PART- A

CNC HORIZONTAL BORER - SPINDLE Φ 200mm

SECTION - I : QUALIFYING CRITERIA

The BIDDER has to compulsorily meet the following requirements to get qualified for considering the technical offer for the CNC HORIZONTAL BORER - SPINDLE DIA - 200MM

SL NO	REQUIREMENTS	VENDOR'S RESPONSE
1.0	Only those vendors (OEMs) satisfying the following criteria should quote **a)** The vendor should have have supplied and commissioned at least one CNC HORIZONTAL BORING MACHINE of same (Spindle Diameter 200mm, Ram+Spindle Travel of 2200mm) 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, should quote. However, if referred machine (s) has/ had been supplied to BHEL, then the machine should be presently working satisfactorily for more than six months (on the date of opening of Tender) after its commissioning and acceptance in BHEL. **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 HORIZONTAL BORING MACHINES have been supplied in the past.	

SL NO	REQUIREMENTS	VENDOR'S RESPONSE
3.0	Specify details of CNC HORIZONTAL BORING MACHINES supplied to other units of BHEL,if any. (Year of commissioning, Spindle Dia, Ram+Spindle Travel, Guideways 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	Spindle Diameter	
5.2	Ram + Spindle Extension	
5.3	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)		

CNC HBM : SPINDLE DIA - 200MM

SL NO	REQUIREMENTS	VENDOR'S RESPONSE
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	
5	Machine Details:	
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,	**Enquiry No. & Dt.:**
Bharat Heavy Electricals Limited,	**Due Date :**
Ramachandrapuram -502032, Andhra Pradesh, INDIA.	**Supplier's Ref.:**
	Date :

Specification cum Compliance Certificate for CNC HORIZONTAL BORING MACHINE - 200 mm

Note:-

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.

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 HORIZONTAL BORING MACHINE - 200 mm complying with specification as below.

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
1.0	**PURPOSE & WORKPIECE MATERIAL**		
1.1	**PURPOSE/APPLICATION**: Floor Type CNC Horizontal Boring Machine shall be required to machine components for Power Generation Industry involving operations like milling, drilling, boring, reaming, threading / tapping etc.	Vendor to note & accept	
1.2	**WORK PIECE MATERIAL**: Machine shall be suitable for machining components of ferrous metals like carbon steel, alloy steel, cast steel, cast iron, stainless steel etc.	Vendor to note & accept	
2	**SPECIFICATION:**		
2.1	**MACHINE CONFIGURATION**: The Machine shall be Floor Type CNC Horizontal Boring Machine with a Rotary Table. Looking from spindle side, AAC is to be on Right side of Rotary Table. Linear movement of Table is to be perpendicular to X-axis.	Vendor to offer	
2.2	**HEAD STOCK**		
2.2.1	Boring spindle diameter	200 mm or more	
2.2.2	Milling spindle diameter	Vendor to specify	
2.2.3	Ram Cross section (LxB) mm	Vendor to specify	
2.2.4	Spindle motor power (Continuous Rating - S1) AC	85KW or more	
2.2.5	Spindle motor make, model etc.	Vendor to submit details	
2.2.6	Spindle speed in RPM (Infinitely variable)	10 or less to 1600 or more	
2.2.7	No. of speed ranges	Vendor to specify	
2.2.8	Max torque on the boring spindle (N-m)	Vendor to specify	
2.2.9	Max torque on the milling spindle (N-m)	Vendor to specify	
2.2.10	Spindle taper	IS0-50	
2.2.11	Torque-Power-Speed characteristics of the spindle system	Vendor to submit	
2.2.12	Oriented Spindle Stop (Any position)	Vendor to confirm	
2.2.13	Spindle Cooling System (Details to be submitted)	Vendor to submit	
2.3	**COLUMN:**		
2.3.1	Column longitudinal travel (X-Axis)	16000 mm	
2.3.2	X-axis feed rate (Infinitely variable)	1 to 5000 mm / min (or more)	

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.3.3	X-axis rapid traverse rate	10000 mm / min (or more)	
2.3.4	Axis Resolution	0.001mm	
2.4	**HEADSTOCK TRAVERSE ON COLUMN:**		
2.4.1	Headstock vertical travel (Y-Axis)	5000 mm	
2.4.2	Traverse Range (w.r.t table top)	0 To 5000 mm	
2.4.3	Y-axis feed rate (Infinitely variable)	1 to 5000 mm / min (or more)	
2.4.4	Y-axis rapid traverse rate	10000 mm / min (or more)	
2.4.5	Axis Resolution	0.001mm	
2.5	**RAM/ SPINDLE TRAVERSE:**		
2.5.1	Boring spindle axial travel (W-Axis)	1000 mm or more	
2.5.2	Ram axial travel (Z-Axis)	1200 mm or more	
2.5.3	Spindle + Ram travel (W+Z)	2200 mm or more	
2.5.4	Lowest spindle position from Table Top (zero level at Table top).	Vendor to confirm and submit details	
2.5.5	Boring Spindle axis feed rate (Infinitely variable)	1 to 3000 mm / min (or more)	
2.5.6	Boring Spindle axis rapid traverse rate	5000 mm / min (or more)	
2.5.7	Ram axis feed rate (Infinitely variable)	1 to 3000 mm / min (or more)	
2.5.8	Ram axis rapid traverse rate	5000 mm / min (or more)	
2.5.9	Axis Resolution (Z & W axis)	0.001	
2.5.10	Spindle & Ram Axes should be independently programmable with Independent Drives and Feed back system.	Vendor to confirm	
2.6	**FEED AND DRIVE SYSTEMS:**		
2.6.1	Feed drives/ motors for X,Y,Z & W axes [AC servo motors] shall be digital type of either Siemens or Fanuc make (Details of model, make, type etc. to be submitted)	Vendor to offer	
2.6.2	Maximum feed force for all axes	Vendor to specify	
2.6.3	Feed back system for X, Y & Ram (Z) axes: Heidenhain linear scales with pressurised compressed air cleaning (Details to be submitted by the vendor). The Air supply system shall have suitable drier, if required.	Vendor to offer	
2.6.4	Feed back system for Spindle (W) Axis: Rotary encoder/ Linear scale of Heidenhain make. (Details to be submitted by the vendor)	Vendor to offer	
2.6.5	Feed back system for Spindle rotation Axis: preferably of Heidenhain make. (Details to be submitted by the vendor)	Vendor to offer	
2.6.6	Type of power transmission: 1.Pre-loaded backlash free hydro-static worm or pre-loaded backlash free double pinion & rack drive for X-axis. 2. Backlash free re-circulating ball screw with Pre-loaded double nut for all other axes. (Complete description of the aforesaid, including diameter of Ball Screw for each axis, to be submitted with the offer)	Vendor to submit	
2.6.7	Mechanism for locking X, Y & Z axis	Vendor to specify	
2.6.8	Maximum thrust rating of all axes.	Vendor to specify	
2.7	**MACHINE GUIDEWAYS:**		
2.7.1	Width of bed guideways, X-axis	Vendor to specify	
2.7.2	Width of column guideways, Y-axis	Vendor to specify	
2.7.3	Details of Guide ways for Ram axis and bearing details of Spindle axis are to be submitted with offer.	Vendor to submit	
2.7.4	Guide ways for X-axis, Y-axis & Z-axis: Hydrostatic (Details to be submitted). Details of lubrication system provided on Spindle axis are also to be submitted with the offer.	Vendor to submit	
2.7.5	Hardness of guideways	Vendor to specify	

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.7.6	Metallic Telescopic covers of stainless steel material to be provided with wipers for X & Y axes guide ways. Joints of telescopic covers should be so sealed to avoid mixing of coolant & hydrostatic oil is to be provided. Telescopic covers for X-axis should be with a slant towards Chip conveyor.	Vendor to offer and confirm	
2.8	**ROTARY TABLE :**		
2.8.1	Table size (LxB)	4500 x 4500 mm	
2.8.2	Maximum load carrying capacity (Tons)	100T or more	
2.8.3	Chart/Table showing relation of weight and distance of c.g. from centre of Rotary Table (loading chart of table) to be submitted.	Vendor to confirm & submit.	
2.8.4	Table rotation (Fully programmable B-axis)	360000 indexing positions	
2.8.5	Accuracy of Rotary axis: (See Clause 2.27)	Vendor to confirm	
2.8.6	Maximum machining torque on B-axis (N-m)	Vendor to specify	
2.8.7	Maximum clamping torque on B-axis (N-m)	Vendor to specify	
2.8.8	Feed rate for Table Rotary Axis. (Deg/ min Infinitely variable or rpm)	Vendor to specify	
2.8.9	Rapid Traverse Rate for Rotary Axis (Deg/ min. or rpm)	Vendor to specify	
2.8.10	Size of T-slots	Suitable for Studs of M36	
2.8.11	T-slots pitch (as per DIN standard)	Vendor to specify and confirm	
2.8.12	Central slot tolerance	Vendor to specify	
2.8.13	Perpendicular Lateral slot size/ tolerance	Vendor to specify	
2.8.14	Size of bore at the center.	Vendor to specify	
2.8.15	Linear traverse of Table (Perpendicular to X-axis)	2500 mm (or more)	
2.8.16	Feed Force on Linear Axis	Vendor to specify	
2.8.17	Feed Rate for Linear axis (mm/ min Infinitely variable)	1 or less to 3000 mm / min (or more)	
2.8.18	Rapid Traverse rate for Linear axis (mm/ min)	5000 mm / min (or more)	
2.8.19	Minimum distance between ram face and table face.	Vendor to specify.	
2.8.20	Cheveron type Metallic Telescopic Covers of stainless steel material are to be supplied with wipers for Table Linear axis. Joints of telescopic covers should be so sealed to avoid mixing of coolant and Hydrostatic oil.	Vendor to confirm	
2.8.21	Feed back devices :		
	a) Heidenhain rotary encoder for B-Axis	Vendor to confirm	
	b) Heidenhain Linear Scale with pressurised compressed air cleaning system for linear (V)-Axis	Vendor to confirm	
2.8.22	Feed motors/drives : Fanuc/Siemens digital AC Servo drives. Details of Make, Model, Type etc. to be submitted.	Vendor to submit.	
2.8.23	Mechanism for locking/ clamping of Table axes	Vendor to specifyprovide details	
2.8.24	Location of the Table looking from Spindle side	On extreme Left side of X-traverse	
2.8.25	Spindle should reach 1000 mm beyond extreme end of Rotary Table.	Vendor to confirm	
2.8.26	Level of Rotary Table should be such so that it can freely rotate without interfering with the Floor Plates	Vendor to confirm	
2.8.27	Hydrostatic Guideways for Table Rotation, Details to be submitted.	Vendor to confirm.	
2.8.28	Hydrostatic Guideways for Table Linear Traverse, Details to be submitted.	Vendor to confirm.	
2.8.29	4 x 90 deg Precision Positioning (Details to be submitted.)	Vendor to confirm & submit details.	
2.8.30	Backlash free re-circulating ball screw with Pre-loaded double nut for Table Linear axis. (Complete description of the same including diameter of Ball Screw, to be submitted with the offer)	Vendor to confirm & submit details.	

