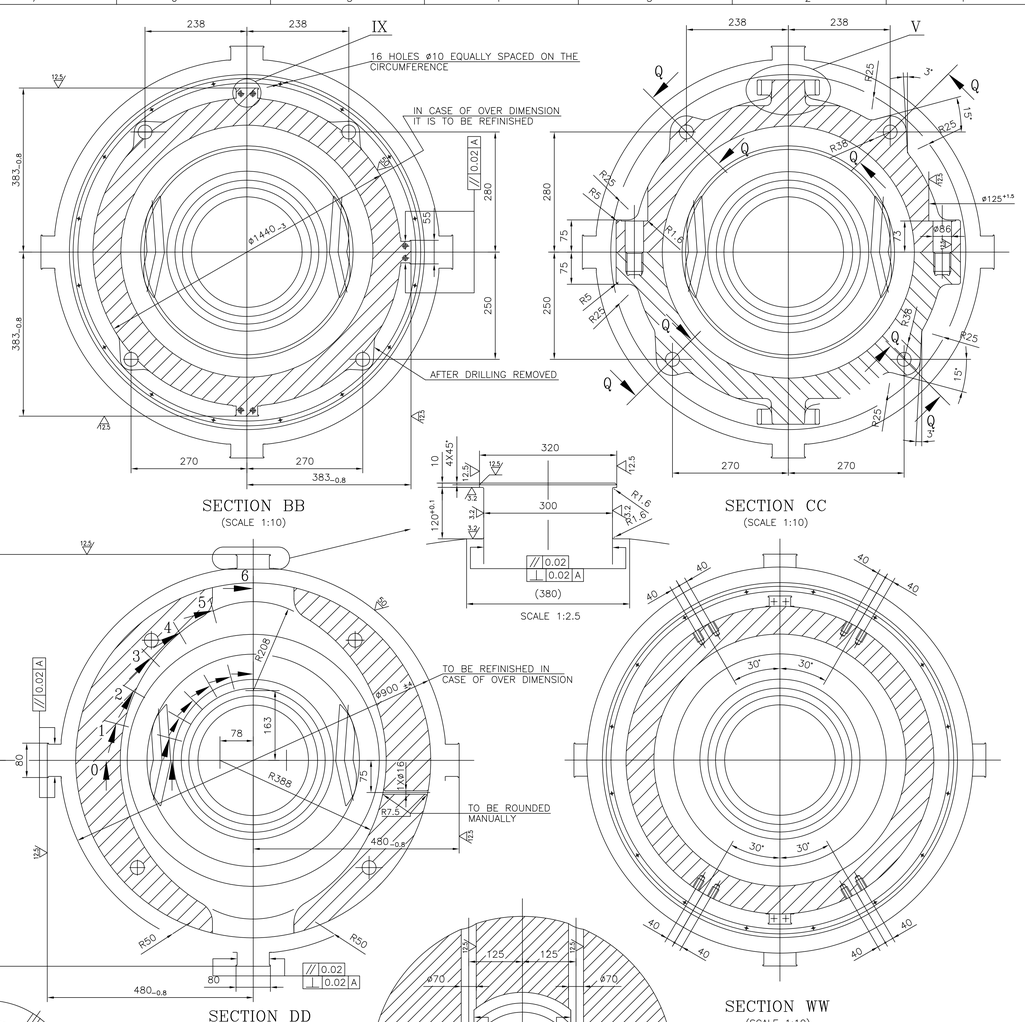
TITLE: CASE MACH-CPRSR DISCH

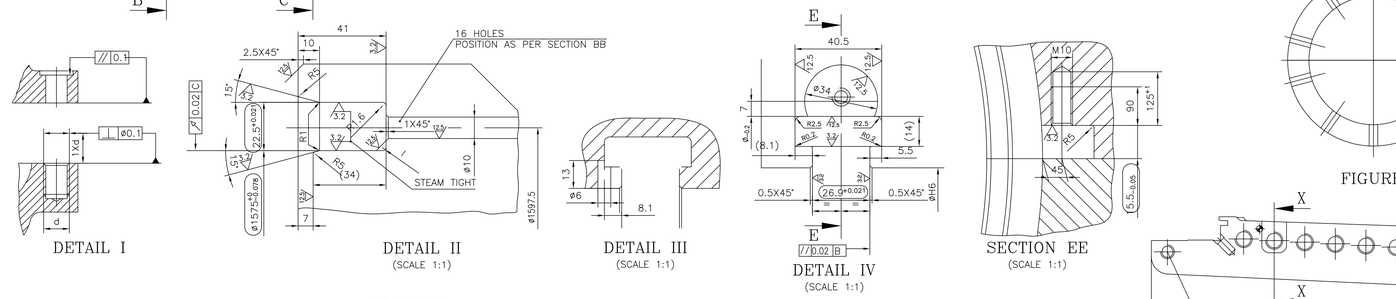
DRAWING NO. 0-351-05-61004 REV. 02

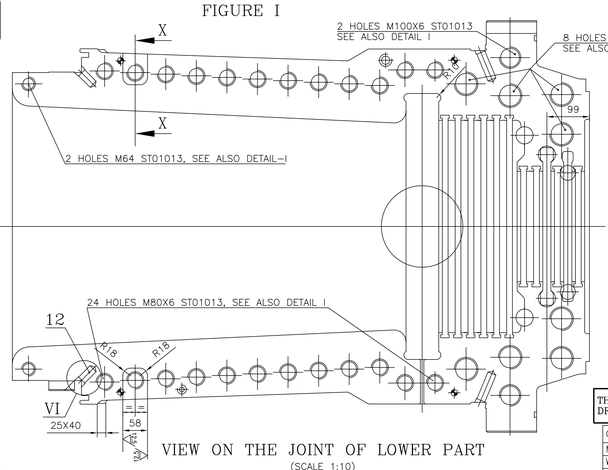
SHT. No 05 NO. OF SHT. 05

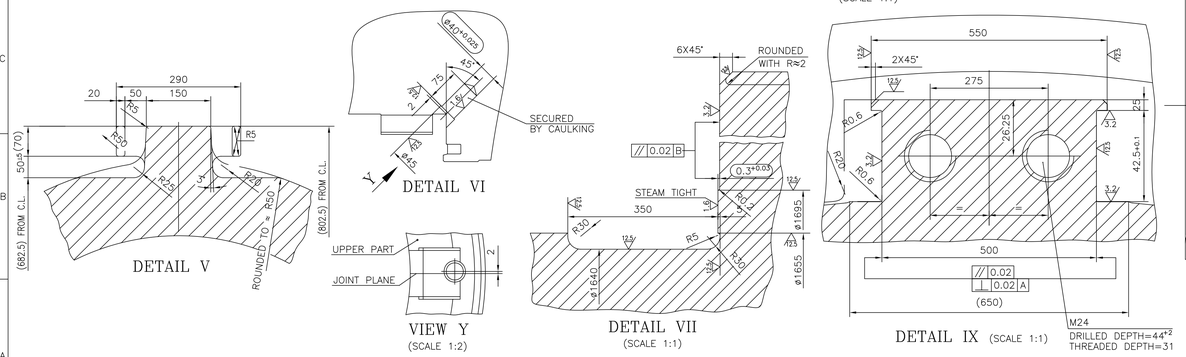
DRAWING No. 0-10502-09000











TECHNICAL REQUIREMENTS :

1. FOR MACHINING OF INNER CONTOUR AND GROOVES REFER DRAWING 'H.P. FLOW PATH', AGAINST PGMA10107 FROM M.I.D. OF THE PROJECT CONCERNED .
2. COUNTERSINKS FOR LOCKING WASHERS ARE MADE ONLY IN THE UPPER PART BUT ON BOTH SIDES OF CASING JOINT AS PER DETAIL IV AND SECTION EE.
3. CYLINDRICAL PINS ITEM NO.12 AND 13 SHOULD BE SECURED BY CAULKING OVER DURING FINAL ASSEMBLY OF HP INNER CASING.
4. DIMENSIONS WITH IN (----) ARE FOR REFERENCE ONLY.
5. IDENTIFICATION ACCORDING TO HW0400397 AT THE PLACE MARKED WITH IN
6. ALL SHARP EDGES OF BORE HOLES MUST BE ROUNDED WITH R3 MAX. OR CHAMFERED (THIS IS ALSO VALID FOR DETAIL-II).
7. GUIDE BOLTS, DRG.NO. 3-12027-02002, VAR 01, ITEM NO. 15 ARE MANUFACTURED AGAINST PGMA 12087.
8. DIMENSIONS/CLEARANCES INDICATED IN ( ) AND ALL THE GEOMETRICAL TOLERANCES ARE CRITICAL TO QUALITY (CTQ).
9. CONSERVE/PAINT AS PER REQUIREMENTS/INSTRUCTIONS OF DRAWING UNDER PGMA 10010 FOR THE PROJECT.

NOTE : REQUIREMENTS FOR STEAM TIGHTNESS :

THE CONTACT AREA BETWEEN TWO MATING FLANGE SURFACES SHOULD BE 60-70% FOR EVERY 200 mm MEASUREING LENGTH.

1. THERE SHOULD BE NO THROUGH PASSAGE IN THE FROM OF DEPRESSION, SCRATCH ETC. RUNNING FROM INSIDE TO OUTSIDE ACROSS THE FLANGE JOINT WHICH MAY RESULT IN STEAM LEAKAGE. ANY SUCH PASSAGE MUST BE DISCONTINUED FOR ATLEAST 30% OF THE WIDTH OF THE CONTACT SURFACE.
2. THE GAP AT THE JOINT IN ASSEMBLED CONDITION MUST NOT EXCEED THE FOLLOWING VALUES :
   INNER SIDE ≤ 0.02
   OUTER SIDE ≤ 0.05

THIS DRG. SUPERSEDES OLD DRG. UNDER SAME NUMBER

GMS No. / C.B.O.M 01050209000			STATUS OF DRG
AGENCY / DEPT	NAME	SIGN	DATE
GRADE OF UNTOL. DIM	S.T.I.	J.P.GUPTA	SD/- 18.06.87
M/CG.- AA0230208 m			
WELDING-CLASS 'B' OF AA0621104			
GAS CUTTING-TABLE 3 OF AA0621101			

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: STEAM TURBINE

BHARAT HEAVY ELECTRICALS LTD. RANIPUR, HARDWAR

	NAME	SIGN	DATE	NO. OF VAR
DRN	A.K. GOEL	SD/-	04.08.03	
CHD	A.K. GOEL	SD/-	05.08.03	
APPD	A.K. JAIN	SD/-	06.08.03	

DEPT STE	SCALE 1:5	WEIGHT (KG) 19600	REF. TO ASSY. DRG.	ITEM No.	NO. OF ITEMS
CODE 4011					

TITLE : H.P. INNER CASING

CARD CODE 7 | DRAWING NO. 0-10502-09000 | 22 23 24

SHEET No. 01 | No. OF SHEETS 02

REV	DATE	ALTERED / CHECKED
09	26.07.04	ALTERED AJ SD/- CHECKED AJ SD/- IN SHEET-2, IN SECTION PP ø45 WAS ø38 C/A NO. STE-04-F0199
08	07.08.03	ALTERED AKG SD/- CHECKED AKG SD/- CTQ DIMENSIONS MARKED AND CTQ & PAINTING TRs ADDED. DRG. SUPERSEDED AND SUBMITTED ON SERVER. C/A NO. STE-03-F1121