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.9	**FLOOR PLATES:**		
2.9.1	Floor plates to cover the floor area to a width of 6000mm along the complete longitudinal travel (X axis) of the machine, except that covered by Rotary Table and AAC.	Vendor to confirm	
2.9.2	Floor Plate Area (L X B)	Vendor to specify	
2.9.3	Number of Floor Plates	Vendor to specify	
2.9.4	Size of each Floor Plate	Vendor to specify	
2.9.5	Load bearing capacity, Tons / sq. Meter	15 Tons / Sq. Meter (or more)	
2.9.6	Thickness	Vendor to specify	
2.9.7	T-slot size	42 mm, Suitable for T-Bolts of size M36	
2.9.8	T-slot pitch as per DIN standard	Vendor to confirm	
2.9.9	Direction of T-slots in the Floor Plates	Parallel to X axis movement	
2.9.10	Coolant collection channels on the sides of the floor plates	Vendor to confirm	
2.10	**CONSTRUCTION:**		
2.10.1	Vendor to furnish details of material, hardness & constructional details, including explanatory drawings, of various Components/ Assemblies like Column, bed, Head Stock, Ram, Spindle, Rotary Table etc. of the machine.	Vendor to submit	
2.10.2	Video images on CD including hard copy explaining the technical features/ Literature with photographs, drawings explaining the technical features should be enclosed with the offer.	Vendor to submit	
2.10.3	Automatic deflection compensation for ram and column effective at any extension of the ram plus spindle is to be provided taking into consideration weight of all posssible cutters/ attachments offered. Details of the offered system should be submitted with offer.	Vendor to confirm and submit	
2.10.4	Head Stock and Column Counterbalancing System. (Details of the offered system to be submitted)	Vendor to submit	
2.11	**OPERATOR'S PLATFORM:**		
2.11.1	Operator's platform of sufficient load carrying capacity to be provided. The platform shall be Headstock mounted type or with Independent vertical movement for total Vertical Traverse as well as forward stroke of sufficient length . Push Button switches are to be provided on the Operator's Platform at suitable location for various movements. A 15 Amp. Plug Point with ON / OFF switch is also to be provided on the Platform. Suitable Fan for the operator is also to be provided.	Vendor to confirm	
2.11.2	Horizontal movement of complete Platform.	Vendor to specify	
2.11.3	Weight carrying Capacity of the Platform	Vendor to specify	
2.11.4	Minimum Height of Platform from Shop Floor.	Vendor to specify	
2.11.5	Splash / Chip guards on operator platform for protection of operator, operator's panel and to avoid spillage of coolant & chips on operator's platform.	Vendor to offer & confirm	

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.12	**OPERATION AND CONTROL SYSTEM:**		
2.12.1	**OPERATOR'S PANEL:**		
2.12.1.1	Swiveling type operator's panel having complete CNC and machine control system with CRT of required configuration shall be provided on the operators platform. All switches on the Operator's panel, including that for table rotation, should be within reach of operator of average Indian height for convenient, efficient & safe operation. All displays/ indications should also be conveniently placed accordingly. Layout showing complete details of the panel should be submitted.	Vendor to confirm & submit	
2.12.2	**CNC SYSTEM & FEATURES :**	Vendor to note & accept	
2.12.2.1	Make	Siemens or Fanuc	
2.12.2.2	Type	PC based latest version	
2.12.2.3	Model: Latest version & model of CNC system, as available at the time of ordering, should be supplied.	Vendor to offer and submit details	
2.12.2.4	Details of Standard features	Vendor to submit	
2.12.2.5	Details of optional features such as parametric programming, copy & paste of programs and others recommended by vendor for proveout components for specified operations or foreseen as required keeping in view of offered accessories/systems/special features etc..	Vendor to submit	
2.12.2.6	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	
2.12.2.7	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.		
2.12.2.8	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	
2.12.2.9	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	
2.12.2.10	Provision of On-screen PLC logic display on the CNC System for diagnostic purposes.	Vendor to offer	
2.12.2.11	In-cycle hour counter with reset facility shall be provided.	Vendor to offer	
2.12.2.12	Power meter for indicating total energy consumption of the machine shall be provided.	Vendor to offer	

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.12.3	**HAND HELD UNIT:**		
2.12.3.1	Hand Held unit with jog axes,spindle inching, hand-wheel and sufficient length of interfacing cable, which can be taken near to the Table for job setting and similar other purposes.	Vendor to offer	
2.12.4	**MANUAL CONTROL**		
2.12.4.1	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.	
2.12.5	**DIAGNOSTIC SYSTEMS**		
2.12.5.1	**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	
2.12.5.2	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	
2.12.5.3	Help guide should be provided to use both diagnostic systems	Vendor to offer & submit	
2.12.6	**NETWORKING**		
2.12.6.1	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	
2.12.6.2	The machine shall appear as a node in the Entire Network. (Network Neighbourhood)	Vendor to offer	
2.12.6.3	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	
2.12.6.4	The program transfer between CNC system and network should also be possible in CNC Mode.	Vendor to offer	
2.12.7	**MACHINE MONITORING SYSTEM (MMS) SIGNALS**		
2.12.7.1	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	
2.12.7.2	Control ON	Vendor to offer	
2.12.7.3	Cycle ON	Vendor to offer	
2.12.7.4	Spindle Running	Vendor to offer	
2.12.7.5	Feed Active (Any of the axes moving)	Vendor to offer	
2.12.7.6	M30 (Program Stop)	Vendor to offer	
2.13	**UPS FOR CNC SYSTEM :**		

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.13.1	UPS of 30 minutes for CNC system with inbuilt cooling and charge status display (Battery charging /discharging time should be specified by vendor)	Vendor to offer	
2.14	**MACHINE LIGHTS**		
2.14.1	Machine Lights for sufficient illumination of complete working area including operator's panel should be provided for clear visibility.	Vendor to offer	
2.14.2	A magnetic base portable spot light with sufficiently long cable should also be provided.	Vendor to offer	
2.14.3	Any lights required in the foundation/ pit area shall also be foreseen and supplied by the vendor.	Vendor to offer	
2.14.4	All light fittings, consumables, adapters/receptacles should have compatibility with Indian equivalents	Vendor to offer	
2.14.5	Flashing/Rotary type light indicating end of cutting, program stop, alarm etc. at a easily visible &suitable place.	Vendor to offer	
2.15	**AIR CONDITIONERS**		
2.15.1	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	
2.15.2	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	
2.16	**HYDRAULIC SYSTEM (DETAILS TO BE SUBMITTED BY THE VENDOR) :**		
2.16.1	The Hydraulic System shall be of Re-circulating Type. Hydraulic Tank should be preferably placed at shop floor.	Vendor to offer and confirm	
2.16.2	Pumps, Valves, Switches (Pressure & Flow) should be of Make : Rexroth / Vickers / Parker / Hawe.	Vendor to offer and confirm	
2.16.3	Filtration System: Sufficient no. of filters (with electric clogging indicator and alarm on PLC) should be used to avoid frequent clogging of the filters and other maintenance related problems. Filter elements should, preferably, be of Make : EPE / Hydac	Vendor to offer and confirm	
2.16.4	Failure indication	Vendor to offer	
2.16.5	Automatic shut off provision, Details should be submitted.	Vendor to offer	
2.16.6	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	
2.16.7	Hydraulic pump capacity (flow / pressure)	Vendor to inform	
2.16.8	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	
2.16.9	Complete hydraulic system should be designed to avoid any leakage or spillage.	Vendor to confirm	

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.16.10	Sufficient stages/nos. of filters should be used to avoid frequent clogging of the filters and other maintenance related problems.	Vendor to offer	
2.17	**FIRST FILLING OF OILS**		
2.17.1	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	
2.18	**COOLANT SYSTEM :**		
2.18.1	Coolant System with all accessories for following variants shall be provided. Selection of all the variants shall be through program and push buttons provided on the Operator's panel as well. a) Recirculating Type Flood Coolant System with nozzles around spindle. b) High Pressure Coolant thru Spindle (20 bar or more)	Vendor to confirm	
2.18.2	All offered attachments, tool holders, boring bars, cassettes, adapters etc. shall have the provision so that coolant is available directly at the tool-cutting tip.	Vendor to confirm	
2.18.3	Coolant collection and recirculation system should be leakproof & perfect to avoid any spillage on shop floor, trenches for cables & foundation pit of the machine etc.	Vendor to confirm	
2.18.4	Coolant Filteration System: Recirculating type coolant system with Vaccum Rotary drum type Filteration System with magnetic separator & oil skimmer.	Vendor to confirm and submit details.	
2.18.5	Coolant Flow Diagram showing filters, pumps, valves, tanks etc. to be submitted with the offer.	Vendor to submit	
2.18.6	Pressure & rate of flow of coolant for different variants (Recirculating/High pressure etc) should be furnished in the offer. The Pressure should be sufficient for the coolant to reach the tool tip at full pressure.	Vendor to specify & confirm.	
2.18.7	Coolant Tank Capacity. Coolant Tank may preferably be placed on the Floor Level. The details of the sysytem, including requisite sump, pump etc., should be clearly indiacted.	Vendor to specify	
2.18.8	Coolant pump & motor details for all variants of coolant system are to be submitted with the offer.	Vendor to submit	
2.18.9	The coolant tank should be fitted with skimmer for regular cleaning of coolant from contamination with tramp oil.	Required.	
2.19	**ELECTRICAL :**		
2.19.1	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	
2.19.2	Tropicalisation: All electrical / electronic equipment shall be tropicalized.	Vendor to offer	
2.19.3	All electrical & electronic control cabinets & panels should be dust and vermin proof.	Vendor to offer	
2.19.4	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
2.19.5	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	
2.19.6	All motors shall conform to IEC or Indian Standards	Vendor to offer	
2.19.7	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	
2.19.8	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	
2.20	**SAFETY ARRANGEMENTS (FOLLOWING SAFETY FEATURES IN ADDITION TO OTHER STANDARD SAFETY FEATURES SHOULD BE PROVIDED ON THE MACHINE):**	Vendor to offer	
2.20.1	Machine should have adequate and reliable safety interlocks / devices to avoid damage to the machine, workpiece and the operator due to the malfunctioning o 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	
2.20.2	A detailed list of all alarms / indications provided on machine should be submitted by the supplier.	Vendor to submit	
2.20.3	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	
2.20.4	All the rotating parts used on machine should be statically & dynamically balanced to avoid undue vibrations & noise.	Vendor to confirm	
2.20.5	Emergency Switches at suitable locations as per International Norms should be provided.	Vendor to offer	
2.20.6	Oil & water pipe lines should not run with electrical cable in the same trench.	Vendor to offer	
2.21	**ENVIRONMENTAL PERFORMANCE OF THE MACHINE (THE MAHINE SHOULD CONFORM TO THE FOLLOWING FACTORS RELATED TO ENVIRONMENT) :**		
2.21.1	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	
2.21.2	There shall not be any emissions from the machine except fumes of cutting fluid during machining.	Vendor to confirm	
2.21.3	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	
2.21.4	No hazardous chemicals shall be required to be used in the machine.	Vendor to confirm	
2.21.5	If any safety / environmental protection enclosure is required it should be built in the machine by the vendor.	Vendor to confirm	
2.21.6	Paint of the machine should be oil / coolant resistant and should not get peeled off and mixed up with coolant.	Vendor to confirm	

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.22	**CHIP CONVEYOR :**		
2.22.1	A chip conveyor to carry both short and curly chips efficiently and effectively to the chip bin to be provided on one end of the machine . Two Chips bins of appropriate size of Indian make, with wheels & handle for movement, should also be supplied	Vendor to confirm	
2.22.2	Type of chip conveyor	Slat type.	
2.22.3	Width of conveyor	Vendor to specify	
2.22.4	Elevation of chip conveyor for chip bin	Vendor to specify	
2.22.5	Material of chip conveyor (to be rust resistant)	Vendor to specify	
2.22.6	Provision for smooth flow of chips to the conveyor.	Vendor to confirm	
2.22.7	Operation of chip conveyor (forward, reverse & inch) through push buttons on operator's panel and also near chips disposal point/chip bin.	Vendor to confirm	
2.22.8	Layout showing location of chip conveyor to be submitted.	Vendor to submit	
2.23	**SERVO VOLTAGE STABILIZER**		
2.23.1	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	
2.23.2	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 Voltage Stabiliser shall be submitted with the offer.	Vendor to offer	
2.24	**ULTRA ISOLATION TRANSFORMER**		
2.24.1	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	
2.24.2	Make (Neel or Servomax or Aplab or equivalent reputed Indian Manufacturer)	Vendor to inform	
2.24.3	Model, Rating & Input/Output Voltage etc.	Vendor to inform	
2.24.4	Catalogue of the Ultra Isolation Transformer shall be submitted with the offer.	Vendor to offer	
2.25	**AIR COMPRESSOR**		
2.25.1	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	
2.25.2	Make, Type & Model	Vendor to inform	
2.25.3	Capacity (Discharge Air Flow & Pressure, Motor Power etc.)	Vendor to inform	
2.25.4	Refrigerant used	Vendor to inform	
2.26	**COMPRESSED AIR POINTS**		
2.26.1	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	
2.27	**ACCURACY TESTS:**		
2.27.1	**GEOMETRICAL ACCURACIES :**		

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.27.2	Geometrical Accuracy Tests shall be in accordance with ISO 3070 standard or equivalent applicable standard. Detailed Test Charts for the same, clearly showing the accuracies to be achieved on the machine, shall also be submitted with the offer.	Vendor to confirm	
2.27.3	All the above accuracies to be demonstrated to BHEL engineers during pre-acceptance tests at Suppliers works and during Erection & Commissioning at BHEL Works.	Vendor to confirm	
2.28	**MACHINE POSITIONING & REPEATABILITY ACCURACIES : SHOULD BE MEASURED AS PER VDI/DGQ 3441 (LATEST REVISION) USING LASER INTERFEROMETER.**		
2.28.1	Positioning uncertainty (Pa per 1000mm) for X,Y,Z,W & V axes	0.01 mm	
2.28.2	Positioning uncertainty Pa for B-axis	10 secs	
2.28.3	Positional scatter (Ps per 1000mm) for X,Y,Z,W & V axes	0.005 mm	
2.28.4	Positional scatter Ps for B-axis	8 secs	
2.28.5	Total positioning error P for entire travel for X,Y,Z,W & V axes	Vendor to specify	
2.28.6	Total positioning error P for B-axis	Vendor to specify	
2.28.7	All the above accuracies to be demonstrated to BHEL engineers during pre-acceptance at Suppliers works and during Erection & Commissioning at BHEL Works.	Vendor to confirm	
3	**TOOLING / LEVELLING & ANCHORING SYSTEM**		
3.1	**STANDARD TOOLING**:		
3.1.1	Cutting tool holders & inserts as per **ANNEXURE- I** to be offered for normal operation of the machine	Vendor to offer	
3.1.2	Tool Storage Cabinets (4 nos.) of reputed Indian make having covered heavy duty drawers of suitable sizes with lock facility to store offered tooling items etc.	Vendor to offer	
3.1.3	1 No of Work bench along with 2 chairs of reputed Indian make	Vendor to offer	
3.1.4	1 No of Godrej Storwel Almirah or equivalent	Vendor to offer	
3.2	**TOOLING FOR COMPONENT PROVE-OUT (AS PER CLAUSE 7.0)**		
3.2.1	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.	Vendor to confirm	
3.2.2	In case of order, manufacturing drgs., catalogues & source of all tooling items should be submitted by vendor.	Vendor to confirm	
3.3	**TOOLS FOR ERECTION, OPERATION & MAINTENANCE**		
3.3.1	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	
3.3.2	Test Mandrel for checking Spindle run-out & alignment should be supplied with protection boxes.	Vendor to offer	
3.4	**LEVELING & ANCHORING SYSTEM**		
3.4.1	Complete set of anchoring materials including foundation bolts, nuts, washers, fixators, leveling shoes etc to fix the machine to the foundation should be supplied. Details to be submitted.	Vendor to offer	
4	**ACCESSORIES:**		
4.1	**AUTOMATIC ATTACHMENT CHANGER (AAC):**		
4.1.1	All attachments shall be suitabe for loading / unloading through AAC	Vendor to confirm	

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
4.1.2	No. of storage positions (Matching with number of offered attachments + 1)	Vendor to confirm	
4.1.3	Location of the attachment changer , looking from spindle side	On extreme right side of X-traverse	
4.1.4	Mounting plates as required for attachments should be supplied	Vendor to confirm	
4.1.5	Maximum Permissible Weight on each Position.	Vendor to specify	
4.1.6	Maximum Permissible Weight on Complete AAC.	Vendor to specify	
4.1.7	Additional Longitudinal Traverse of X-axis required to accommodate and use AAC, beyond the specified X-axis traverse shall be seperately offered by the vendor.	Vendor to specify	
4.1.8	Suitable Software based customised screens and manual key based arrangement should be provided to extract an Attachment trapped in the AAC cycle. Details of both the system to be provided along with the offer.	Vendor to offer	
4.1.9	AAC Rack should be totally covered from the top and three side. On the front side a shutter shall be provided which shall open and close through CNC programme for loading and unloading the Attachments.	Vendor to confirm	
4.2	**PROGRAMMABLE BORING & FACING HEAD**		
4.2.1	Model No. (Preferably D'Andrea Model: UT5-630 or equivalent)	Vendor to inform	
4.2.2	Head body diameter	Vendor to inform	
4.2.3	Speed Range	Vendor to inform	
4.2.4	Radial axis independent positioning	Vendor to inform	
4.2.5	Slide stroke	Vendor to inform	
4.2.6	Slide feed rate	Vendor to inform	
4.2.7	Machining range in Boring for internal diameter	Vendor to inform	
4.2.8	Accuracy of Bore Size (Bore Tolerance)	H7	
4.2.9	Diameter range for machining external diameter indicating max. depth	Vendor to inform	
4.2.10	Machining range in facing indicating maximum depth.	Vendor to inform	
4.2.11	Maximum boring depth without entry of Boring Head.	Vendor to inform	
4.2.12	Maximum torque	Vendor to inform	
4.2.13	Maximum cutting force in boring	Vendor to inform	
4.2.14	Maximum cutting force in facing	Vendor to inform	
4.2.15	Slide Counter Balance mechanism	Vendor to inform	
4.2.16	Item wise details of complete set of standard Tool Holders and Tools, available with the offered Head, are to be submitted with the offer. Complete details of any special arrangement offered to meet the specified requirement of Boring range are also to be submitted.	Vendor to inform	
4.2.17	Tool Holder with BT 50 taper for presetting of the Tools for offered Boring and Facing Head is to be offered with complete details.	Vendor to offer.	
4.2.18	Catalogue of the offered Head is to be submitted with the offer.	Vendor to offer and submit	
4.2.19	Coolant system: External coolant with requisite flexible pipes on its snout is to be provided. The arrangement for its supply may be made through the coolant supply system available on the Head Stock.	Vendor to offer and submit	

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
4.3	**CNC ANGULAR HEAD/RIGHT ANGLE MILLING HEAD:**		
4.3.1	Power	40KW or more	
4.3.2	Max torque	Vendor to inform	
4.3.3	Speed Range (Infinitely Variable)	Vendor to inform	
4.3.4	Speed ratio (1:1 between spindle of Machine and Head)	Vendor to confirm	
4.3.5	Spindle taper	ISO50/BT50	
4.3.6	Traverse Range of C-axis	360 deg.	
4.3.7	Resolution of C-axis	1 deg.	
4.3.8	Power-Torque-Speed characteristic diagram to be submitted	Vendor to submit	
4.3.9	Wt. of the head	Vendor to inform	
4.3.10	Coolant system: Internal (thru spindle) & External coolant with requisite flexible pipes on its snout is to be provided.	Vendor to confirm	
4.3.11	Pull Stud for mounting the Head and for mounting the Tools in the taper of the Head shall be supplied by the vendor.	Vendor to confirm	
4.3.12	Drawing/Catalouge page showing major diamensions of the head shall be submitted with the offer.	Vendor to submit	
4.4	**CNC UNIVERSAL MILLING HEAD:**		
4.4.1	Power	30 KW or more	
4.4.2	Max torque	Vendor to inform	
4.4.3	Speed Range	Vendor to inform	
4.4.4	Speed ratio (1:1 between spindle of Machine and Head)	Vendor to inform	
4.4.5	Spindle taper	ISO50/ BT50	
4.4.6	Traverse Range of A-axis in deg.	(+/ -) 95 deg.	
4.4.7	Resolution of A-axis	0.001 deg.	
4.4.8	Rotation of C-axis (Any number of rotation)	360 deg	
4.4.9	Resolution of C-axis	0.001 deg.	
4.4.10	Power-Torque-Speed characteristic diagram to be submitted	Vendor to submit	
4.4.11	Weight of the head	Vendor to inform	
4.4.12	Coolant system: Internal (thru spindle) & External coolant with requisite flexible pipes on its snout is to be provided.	Vendor to offer.	
4.4.13	Pull Stud for mounting the Head and for mounting the Tools in the taper of the Head shall be supplied by the vendor.	Vendor to offer.	
4.4.14	Drawing/Catalouge page showing major diamensions of the head shall be submitted with the offer.	Vendor to submit	
4.5	**JIB CRANE**		
4.5.1	Capacity	1 Ton	
4.5.2	Mounted on top of column with all power operated movements (including swivel motion) through push buttons	Vendor to confirm	
4.5.3	Swivelling range and speed	Vendor to specify	
4.5.4	Crane reach should cover the rotary table when fully drawn towards machine spindle	Vendor to confirm	
5	**SPARES :**		
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	