INVENTORY No. | SIGN & DATE | REFERENCE No. 7404-12230/35 | DB

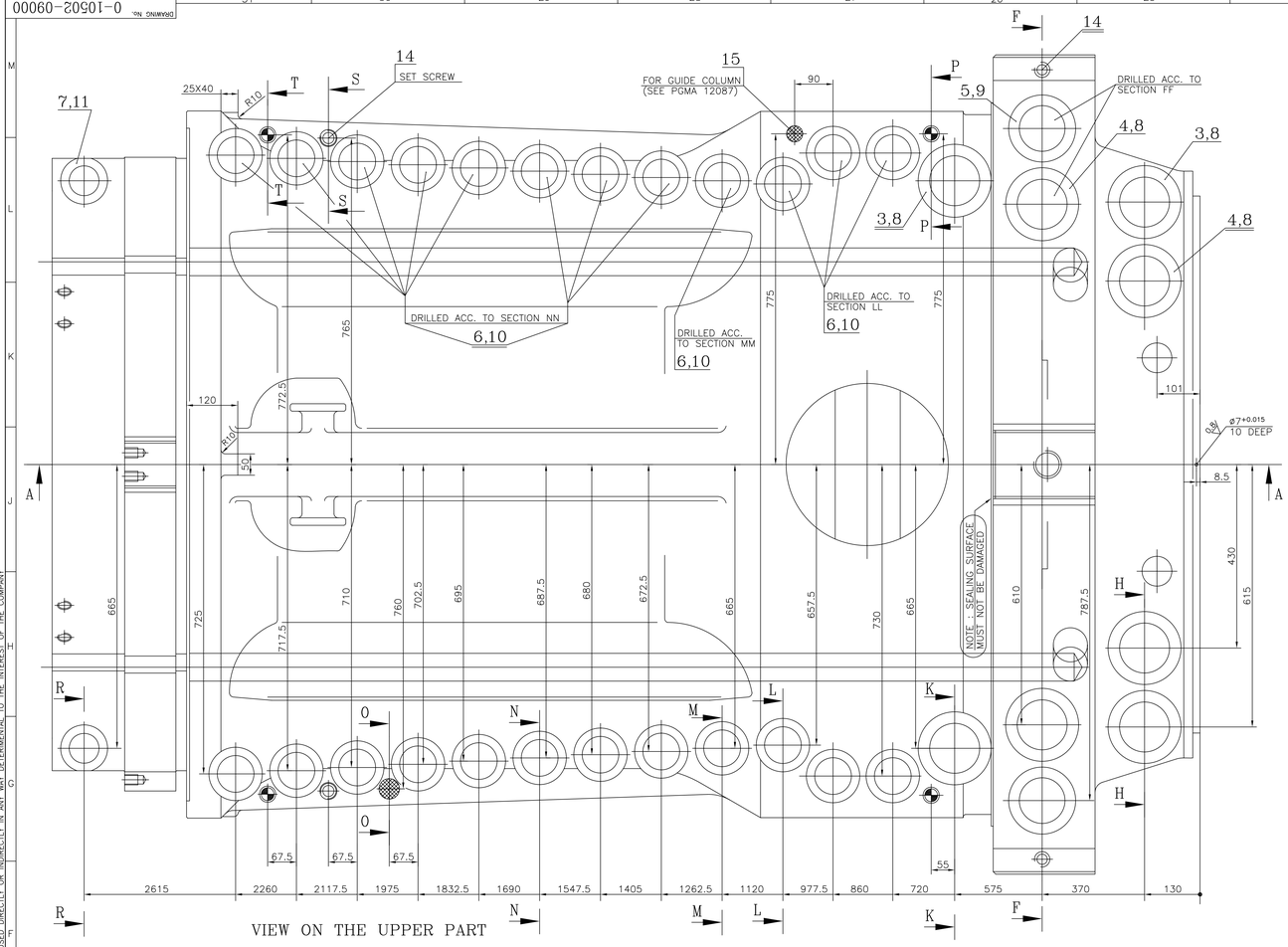
AO SIZE

DRAWING No. 0-10502-09000

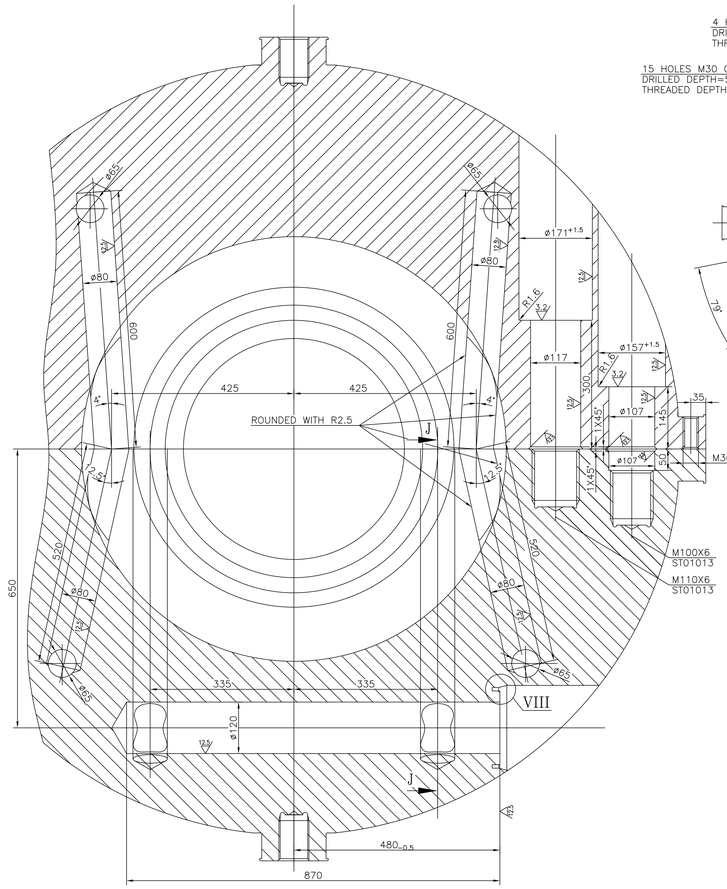
7404-12230/35 RFQ/Drawing No.

SIGN. & DATE

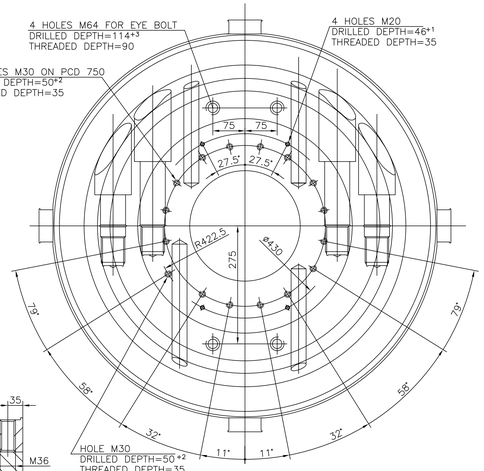
INVENTORY No.



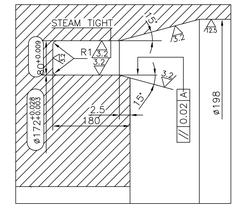
VIEW ON THE UPPER PART



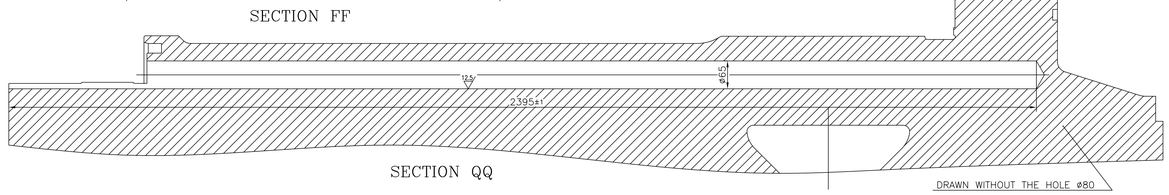
SECTION FF



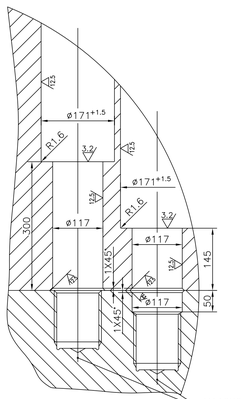
VIEW Z
(SCALE 1:10)



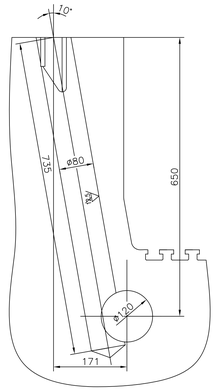
DETAIL VIII
(SCALE 2:1)



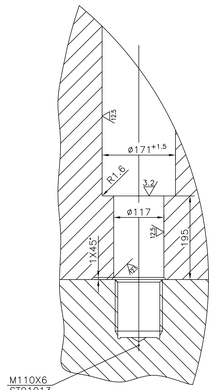
SECTION QQ



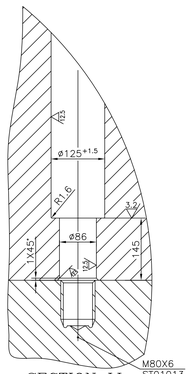
SECTION HH



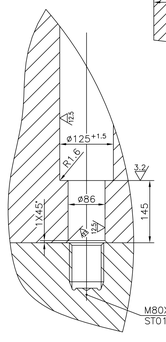
SECTION JJ



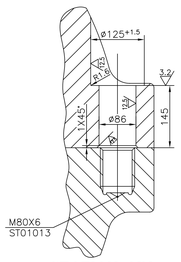
SECTION KK



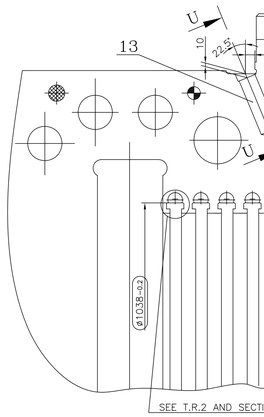
SECTION LL



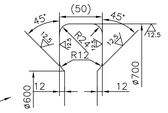
SECTION MM



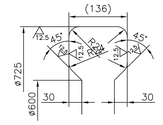
SECTION NN



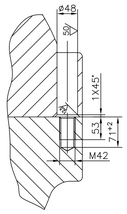
VIEW ON THE JOINT OF UPPER PART



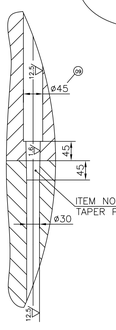
(SCALE 1:2.5)



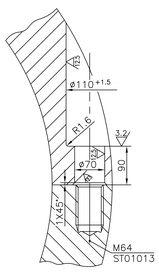
DETAIL X
(SCALE 1:2.5)