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
5.1.1	**MECHANICAL & HYDRAULIC SPARES: FOLLOWING SPARES ARE TO BE OFFERED**	Vendor to offer	
5.1.1.1	Pressure control valves, Pressure reducing valves, Flow control valves & Direction control valves used in Hyd / Lub / Pneumatic/ coolant circuit. (5 Nos of each type)	Vendor to offer	
5.1.1.2	Pressure switches, flow switches used in Hyd / Lub / Pneumatic/ coolant circuit. (10 No.s of each type)	Vendor to offer	
5.1.1.3	All types of regenerative type filter inserts (10 Nos of each type)	Vendor to offer	
5.1.1.4	All types of Disposable type filter inserts (30 Nos of each type)	Vendor to offer	
5.1.1.5	All types of Accumulators with charging kit (1 no. of each type)	Vendor to offer	
5.1.1.6	One set of belts (including timing belt) used in the machine.	Vendor to offer	
5.1.1.7	One set of seal kits used in different hydraulic & pneumatic cylinders in the machine.	Vendor to offer	
5.1.1.8	All types of shaft seals (2 nos of each type), O-rings & Piston 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 (10 Nos each type)	Vendor to offer	
5.1.2.2	Contactors (5 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 (10 Nos each type)	Vendor to offer	
5.1.2.5	Push Buttons (10 Nos each type)	Vendor to offer	
5.1.2.6	Indicating Lamps (10 Nos each type)	Vendor to offer	
5.1.2.7	Semiconductor Fuses (10 Nos each type)	Vendor to offer	
5.1.2.8	Special Fuses (10 Nos each type)	Vendor to offer	
5.1.2.9	Circuit Breakers (1 No each type)	Vendor to offer	
5.1.2.10	Main Power Switch (1 No each type)	Vendor to offer	
5.1.2.11	Encoders (1 No each type)	Vendor to offer	
5.1.2.12	Scanning Head Unit for Linear Scales (1 No each type)	Vendor to offer	
5.1.2.13	Spare Hard disk loaded with Ghost of the machine after final commissioning	Vendor to offer	
5.1.2.14	I/O Modules of PLC (1 No each type)	Vendor to offer	
5.1.2.15	Power Module & Control Cards for Main Drive as well as Feed Drives (1 No each type)	Vendor to offer	
5.1.2.16	Limit Switches & Micro Switches (10 Nos each type)	Vendor to offer	
5.1.2.17	Backup batteries (1 No each type)	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	

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
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	
6.15	One additional set of all the above documentation on CD.	Vendor to offer	
7	**PROVE-OUT MACHINING OF BHEL COMPONENT**		

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
7.1	Drawings of proveout components are enclosed. Job setting plan, Machining process plan & Requirement of Tools etc. for machining of proveout components shall be discussed and mutually agreed (Final proveout component drawing no. may change, however, the machining features of the changed components shall be in line with the original component drawing). **Rough & Finish Milling of Horizontal joint plane of Upper & Lower Halves including Drilling/C-Boring/Reaming/Threading/Tapping of holes on Horizontal joint & Half bore milling (skim cut) at two extreme ends using Circular Interpolation with Right Angle Milling Head** of prove out component as detailed at Clause 7.3 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 after complete erection. **Material for the Prove-out components 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 to accept & offer	
7.2	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..The cost of such deviation / rejection, if any, shall be refunded by the vendor to BHEL.	Vendor to accept & confirm	
7.3	Component Name : Frame-9E GT Compressor Discharge Casing		
	Machining Drawing : 03510597004-03		
	Casting Drawing : 03510597004-01 (UH) 03510597004-02 (LH)		
	UH: Upper Half LH: Lower Half		
	Raw Material : Ductile Cast Iron		
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	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	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.	
10.2	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	
10.3	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. 12.0 (Machine Acceptance) and testing/demonstration of tele-diagnostic service etc. shall also be part of the commissioning activity.	Vendor to offer	
10.4	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	
10.5	Commissioning spares, required for commissioning of the machine within stipulated time, shall be brought by the supplier on returnable basis.	Vendor to accept	
10.6	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	
10.7	Schedule of Erection and Commissioning shall be submitted with the offer.	Vendor to submit	
10.8	Terms & conditions for Erection & Commissioning should be furnished in detail separately by vendor along with offer.	Vendor to submit	
10.9	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**		

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
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. No. 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 2.26	Vendor to accept & confirm	
12.1.2	Demonstration of specified/offered Positioning accuracies as per clause 2.27	Vendor to accept & confirm	
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 NAS test piece.Vendor to supply test piece & tooling for machining of test piece.	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 2.26	Vendor to accept & confirm	
12.2.2	Demonstration of specified/offered Positioning accuracies as per clause 2.27	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 NAS test piece.Vendor to supply test piece & tooling for machining of test piece.	Vendor to accept & confirm	

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
12.2.8	Successful machining of proveout components to required drawing accuracies as per Sl. No. 7.0	Vendor to accept & confirm	
12.2.9	Two weeks of supervision by Vendor of independent operation of machine by BHEL after job proveout.	Vendor to accept & confirm	
12.2.10	Training of BHEL machine operators in operation of complete machine & accessories etc by the supplier's experts / engineers during their stay at BHEL works.	Vendor to accept & confirm	
13	**PACKING**		
	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 :**		
14.1	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 comply	
15	**GENERAL :**		
15.1	Machine Model	Vendor to specify	
15.2	Total connected load (KVA):	Vendor to specify	
15.3	Floor area required (Length, Width, Height) for complete machine & accessories. The Layout of the machine may be planned so that the Rotary Table shall be at the Left Hand side of the X-Traverse & AAC on right hand side while looking from the Spindle.	Vendor to specify	
15.4	Painting of Machine / Electrical Panels : Colour as per vendor standard	Vendor to confirm	
15.5	Total weight of the machine	Vendor to specify	
15.6	Weight of heaviest part of machine	Vendor to specify	
15.7	Weight of the heaviest assembly/ subassembly of the Machine	Vendor to specify	
15.8	Dimensions of largest part/ subassembly/ assembly of the machine	Vendor to specify	
15.9	Vendor to submit, along with offer, the reference list of customers where similar machines have been supplied mentioning the customer, Machine Model, major specifications of the supplied machine, CNC System, Year of Supply etc.	Vendor to specify	
15.10	Detailed catalogues , sketch/ photographs of the m/c and accessories/ attachments should be submitted with the offer.	Vendor to specify	
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 included in the standard scope of the machine.	Vendor to specify	
15.12	Ladder is to be provided to access the machine elements located at the top of the column.	Vendor to offer & confirm	

ANNEXURE - I

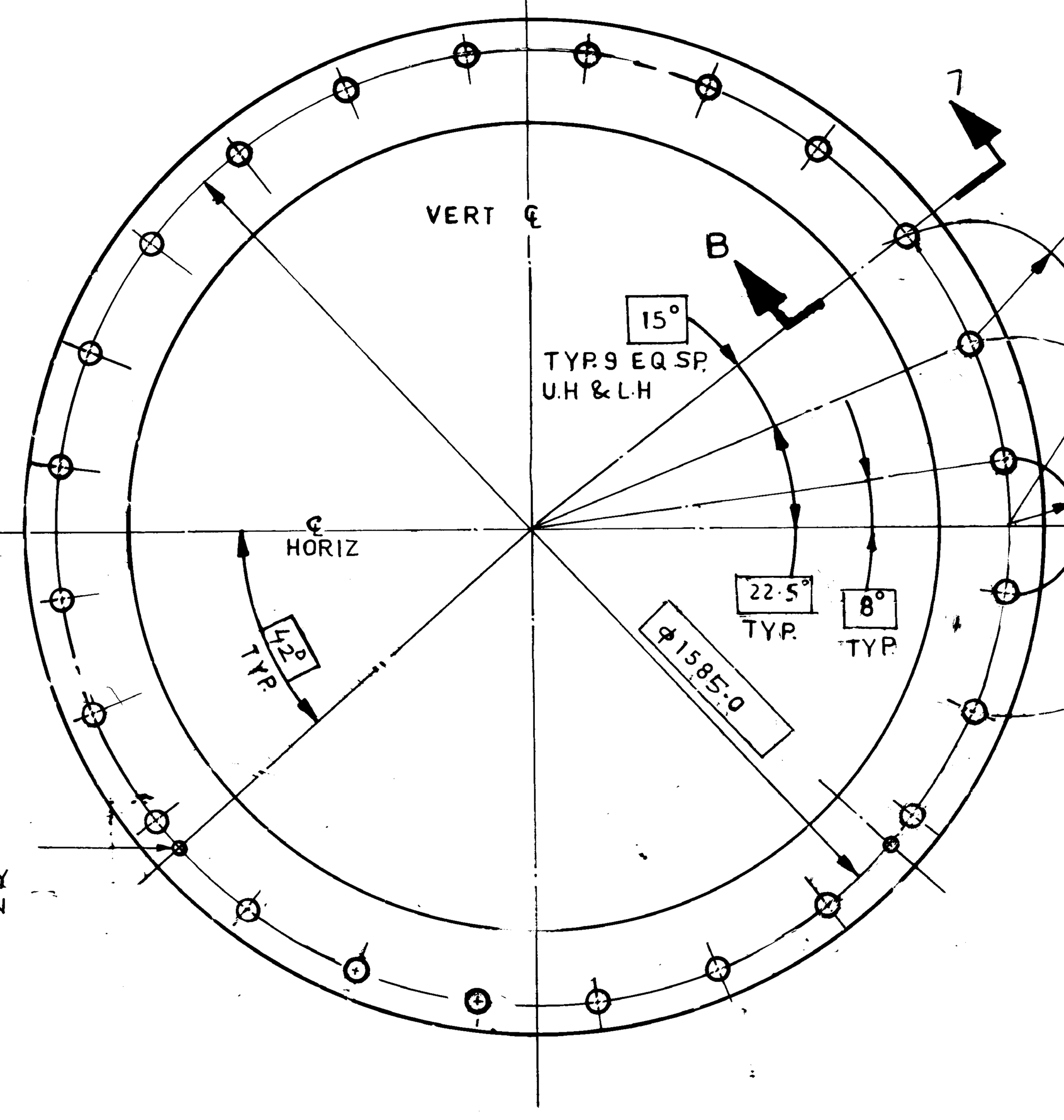
TOOLING LIST FOR CNC HBM : 200MM

SNO	TOOL DESCRIPTION	QTY	REMARKS
1	ISO-60/50 adapter	2 Each	
2	Stub Arbor – φ22, 27,32 & 40 mm.	2 Each	Taper : ISO-50
3	Face milling holder for flange mounting φ40, 60 mm.	2 Each	Taper : ISO-50
4	Combi milling holders – φ16,22,27,32,40 mm	2 Each	Taper : ISO-50
5	Collet Chuck with Chucking range : φ3.0 to 26.0 mm	2 Each	Taper : ISO-50
6	Collets size : φ3.0 to 26.0 mm in steps of 1.0 mm	2 Each	
7	End Mill Holders (Weldon Type) : φ 6, 8 , 10 , 12 , 16, 20,25,32 and 40 mm.	2 Each	Taper : ISO-50 (With coolant through flange)
8	Morse Taper Holder with tang for MT-1,MT-2, MT-3, MT-4,MT-5 & MT-6	2 Each	Taper : ISO-50 up to MT-5 and ISO-60 for MT-6
9	Pull Studs without coolant hole	10 Nos	Taper : ISO-50
10	Pull Studs with coolant hole	10 Nos	Taper : ISO-50
11	Micro fine grain Solid carbide short End mills : Dia 8.0,10.0,12.0,16.0 and 20.0 mm	4 each	
12	Inserted carbide Face Mills : φ160, 200, 315, 400 and 500.	1 each	Face mills with 45 deg approach angle.
13	Inserted carbide Square shoulder Face Mills : φ50,63,80,100,125	1 each	Face mills with 90 deg approach angle.
14	Inserts for the above face mills of Grade GC 4030 & GC 3040 of Sandvik or equivalent grade of other reputed suppliers.	100 Nos each.	
15	Inserted carbide Full Side & Face milling cutters: φ 160 x 12 thk φ250 x 12 thk and φ 315 x 16 thk	1 each	
16	Inserts for the above side & face mills of Grade GC 4030 & GC 3040 of Sandvik or equivalent grade of other reputed suppliers	100 Nos each	
17	Sandvik Weldon type End mills (Coromill 390) of φ 20,25,32 & 40 mm	1 No each	End mill with 90 degree approach angle.
18	Inserts for above End mills of Sandvik grade GC 4030 & GC 3040 or equivalent grade of other reputed suppliers	50 each	
19	U-max Long edge milling cutter φ 32 & φ 40 mm of Sandvik make or equivalent	1 No each	
20	Inserts for above long edge mill of Grade GC 4030 & GC 3040 of Sandvik or equivalent	50 Nos each	
21	Sandvik Coromant U drill or equivalent of following diameters with L/D = 4: φ 12.7, φ 15.0, φ17.0, φ20, φ21, φ 24, φ 26, φ 30, φ 32, φ 35, φ 41, φ 43 , φ58	1 No each	

CNC HBM : SPINDLE DIA - 200 MM

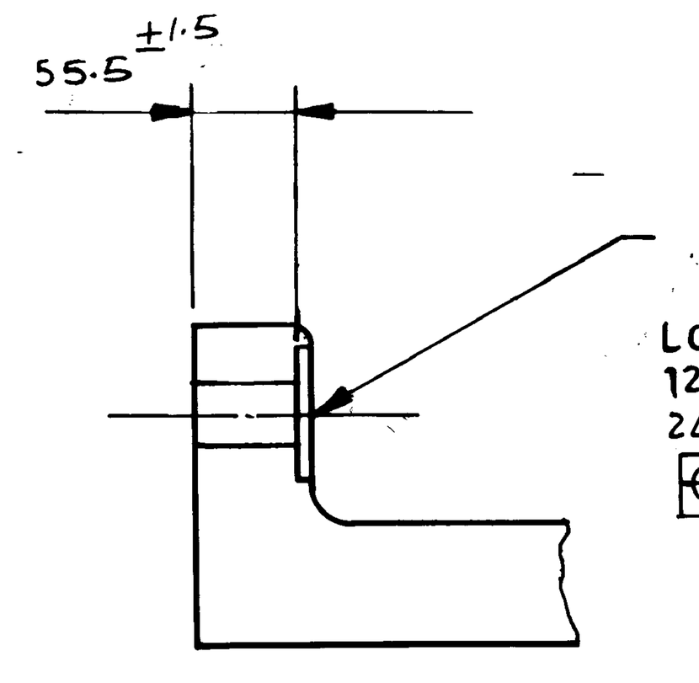
SNO	TOOL DESCRIPTION	QTY	REMARKS
22	Inserts for the above drills for ISO P and K materials drilling of Sandvik or equivalent.	50 Nos each	
23	U Drills of φ 66, φ 68, φ74, φ76, φ84 and φ 94 with L/D = 3	1 No each	
24	Inserts for the above drills for ISO P and K material classification	50 Nos each	
25	Adjustable Coromant U-drill holders and slide for above U-Drills	1 No each	

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



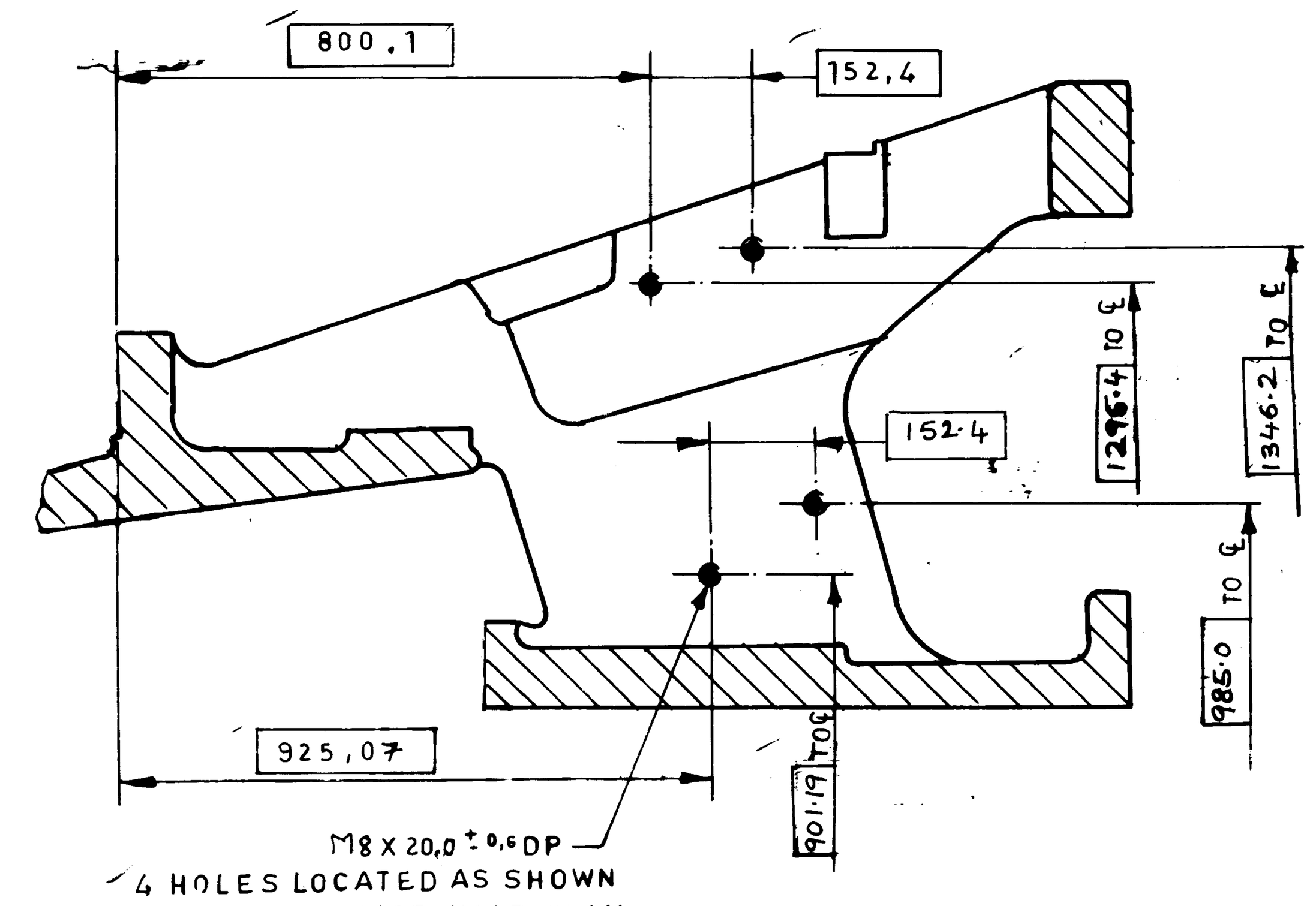
φ21 ±0.1 THRU
2 HOLES L H ONLY
LOCATE AS SHOWN
⊕ φ1.5 Ⓜ