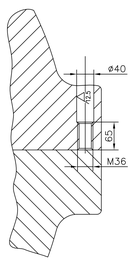
SECTION OO



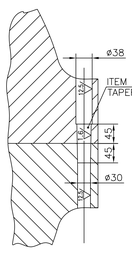
SECTION PP



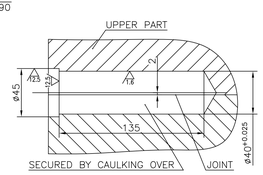
SECTION RR



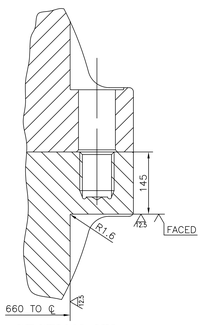
SECTION SS



SECTION TT



SECTION UU (SCALE 1:2)



SECTION XX

REV	DATE	ALTERED / CHECKED
09	26.07.04	ALTERED AJ SD/- / CHECKED AJ SD/-
		IN SECTION PP ø45 WAS ø38 C/A NO. STE-04-F0199
08	07.08.03	ALTERED AKG SD/- / CHECKED AKG SD/-
		CTQ DIMENSIONS MARKED AND CTQ & PAINTING TRs ADDED. DRG. SUPERSEDED AND SUBMITTED ON SERVER. C/A NO. STE-03-F1121

THIS DRG. SUPERSEDES OLD DRG. UNDER SAME NUMBER

GRADE OF UNTOL. DIM

M/CG.- AA0230208 m

WELDING-CLASS 'B' OF AA0621104

GAS CUTTING-TABLE 3 OF AA0621101

~~GMS No.~~ / C.B.O.M	STATUS OF_ORG
0105020900	

AGENCY / DEPT	NAME	SIGN	DATE
S.T.T.	J.P.GUPTA	SD/-	18.06.87

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: STEAM TURBINE

BHARAT HEAVY ELECTRICALS LTD. RANIPUR, HARDWAR

	NAME	SIGN	DATE
DRN	A.K. GOEL	SD/-	04.08.03
CHD	A.K. GOEL	SD/-	05.08.03
APPD	A.K. JAIN	SD/-	06.08.03

NO. OF VAR: —

DEPT	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM No.	NO. OF ITEMS
STE	1:5	19600		—	—