VIEW E-3 (F10, SH.1)
AFT INNER BARREL FLANGE



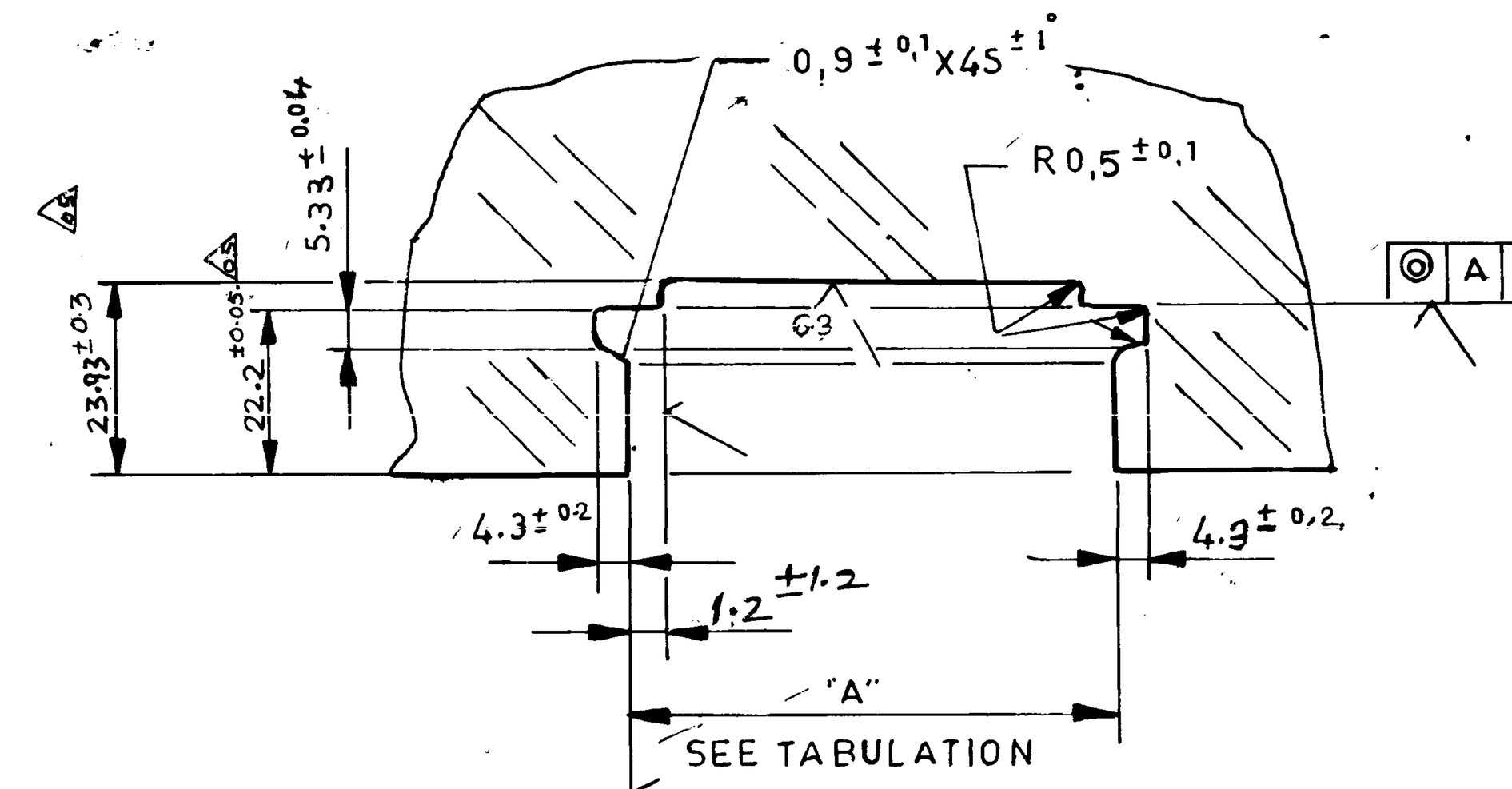
φ76.0 ±0.1 S'FACE TO DIM.
φ35.0 ±0.3 THRU
LOCATE AS SHOWN
12 HOLES UH & LH
24 HOLES TOTAL
⊕ φ0.7 Ⓜ

SECTION B-7 (B-4)



M8 X 20.0 ±0.6 DP
4 HOLES LOCATED AS SHOWN
2 STRUTS LOWER HALF ONLY
8 HOLES TOTAL ⊕ φ3.0 Ⓜ
(LOWER SIDE 2ND STRUT FROM HORIZ JOINT, SYM. ABOUT VERT. ℄)

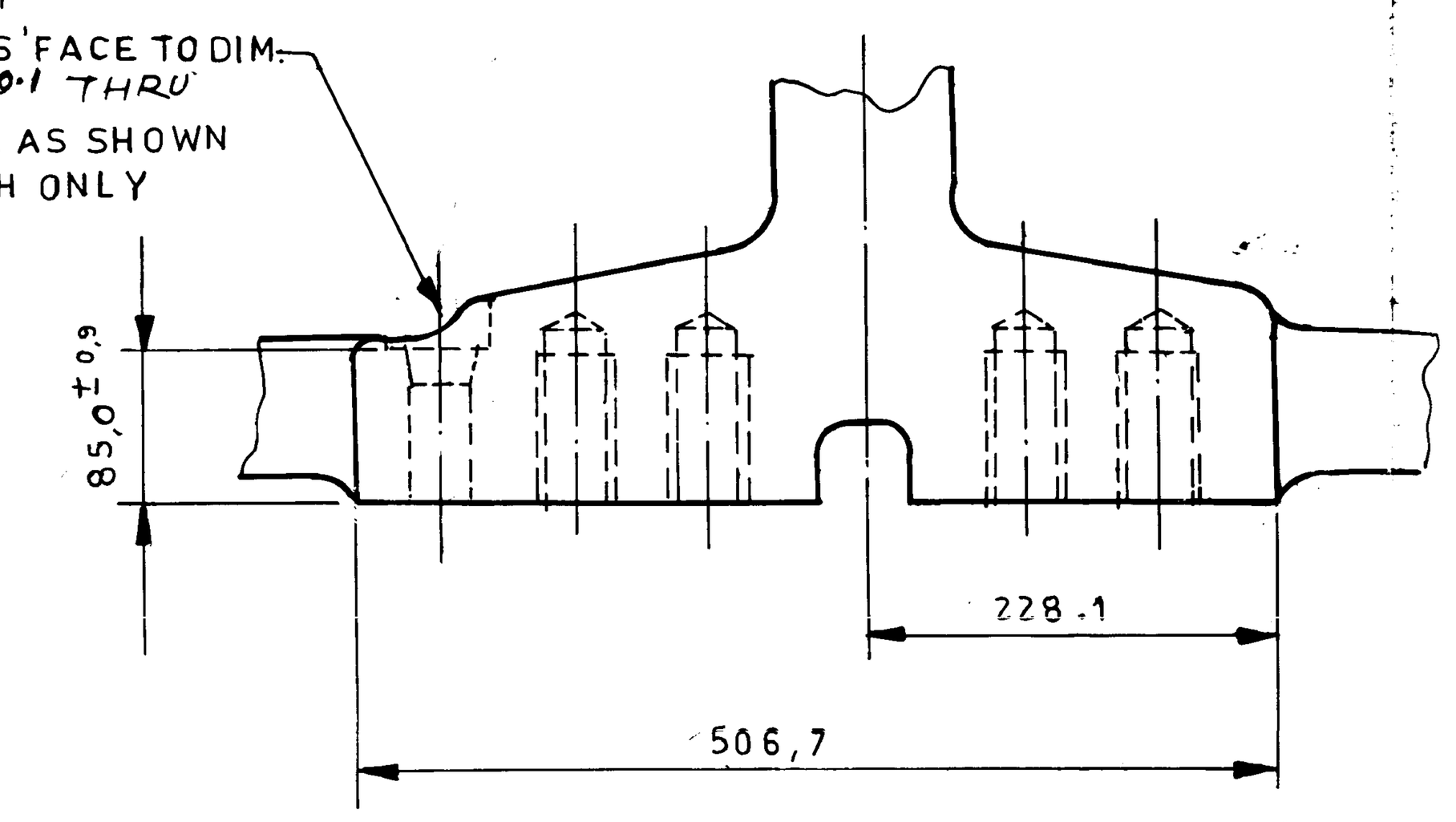
SECTION D-10 (H-12, SH-1)



ENLARGED DETAIL H-3 (D-5, SH.1)

STAGE NO.	DIM "A"
11-12	59.63 ±0.06
13 THRU 17	53.53 ±0.06
E1-E2	67.25 ±0.06

φ58.0 ±0.1 S'FACE TO DIM.
φ37.0 ±0.1 THRU
1.25" NPT, LOCATE AS SHOWN
1 HOLE, 6 PADS LH ONLY
⊕ φ0.7

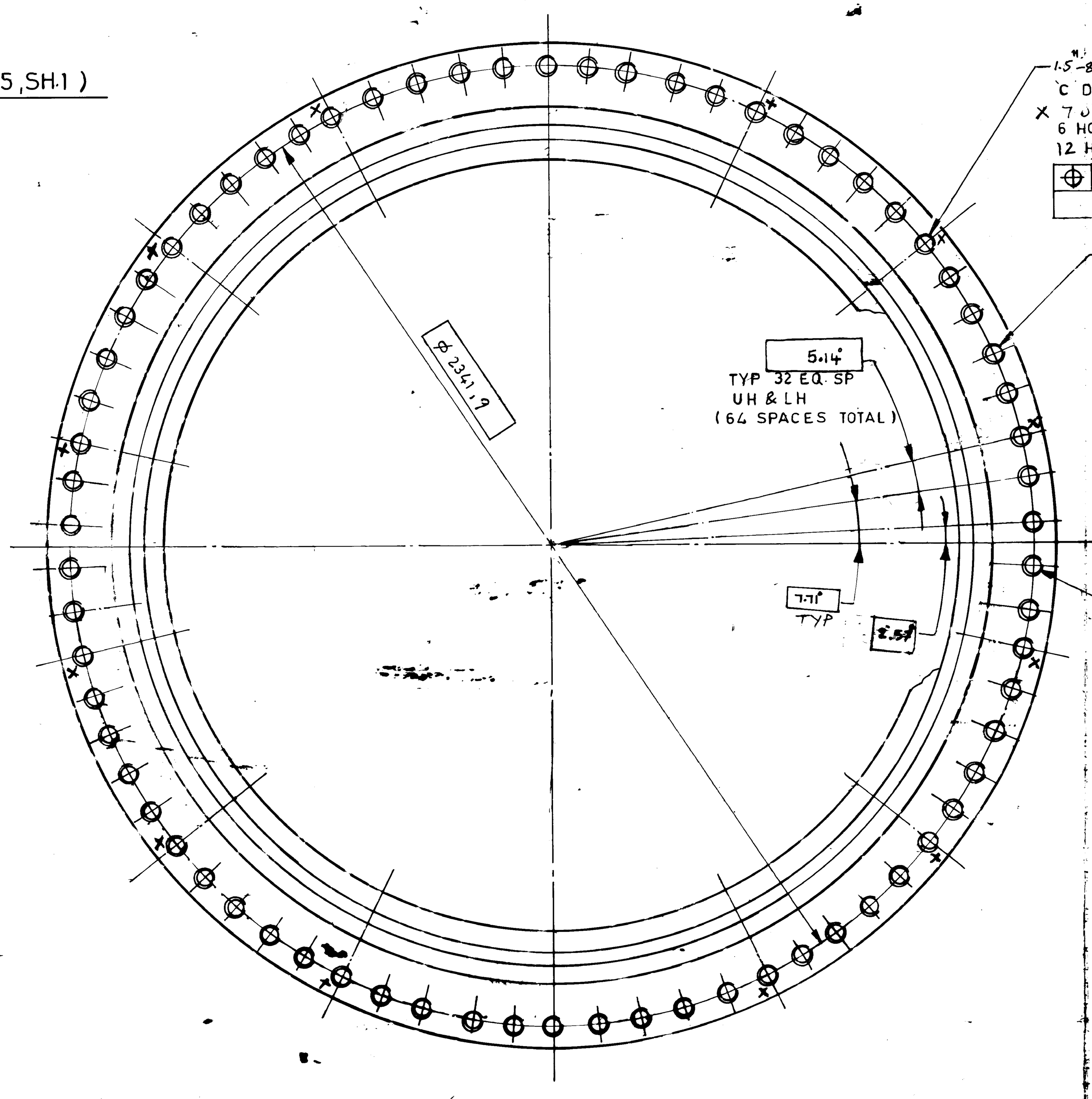


VIEW H-6 (J-14, SH.1)