CODE 4011

TITLE : H.P. INNER CASING

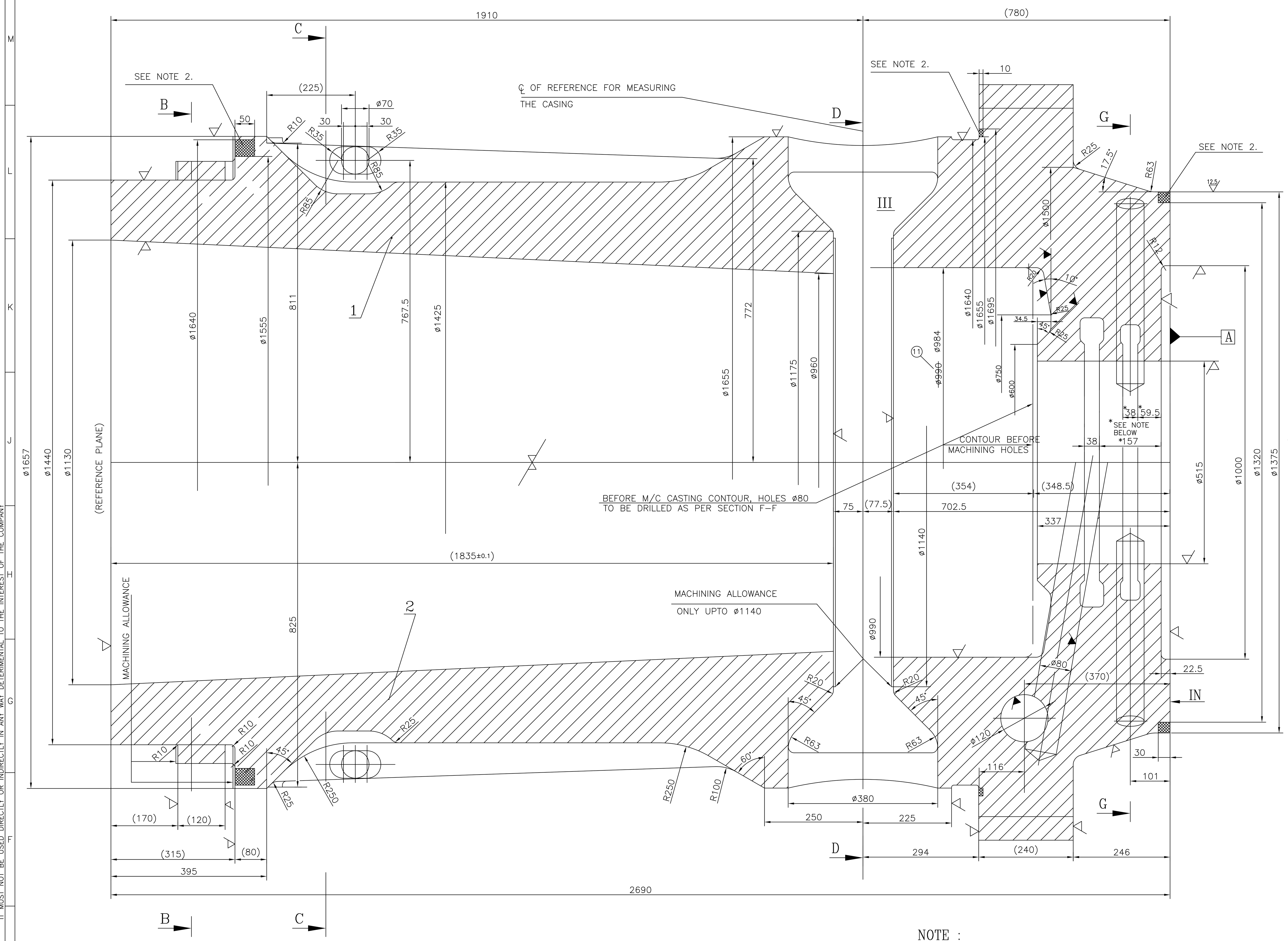
CARD CODE: 7

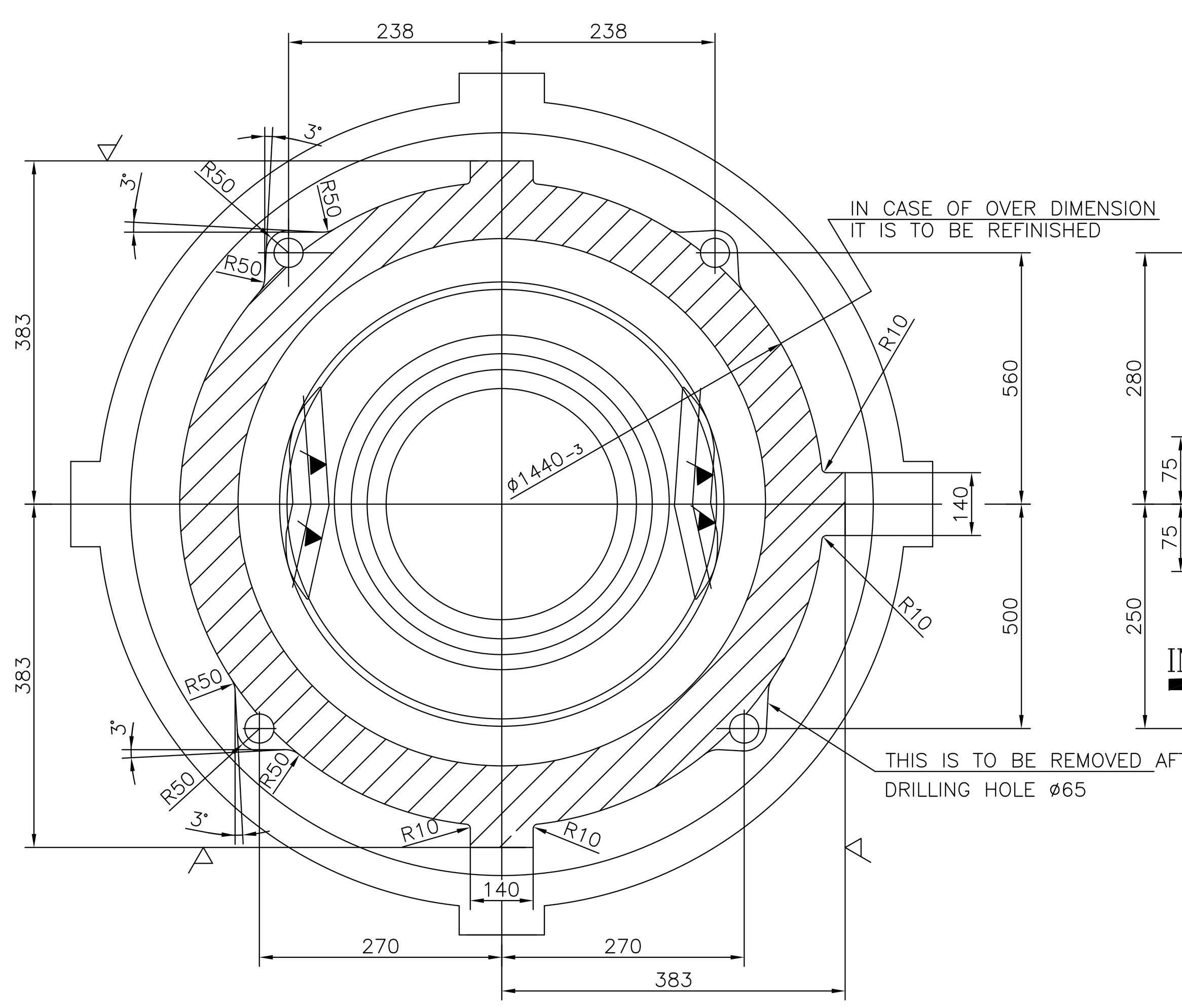
DRAWING NO. 0-10502-09000 —

SHEET No. 02 No. OF SHEETS 02

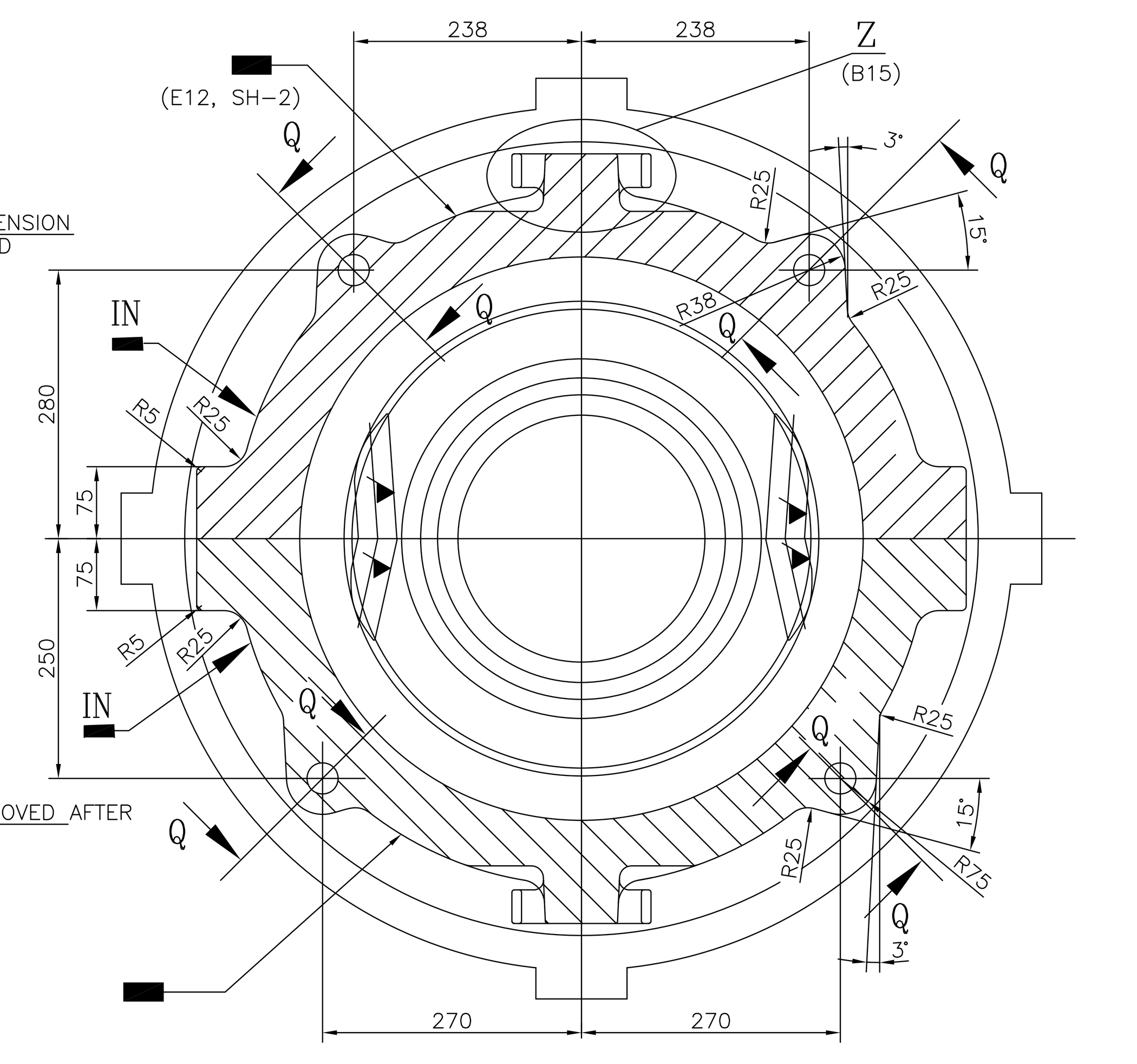
A0 SIZE

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN mm) FORM DG 46 (B)

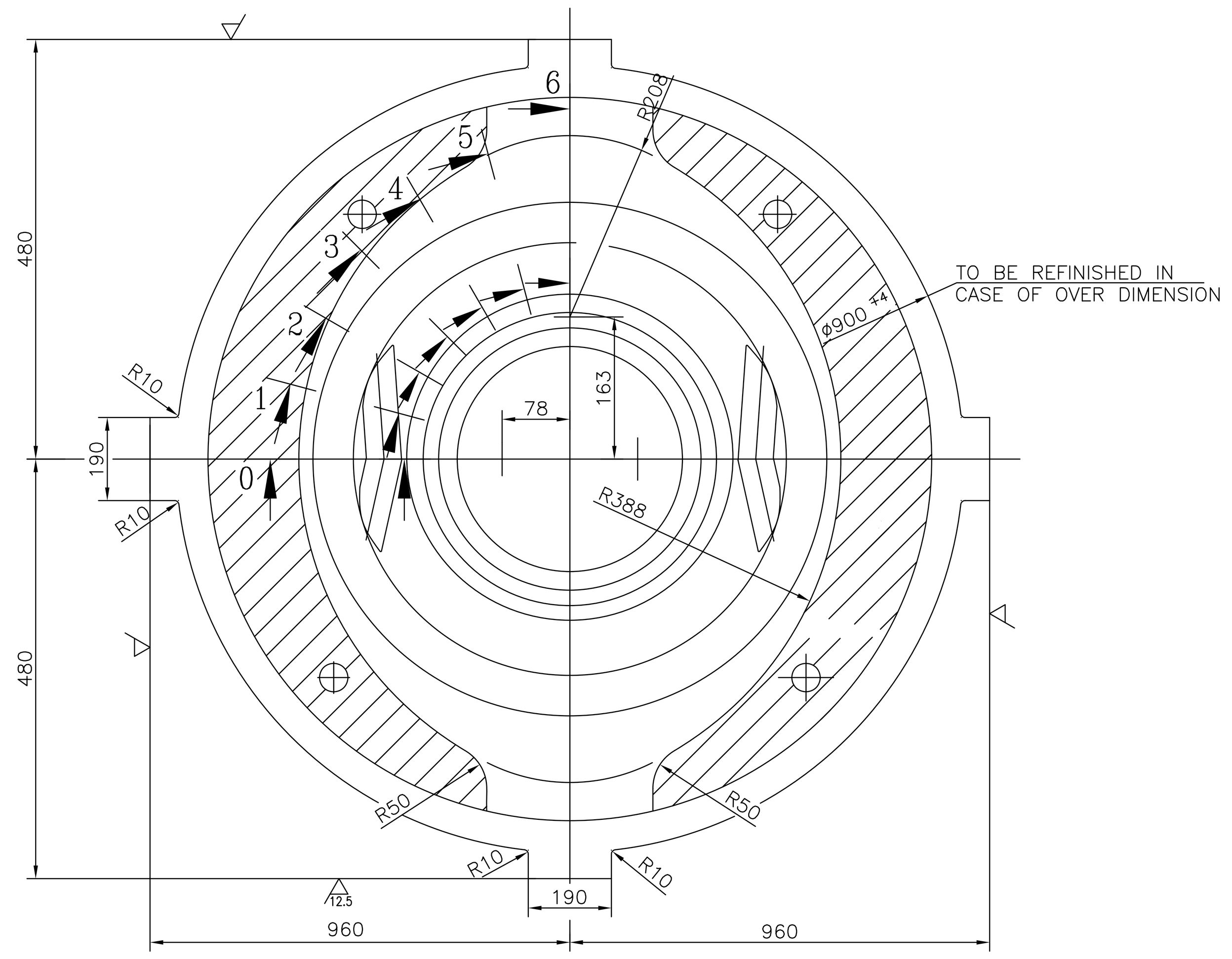




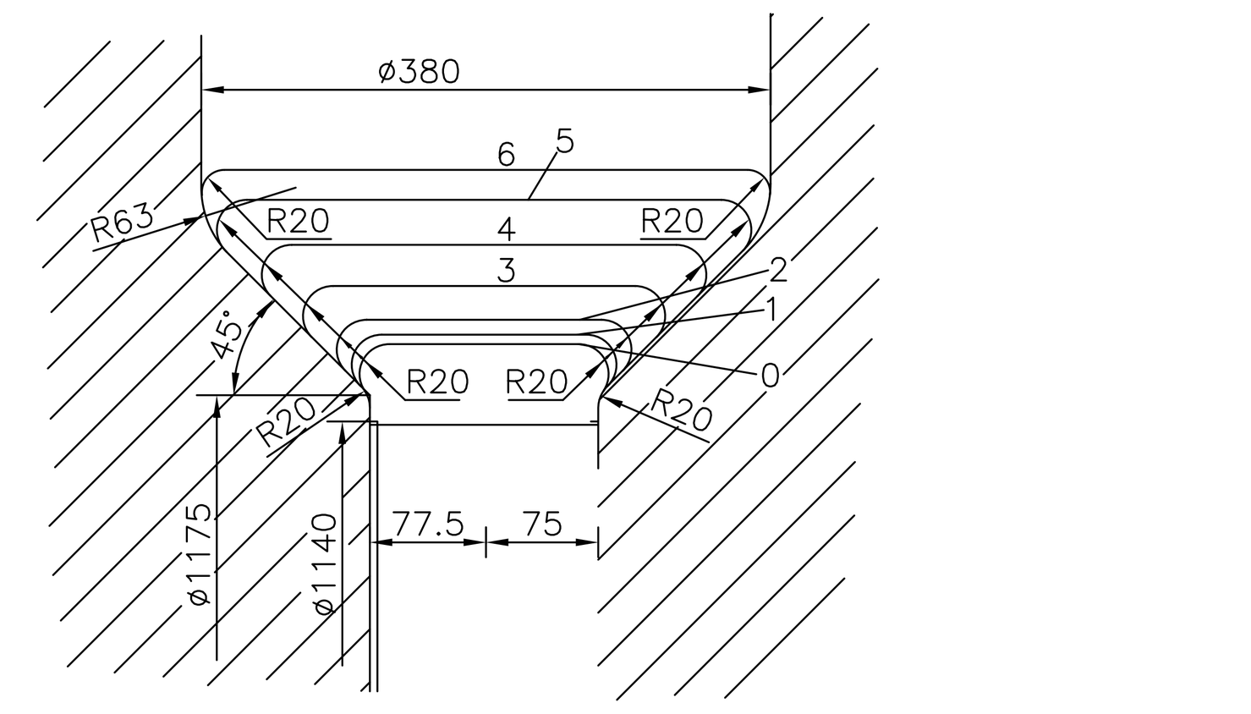
SECTION BB



SECTION CC



SECTION DD



SECTIONS OF CORE 0–6

NOTE :

ACTUAL ALLOWANCE ON FACE ▶—[A] SHOULD BE TAKEN IN TO CONSIDERATION FOR MACHINING WHILE MAINTAINING THESE AXIAL DIMENSIONS MARKED.

THE ACTUAL ALLOWANCE ON FACE ▶—[A] SHOULD BE RECORDED IN INSPECTION SHEET IN ADDITION TO OTHER DIMENSIONS. SPECIAL CARE IS TO BE TAKEN THAT THESE GROOVES COINCIDE ON BOTH HALVES (THESE GROOVES ARE TO BE MACHINED AFTER DRILLING HOLES)

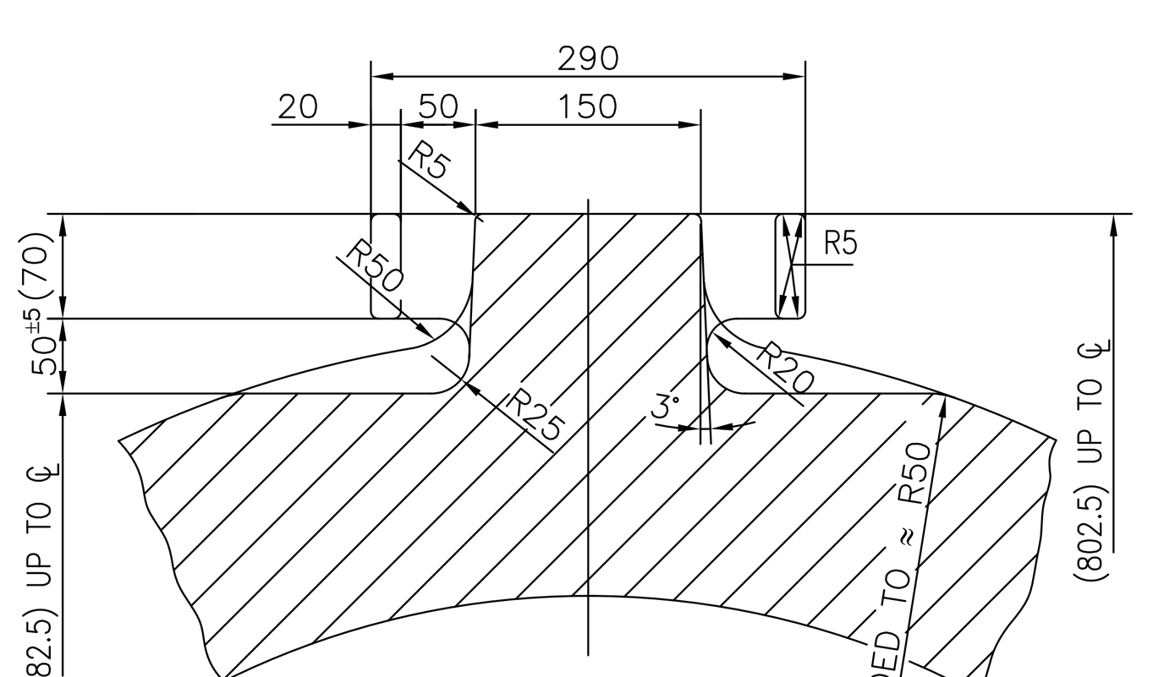
TECHNICAL REQUIREMENTS:–

SPECIFICATION NO. MENTIONED IN PURCHASE ORDER.
E SPECIFIED ANY WHERE ON THE DRAWING, THE CASTING SHALL CONFORM TO QUALITY LEVEL 2.

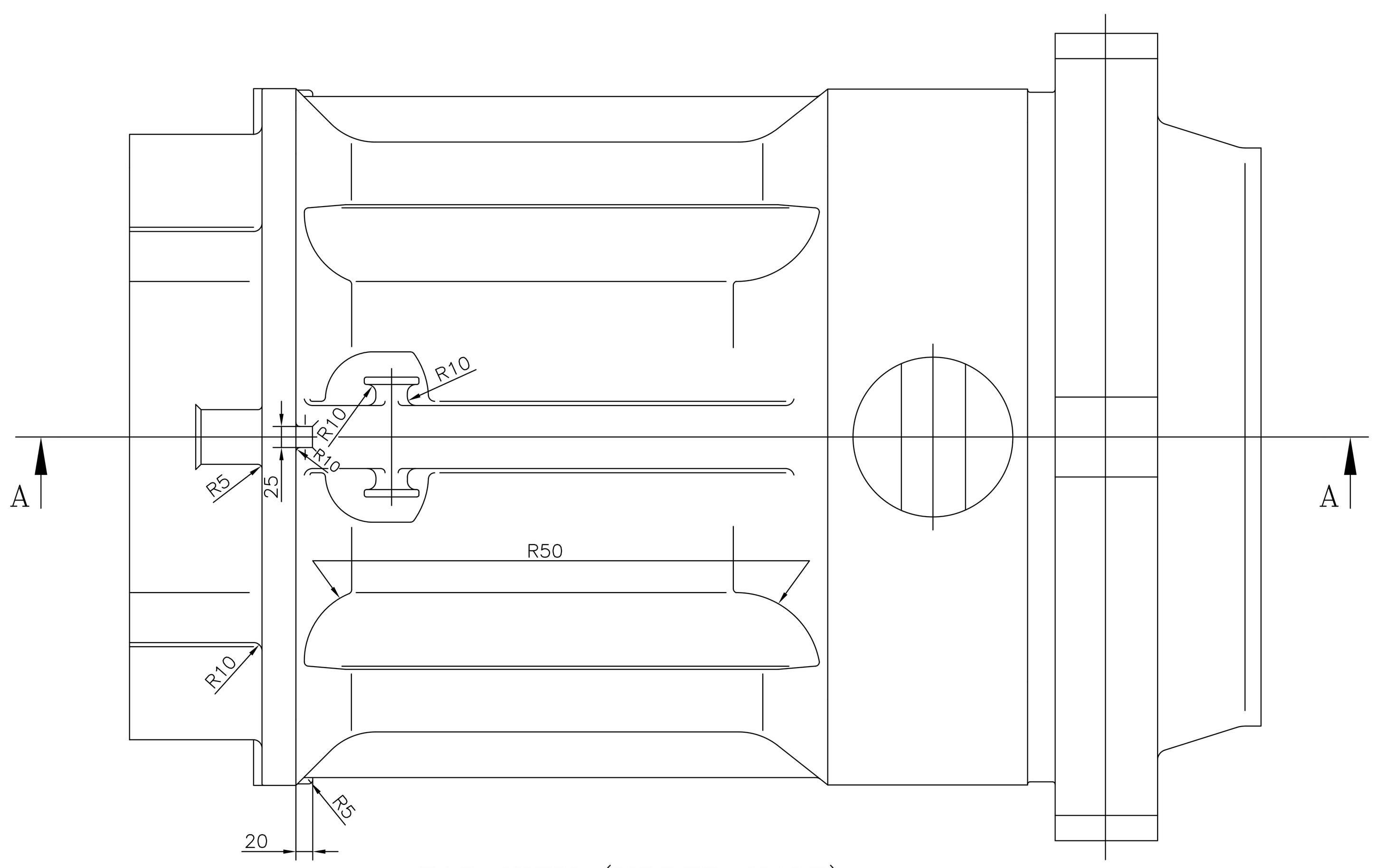
4. NO SHRINKAGE SHALL OPEN OUT DURING MACHINING OF BLADE GROOVES. ONLY FLAWS FOR RIM ZONE AS PER HW 0980830 ARE PERMISSIBLE.
5. DIMENSIONS WITHIN (– – – – –) ARE FOR REFERENCE ONLY.
6. IDENTIFICATION NUMBER SHALL BE CAST ON AT THE LOCATION SHOWN IN ⟶ .SUPPLIER'S EMLBEM AND DRAWING NO. SHALL BE CAST ON AT THE LOCATION SHOWN ▬.
7. SUPPLIER SHALL SENT KEEL BLOCK TACK WELDED TO THE CASTING.
8. REFERENCE LINE SHALL BE MARKED ON BOTH HALVES OF THE CASTING. JOINT PLANE SHOULD BE MATCHED WITHIN 5MM ON BOTH SIDES OF FLANGE.
9. MACHINING SYMBOLE ∇ DENOTES 12.5∇.
10. AS CAST TOLERANCE POSITE.

NOTE:–

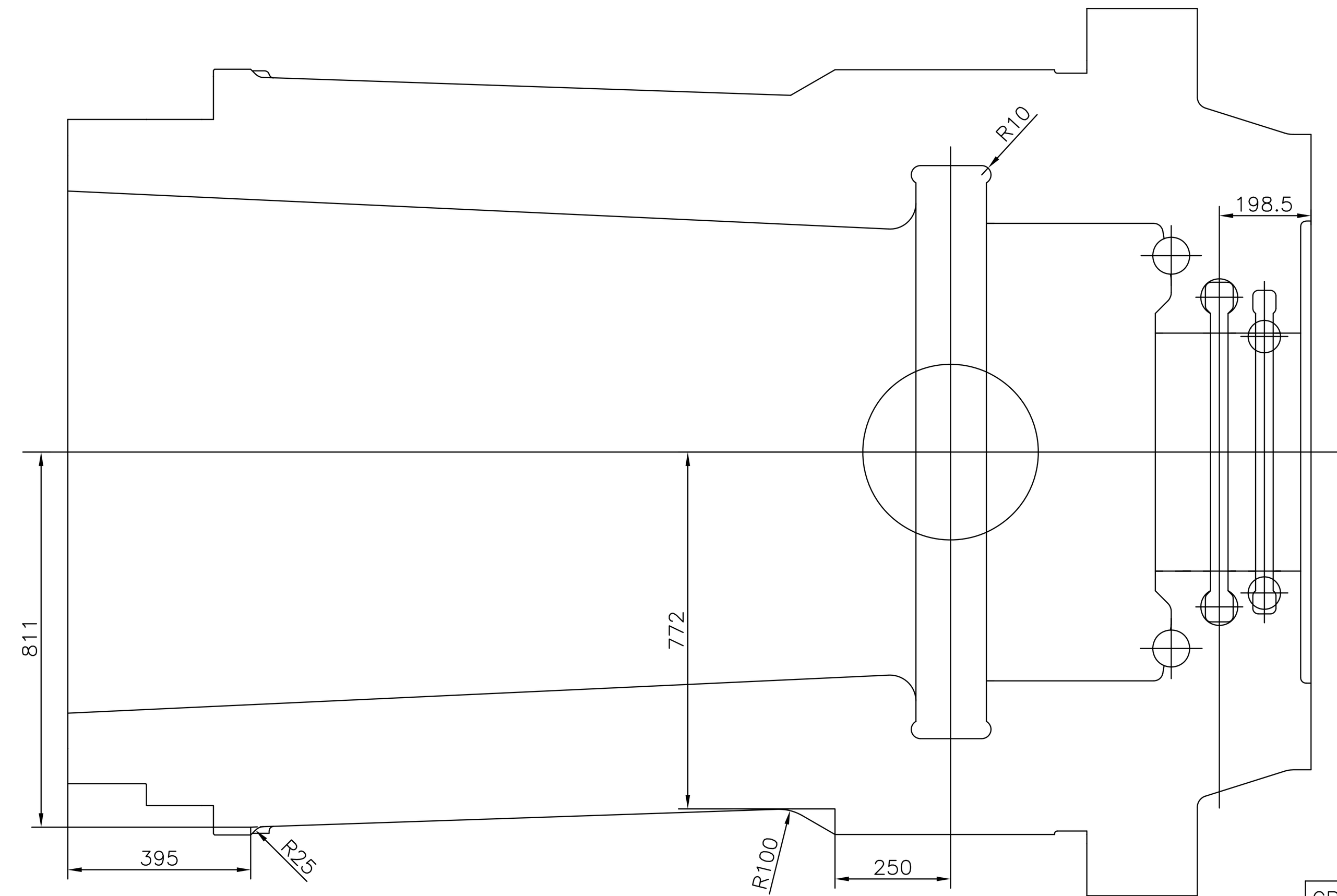
1. ⬭ CHECK DIMENSION.
2. ▩ SEALING SURFACES QUALITY LEVEL 1
3. CASTING TO BE SUPPLIED IN ROUGH MACHINED CONDITION BUT WITH HOLES / SURFACES MARKED ▼ SHALL BE SUPPLIED IN FINISH MACHINED CONDITION BY CASTING SUPPLIER.