DRAWING IS IN THIRD ANGLE PROJECTION

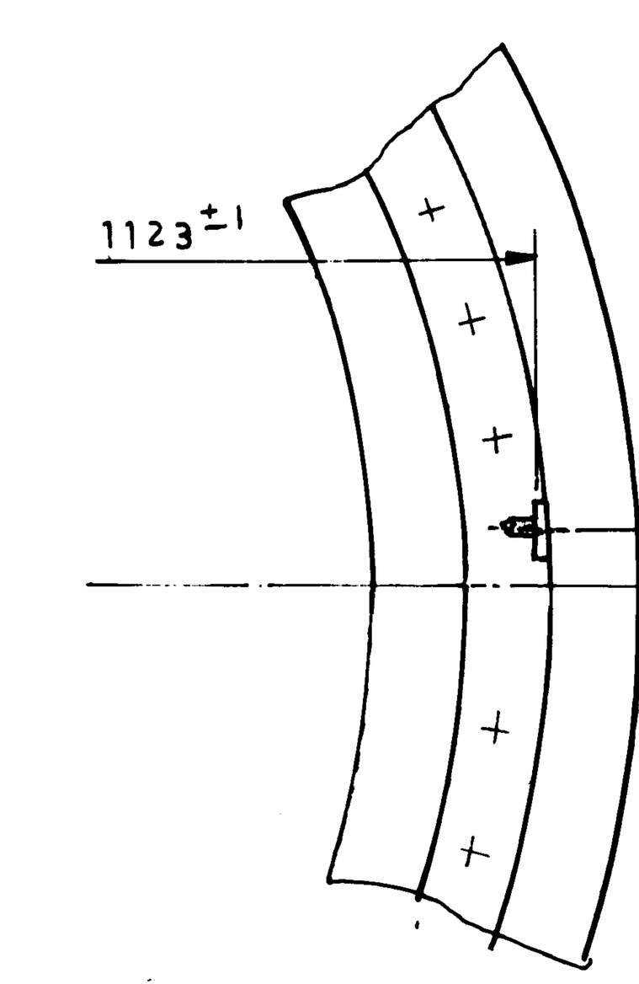
1.5"-8UN-2B X 89 ±1.4 DP
C' DRILL φ42.0 ±0.1
X 7.0 ±0.6 DP
6 HOLES MARKED "X" UH & LH
12 HOLES TOTAL
⊕ φ0.7 Ⓜ
114.0 Ⓟ

1.5"-8UN-2B TAP THRU
C' DRILL φ42.0 ±0.1 X 7.0 ±0.6 DP
27 HOLES UH & LH
54 HOLES TOTAL
⊕ φ0.7 Ⓜ
114.0 Ⓟ



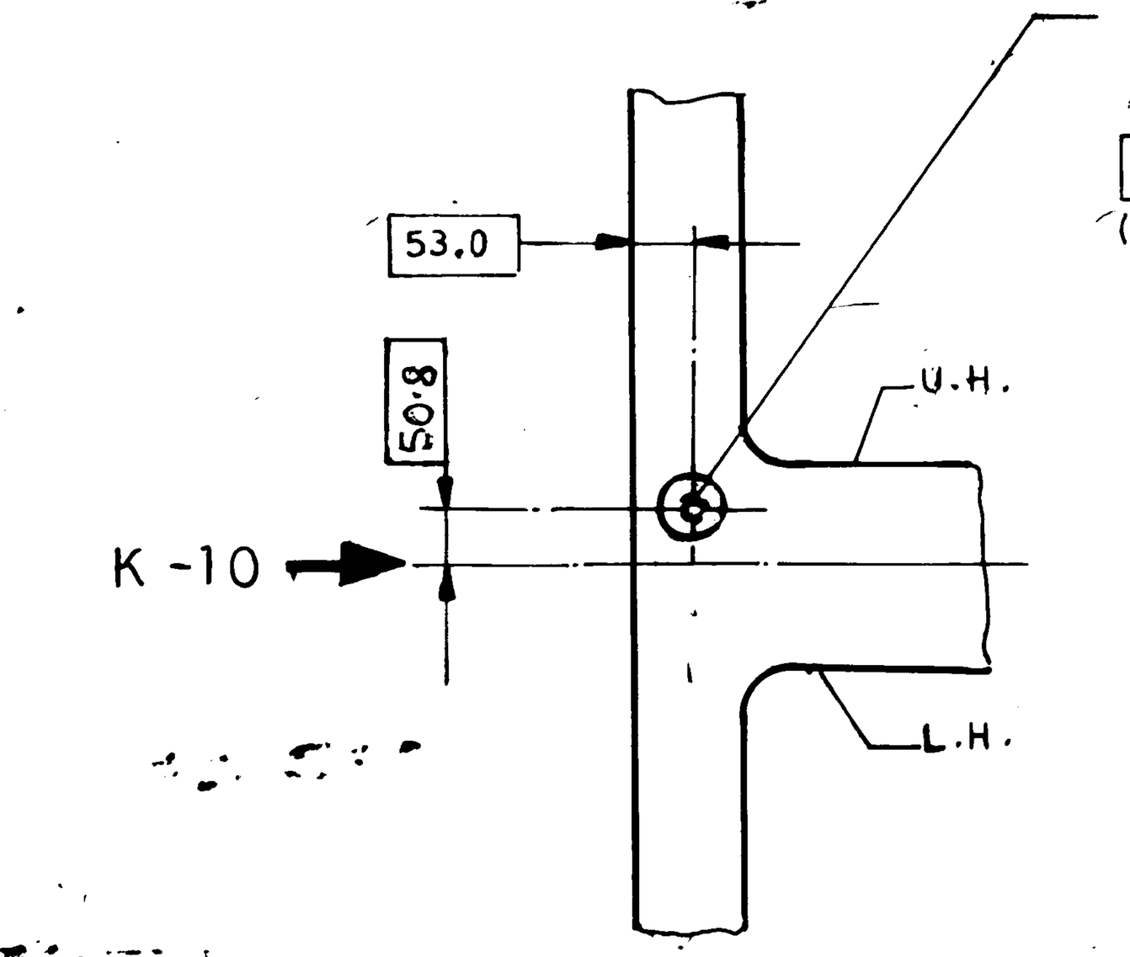
1.5"-8UN-2B X 89 ±1.4 DP
C' DRILL φ42.0 ±0.1
X 7.0 ±0.6 DP
2 HOLES EACH HALF
4 HOLES TOTAL
⊕ φ0.7 Ⓜ
142.0 Ⓟ

SECTION M-6 (D-6, SH-1)



VIEW K-10 (K-11)

φ26 ±0.1 SPOTFACE
0.25"-20 UNC-2B X 12.7 ±0.5 DP
ONE HOLE
⊕ φ0.7 Ⓜ
(VIB. SENSOR)



DETAIL K-12

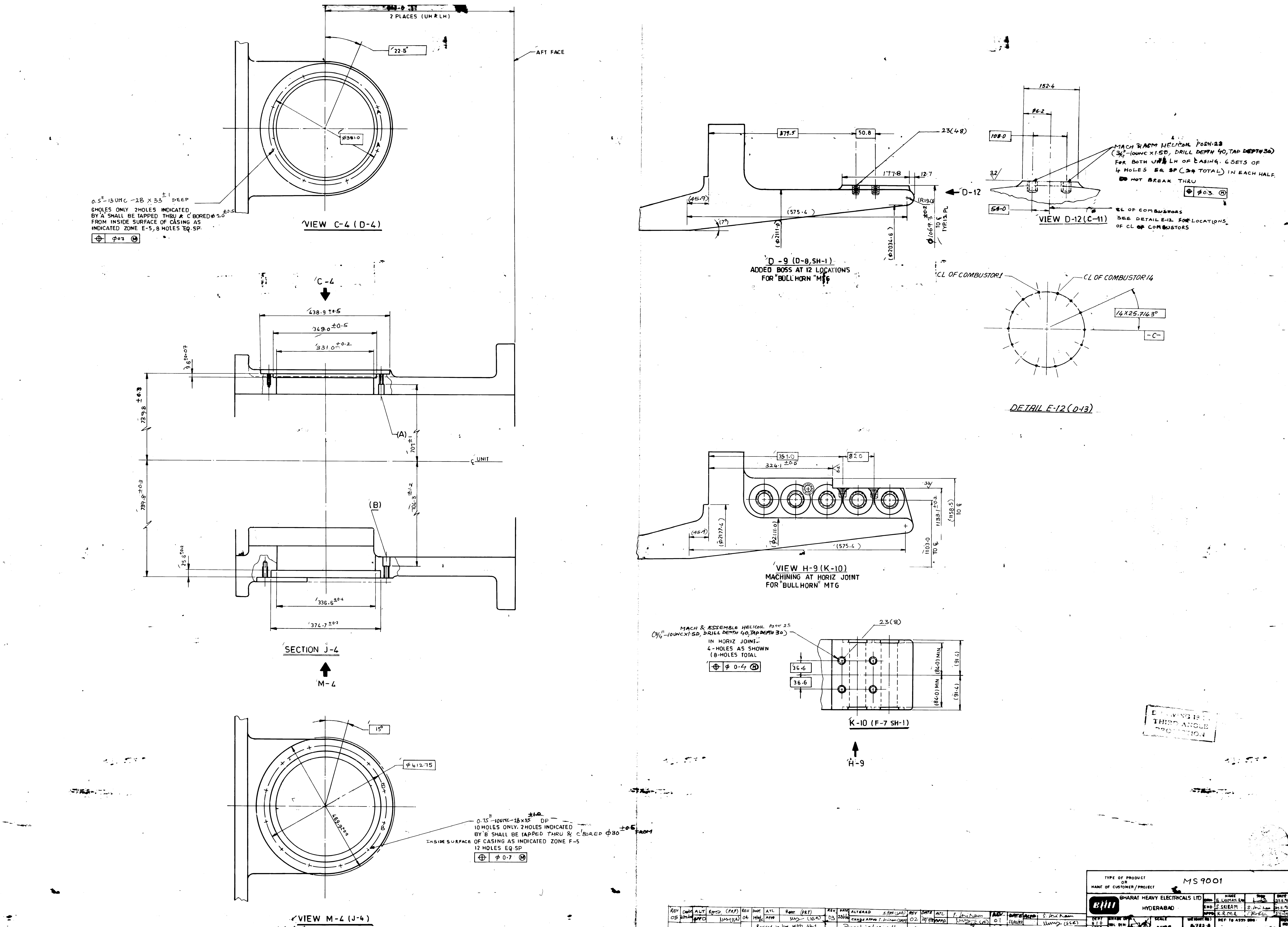
DRAWING IS IN THIRD ANGLE PROJECTION

REV	DATE	ALTERED	REV	DATE	ALTERED
05	6/12/00	Zone D1M 23.93 ±0.3 was 24.1 ±0.3; F1 D1M 22.20 ±0.05 was 22.4 ±0.05. DCA: GT 1256	04		Revised in line with Sh-1. DCA NO: GT 1235
03	23/11/00	Zone D1M 24.1 ±0.3 was 23.93 ±0.3; F-1 D1M 22.4 ±0.05 was 22.20 ±0.05. DCA NO: GT 1164	02		D1M 23.93 ±0.3 was 24.1 ±0.3; D1M 22.20 ±0.05 was 22.4 ±0.05. DCA NO: GT 0996
01	11/12/97	Revised in line with Sh 1. DCA NO: GT 0928			