DETAIL Z



TOP VIEW (UPPER HALF)



VIEW ON THE JOINT OF LOWER PART

GS 17 Cr Mo V5–10

VAR.00	REMARKS	ITEM NO.	DESCRIPTION	STD	DRAWING NO.	VAR	MATERIALCODE / MATERIALSPEC	A / C	UNIT WT. / UNIT	GS
		002	LOWER HALF		01050209901		W92310502081 HW19582		11270 00	
		001	UPPER HALF		01050209901		W92310502073 HW19582		11270 00	

REV	DATE	ALTERED / CHECKED	DESCRIPTION
11	16.02.09	ALTERED ASHOK sd/– CHECKED P.NATH sd/–	K-10 DEEP DRILLED HOLES& GROOVES ADDED, AND SHEET NO. 2 ADDED & DIMENSION 984 IN PLACE OF 990 CA/NO.MTE–09–F0028
10	27.12.07	ALTERED ASHOK sd/– CHECKED P.NATH sd/–	DEEP DRILLED HOLES & GROOVES REMOVED, AND DRG.SHEET NO.2 IS WITHDRAWN CA/NO.MTE–07–F0615
09	02.02.07	ALTERED ASHOK sd/– CHECKED P.NATH sd/–	M–9 M–13 K–13 K–14 K–16 J–16 A–14 DIM. (780),811,1425 & 767.5 WAS 780, (811),(1425) & (767.5) DIM. ø1130 ADDED TOP VIEW (UPPER ADDED) CA/NO.MTE–07–F0017
08	14.02.06	ALTERED RAJPAL sd/– CHECKED P.NATH sd/–	LOCATION OF INDENTIFICATION CHANGE C/ADVICE NO.– MTE–06–F0083
07	21.05.03	ALTERED AR SD/– CHECKED PN SD/–	SUPERSEDES OLD DRAWING UNDER SAME NO. C/A NO. MTE–03–F1028

GRADE OF UNTOL. DIM
M/CG.– AA0230208 m
WELDING–CLASS 'B' OF AA0621104
GAS CUTTING–TABLE 3 OF AA0621101

~~GMS No.~~/ C.B.O.M 01050209000 — STATUS OF DRG U

AGREED DEPT	NAME	SIGN	DATE
STT	J.P.GUPTA	SD/–	
STE	S.K.KUNDU	SD/–	30.10.86

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: STEAM TURBINE

BHEL — BHARAT HEAVY ELECTRICALS LTD. RANIPUR, HARDWAR

	NAME	SIGN	DATE
DRN			
CHD			
APPD		SD/–	

NO. OF VAR

DEPT	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM No.	NO. OF ITEMS
MTE / CODE 4300	1:10	22540.00	————	——	——

TITLE : HP INNER CASING (R/Mc)

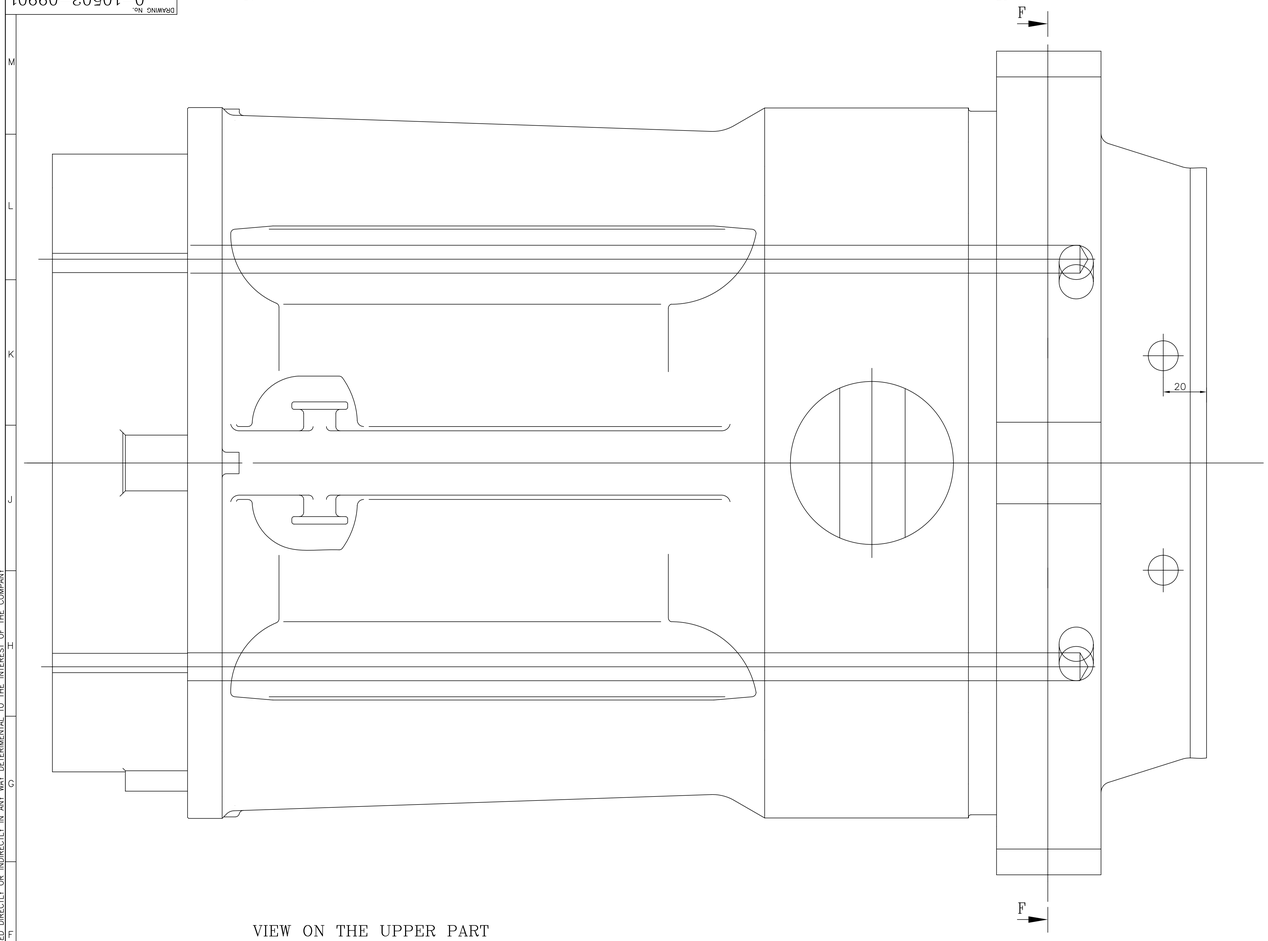
CARD CODE — DRAWING NO. 0–10502–0990 —

SHEET No. 01 — No. OF SHEETS 02

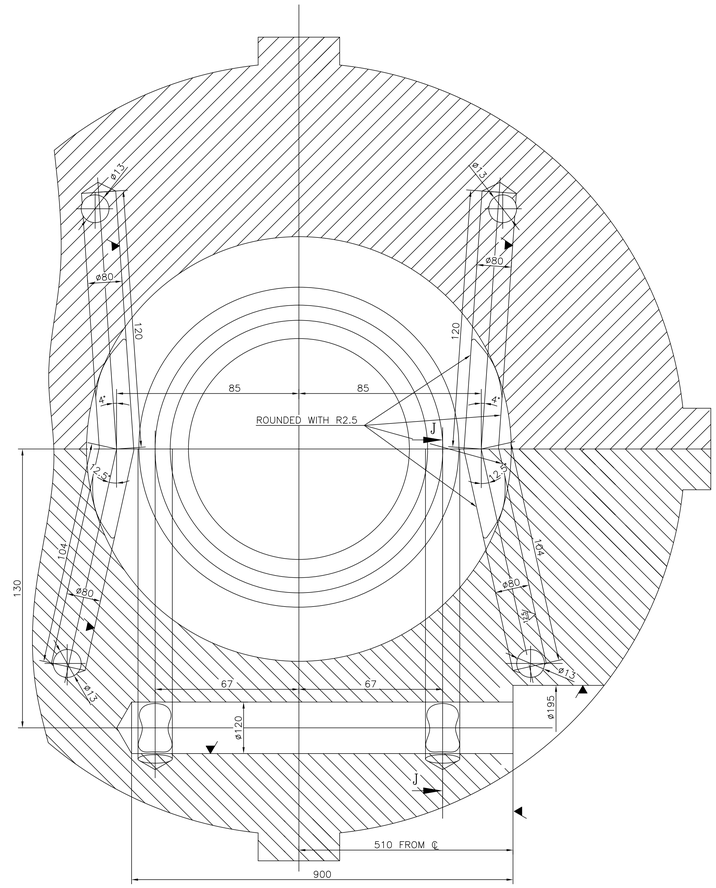
A0 SIZE

0–10502–0990I — 7404–12230 REF.DRAWING No.

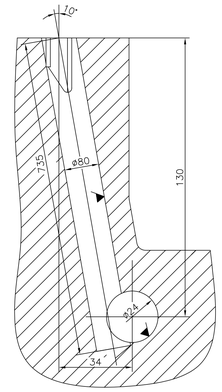
DRAWING No. 0-10502-09901



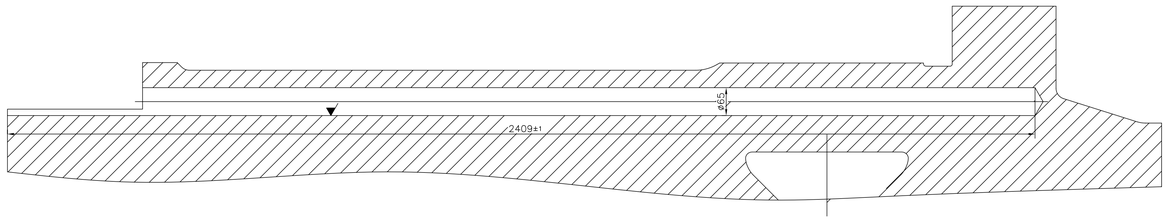
VIEW ON THE UPPER PART



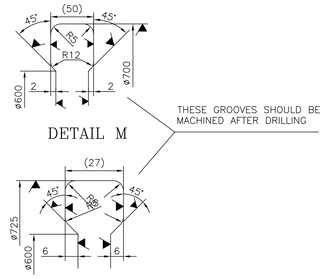
SECTION FF



SECTION JJ



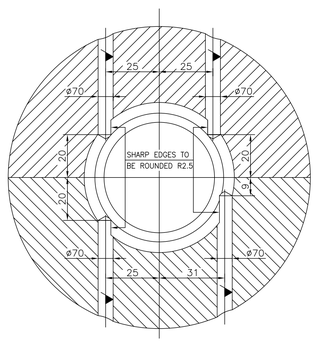
SECTION QQ



DETAIL M

THESE GROOVES SHOULD BE MACHINED AFTER DRILLING

DETAIL V



SECTION GG

TECH. REQ. (FOR FINISH MACHINING AT SUPPLIER'S WORKS)

1. FINISH DIMENSIONS ARE TO BE MAINTAINED KEEPING IN VIEW THE ACTUAL ALLOWANCE ON REFERENCE FACES. THE ACTUAL ALLOWANCE ON REFERENCE AND THESE DIMENSION MUST BE INDICATED ON SUPPLIER'S INSPECTION SHEET.
2. ALL THE HOLES SHOULD BE THOROUGHLY CLEANED AND PLUGGED WITH POLYCARBONATE PLUGS.
3. FINISH MACHINED DIMENSIONS WHERE NO TOLERANCE HAS BEEN INDICATED SHOULD BE TAKEN AS MEDIUM GRADE AS PER DIN 7168.
4. ALL FINISH MACHINED SURFACES & HOLES ARE TO BE PROTECTED WITH TECTYL 858 (C) OR EQUIVALENT MATERIAL FOR PRESERVATION AGAINST CORROSION DURING TRANSPORT.

SPECIAL NOTE :-

CASTING TO BE SUPPLIED IN ROUGH MACHINED CONDITION BUT HOLES/SURFACE MARKED ▼ SHALL BE SUPPLIED IN FINISH MACHINED CONDITION BY CASTING SUPPLIER.

GMS No. / C.B.O.M	01050209000		STATUS OF DRG
AGREED T DEPT.	NAME	SIGN	DATE
STT	J.P.GUPTA	SD/-	
STE	S.K.KUNDU	SD/-	30.10.86

GRADE OF UNTOL. DIM
M/CG.- AA0230208 m
WELDING-CLASS 'B' OF AA0621104
GAS CUTTING-TABLE 3 OF AA0621101

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: STEAM TURBINE

BHARAT HEAVY ELECTRICALS LTD. RANIPUR, HARDWAR

	NAME	SIGN	DATE	NO. OF VAR
DRN	A. RAWAT	SD/-	22.8.03	
CHD	P.NATH	SD/-	25.8.03	—
APPD	P.NATH	SD/-	02.9.03	—

REV	DATE	ALTERED / CHECKED
11	16.02.09	ALTERED ASHOK SD/- CHECKED P.NATH SD/-
K-10		SHEET NO. 02 ADDED & DIMENSION 984 IN PLACE OF 990 (IN SHEET NO. 1) CA/NO.MTE-09-F0028
07	27.06.01	ALTERED AR SD/- CHECKED PN SD/-
		SUPERSEDES OLD DRAWING UNDER SAME NO. C/A NO. MTE-03-F1028

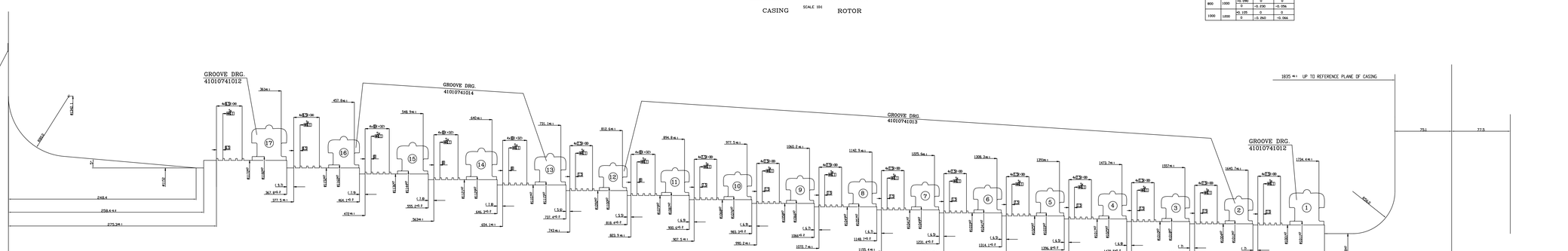
DEPT MTE | CODE 4300 | SCALE 1:10 | WEIGHT (KG) | REF. TO ASSY. DRG. | ITEM No. | NO. OF ITEMS

TITLE : H.P. INNER CASING(R/Mc)

CARD CODE | DRAWING NO. 0-10502-09901 | SHEET No. 02 | No. OF SHEETS 02

INVENTORY No. | SIGN & DATE | REFERENCE No. 7404-12230

A0 SIZE



R

(TURBINE SIDE)

DETAIL OF GROOVE FOR SEALING STRIP

TOLERANCE TABLE

NOMINAL SIZE mm		TOLERANCE RANGE		
		H7	h9	h6
ABOVE	UP TO	UPPER LOWER	UPPER LOWER	UPPER LOWER
800	1000	+0.090 0	0 -0.230	0 -0.056
1000	1200	+0.105 0	0 -0.260	0 -0.066

2.5 ALL OVER

FINISH MACHINING CONTOUR OF ROTOR

TECHNICAL REQUIREMENTS:

1. RADIAL RUN OUT MEASUREMENTS TO BE DONE AT STAGES 1R, 9R & 17R WITH RESPECT TO A-B, AS MENTIONED IN THE DRG. OF HP ROTOR (PGMA 10101). THE SURFACE FINISH AT THESE LOCATIONS SHALL BE 2.5. PERMISSIBLE RUNOUT VALUES, WHICH ARE VALID FOR ALL STAGES, SHALL BE AS PER THE SKETCH BELOW.

2. INSERTION GROOVES TO BE MADE AS PER DRG. 31010741021.
3. LOCATION OF INSERTION GROOVES TO BE TAKEN AS PER TECHNOLOGICAL INSTRUCTION NO. 0944.004 (FV 100113), α = 30°
4. LIST OF GROOVE DRAWINGS

MOVING BLADE		GUIDE BLADE	
STAGE	DRAWING NO.	STAGE	DRAWING NO.
1R-3R	41020446012	1R	41010741012
4R-12R	41020446014	2R-12R	41010741013
13R-15R	41020446015	13R-16R	41010741014
16R-17R	41010741011	17R	41010741012

5. FOR THE VALUE OF TOLERANCES (H7, h9 AND h6), SEE TOLERANCE TABLE.

GRADE OF UNTOL DIM: –
MCG: –C/M/F/ AA 023 0208
WELDING: –'T1' 0 610 003
GAS CUTTING: –'T3' AA 0621101

~~GMS No.~~/CBOM NO. 91010741000
STATUS OF DRG U

AGREED DEPT	NAME	SIGN	DATE
STT	G.SINGH	Sd/-	17.4.03
NCT	P.K.ARORA	Sd/-	16.4.03
STT	Y.P.ANAND	Sd/-	10.5.03

REV	DATE	ALTERED / CHECKED		ZONE	
01	10.03.08	ALTERED V.K.S Sd/- CHECKED P.K.B Sd/-		C8	DIM ø686 WAS ø636 (STE-08-F0072)

TYPE OF PRODUCT
OR
NAME OF CUSTOMER/PROJECT
STEAM TURBINE

BHARAT HEAVY ELECTRICALS LTD.
RANIPUR, HARDWAR

	NAME	SIGN	DATE
DRN	HANS LAL	Sd/-	07.05.02
CHD	SKG/ PKB	Sd/-	20.03.03
APPD	T.K.GHOSH	Sd/-	23.05.03

NO. OF VAR ——

DEPT STE
CODE 4011
SCALE 1:1
WEIGHT (KG) ——
REF. TO ASSY. DRG. 91010741000
ITEM NO. –
NO. OF ITEMS

TITLE :
GROOVE PLAN HPT

DRAWING NO.
9-10107-41051
REV.
SHEET No. 1 No. OF SHEETS 1

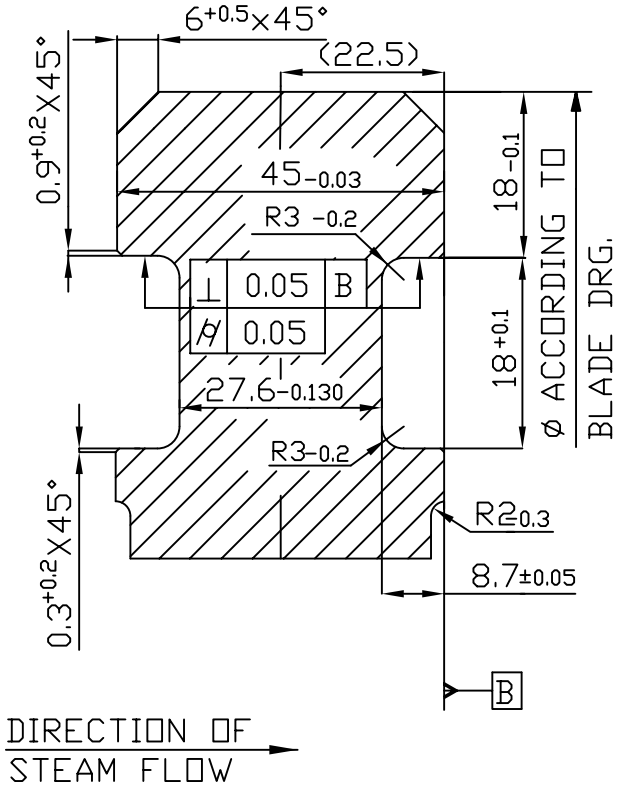
FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN mm) FORM DG 39(B)

REV	DATE	ALTERED / CHECKED	REV	DATE	ALTERED / CHECKED	~~GMS No.~~/ C.B.O.M. NO.	STATUS OF DRG
						91010741000	U

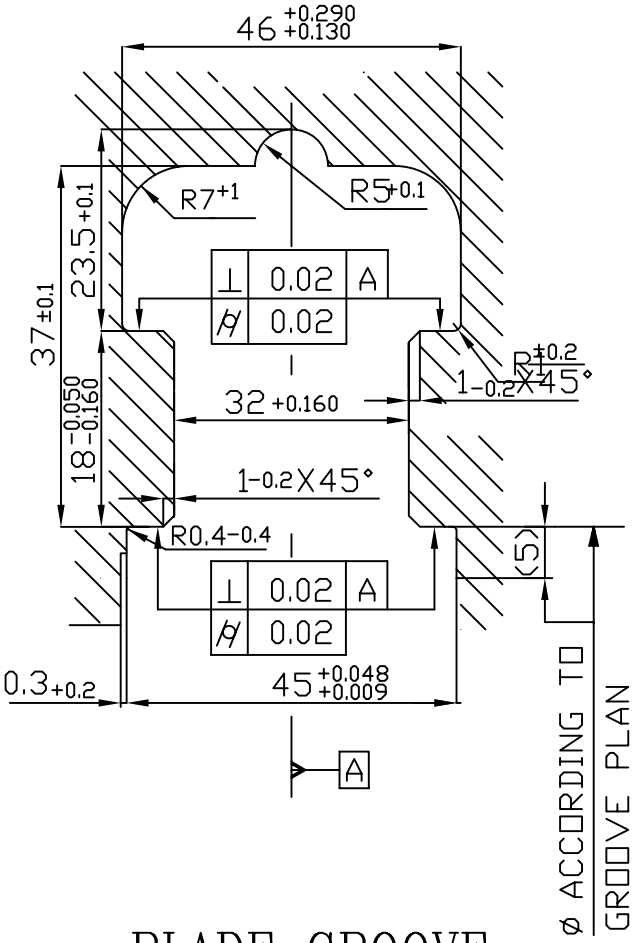
ZONE		ZONE		AGREED DEPT	NAME	SIGN	DATE
				STT	G.SINGH	Sd/-	17.4.03
				NCT	P.K.ARORA	Sd/-	16.4.03

GRADE OF UNTOL.DIM M/CG. C/M/F –AA0230208 | WELDING A/B/C/D AA0621104 | GAS CUTTING–T3 AA0621101

3.2 ALL OVER



BLADE ROOT



BLADE GROOVE

66661576 Ref.Drawing No>

Sign & Date

	NAME	SIGN	DATE	NO. OF VAR
DRN	HANS LAL	Sd/-	07.3.03	
CHD	P.K.BANSAL	Sd/-	20.3.03	
APPD	T.K.GHOSH	Sd/-	23.5.03	

BHARAT HEAVY ELECTRICALS LTD.
RANIPUR, HARDWAR

DEPT STE	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM No.	NO. OF ITEMS
CODE 4011	NTS	———	91010741000	———	———

Inventory No.

TITLE : ROOT AND GROOVE FOR GUIDE BLADE

CARD CODE

DRAWING NO. 74–10107–4101222 23 24

SHEET No. 01 | No. OF SHEETS 01

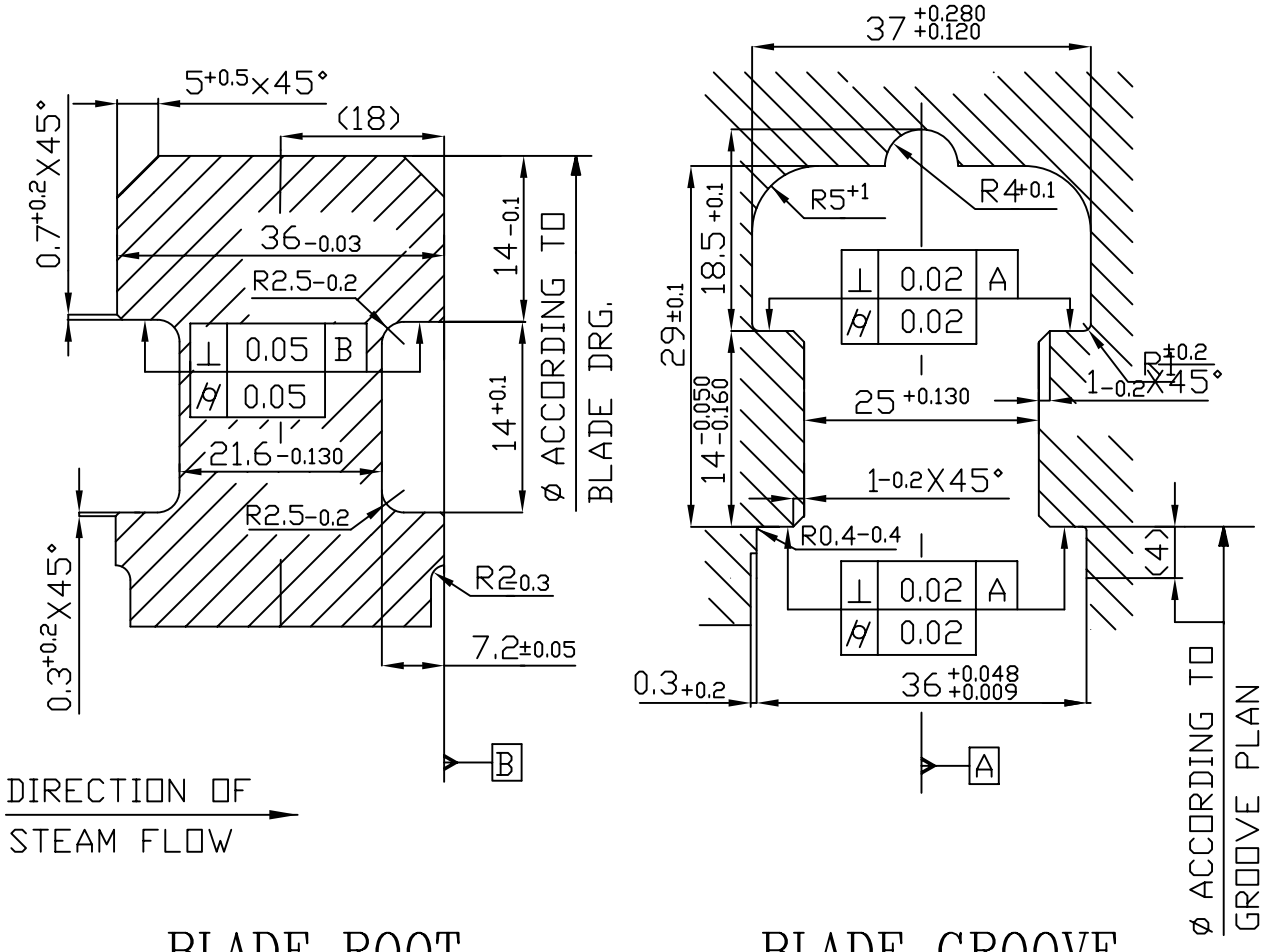
FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN mm) FORM DG 39(B)

REV	DATE	ALTERED / CHECKED	REV	DATE	ALTERED / CHECKED	~~GMS No.~~/ C.B.O.M. NO.	STATUS OF DRG
						91010741000	U

ZONE		ZONE		AGREED DEPT	NAME	SIGN	DATE
				STT	G.SINGH	Sd/-	17.4.03
				NCT	P.K.ARORA	Sd/-	16.4.03

GRADE OF UNTOL.DIM M/CG. C/M/F –AA0230208 | WELDING A/B/C/D AA0621104 | GAS CUTTING–T3 AA0621101

3.2 ALL OVER



BLADE ROOT

BLADE GROOVE

66661556 Ref.Drawing No>

Sign & Date

	NAME	SIGN	DATE
DRN	HANS LAL	Sd/-	07.3.03
CHD	P.K.BANSAL	Sd/-	20.3.03
APPD	T.K.GHOSH	Sd/-	23.5.03

BHARAT HEAVY ELECTRICALS LTD.
RANIPUR, HARDWAR

NO. OF VAR

Inventory No.

DEPT STE	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM No.	NO. OF ITEMS
CODE 4011	NTS	——	91010741000	——	——

TITLE : ROOT AND GROOVE FOR GUIDE BLADE

CARD CODE

DRAWING NO. 74–10107–4101322 23 24

SHEET No. 01 | No. OF SHEETS 01

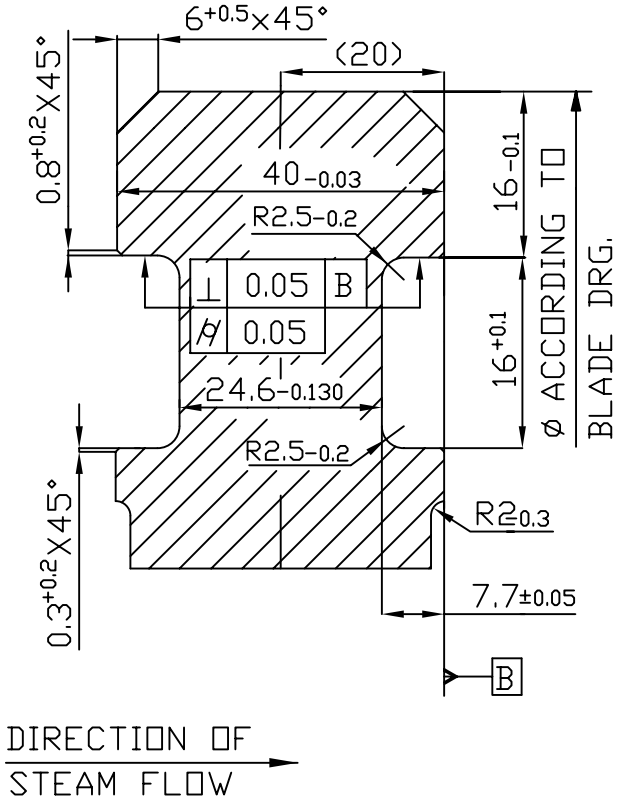
FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN mm) FORM DG 39(B)

REV	DATE	ALTERED / CHECKED	REV	DATE	ALTERED / CHECKED	~~GMS No.~~/ C.B.O.M. NO.	STATUS OF DRG
						91010741000	U

ZONE		ZONE		AGREED DEPT	NAME	SIGN	DATE
				STT	G.SINGH	Sd/-	17.4.03
				NCT	P.K.ARORA	Sd/-	16.4.03

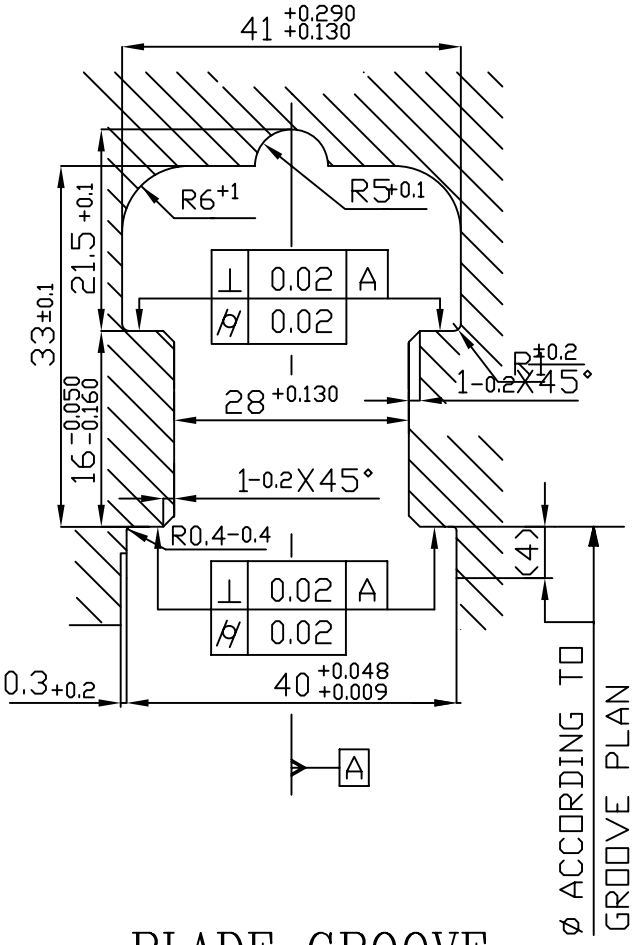
GRADE OF UNTOL.DIM M/CG. C/M/F –AA0230208 | WELDING A/B/C/D AA0621104 | GAS CUTTING–T3 AA0621101

3.2 ALL OVER



DIRECTION OF STEAM FLOW

BLADE ROOT



BLADE GROOVE

	NAME	SIGN	DATE	NO. OF VAR
DRN	HANS LAL	Sd/-	07.3.03	
CHD	P.K.BANSAL	Sd/-	20.3.03	
APPD	T.K.GHOSH	Sd/-	23.5.03	

BHARAT HEAVY ELECTRICALS LTD.
RANIPUR, HARDWAR

DEPT STE	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM No.	NO. OF ITEMS
CODE 4011	NTS	———	91010741000	———	———

TITLE : ROOT AND GROOVE FOR GUIDE BLADE

CARD CODE

DRAWING NO. 74–10107–4101422 23 24

SHEET No. 01 | No. OF SHEETS 01

66661566 Ref.Drawing No>

Sign & Date

Inventory No.