ADDITIONAL INFORMATION
STATUS OF DRAWING
DISTRIBUTION OF PRINTS

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: MS 9001
BHARAT HEAVY ELECTRICALS LTD. HYDERABAD
DRN: E. LAXMAIAH · CHD: S. SRIRAM · APPD: N.R.M.R
SCALE: NTS
WEIGHT (KG): 14782.0
TITLE: CASE, COMPRESSOR DISCHARGE
DRAWING NO.: 0-35105-97004
REV: 05
SHEET NO 3 · NO OF SHEETS 5

DRG. NO. 109E3275 REV 06



REV	DATE	ALT / APPD	DESCRIPTION	DCA NO
05		ALT Rgms (PRP) / APPD (SSR)	Revised in Line with sh-3	DCA No: GT 1256
04	19/…	ATL Rgms (PRP) / APPD (SSR)	Revised in line with sh-1	DCA NO: GT 1235
03	28/1/…	ALTERED B.R… (SKR) / CHKD & APPVD S. Sriram (SRM)	Revised in line with Sh-1 and Sh-3	DCA No: GT1164
02	20/7/…	ATL P. Sriram / APPD. (SSR)	Revised in line with sh3	
01	11/12/97	APPD S. Sriram (SSR)	Revised in Line with SH 1	

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: MS 9001

BHARAT HEAVY ELECTRICALS LTD
HYDERABAD

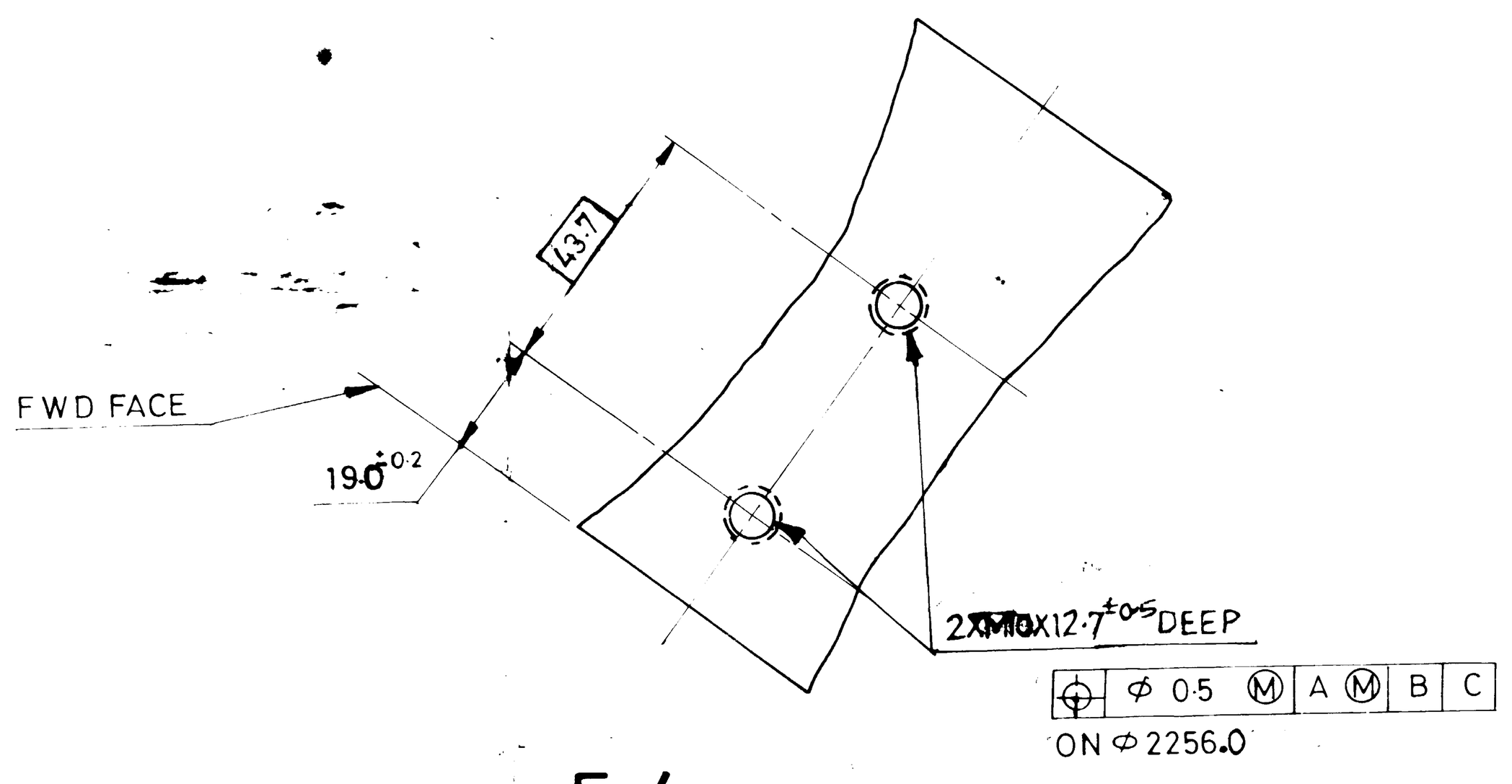
	NAME	SIGN	DATE
DRN	E. LAXMAN RAO		27.11.96
CHD	S. SRIRAM	S. Sriram	27.11.96
APPD	R.R.M.R.		27.11.96

DEPT GTD · CODE 423 · SCALE NTS · WEIGHT (KG) 4,782.0 · REF. TO ASSY. DRG: -

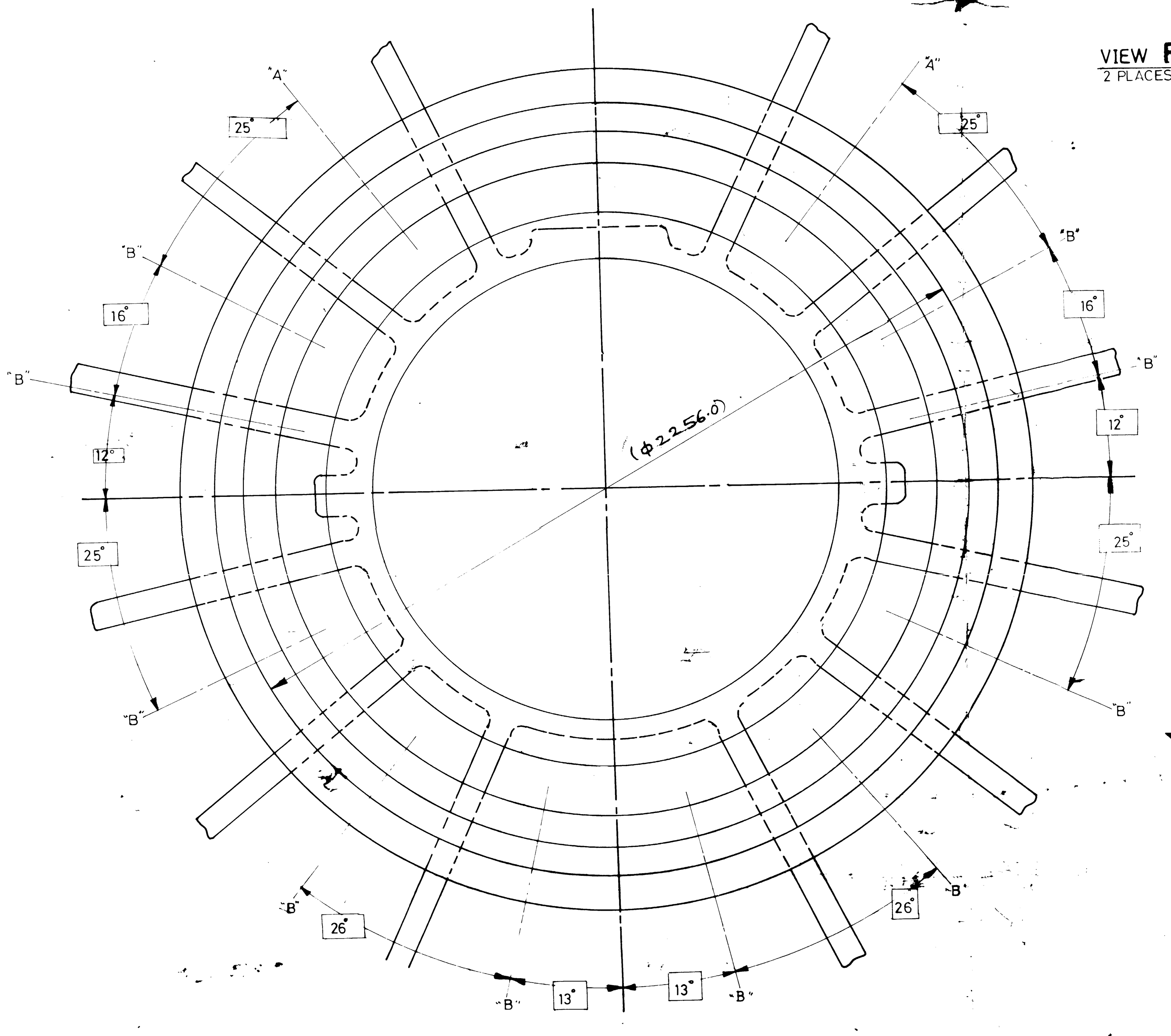
TITLE: CASE, COMPRESSOR DISCHARGE

DRG NO: 0-35705-…-D04 · SHEET NO 4

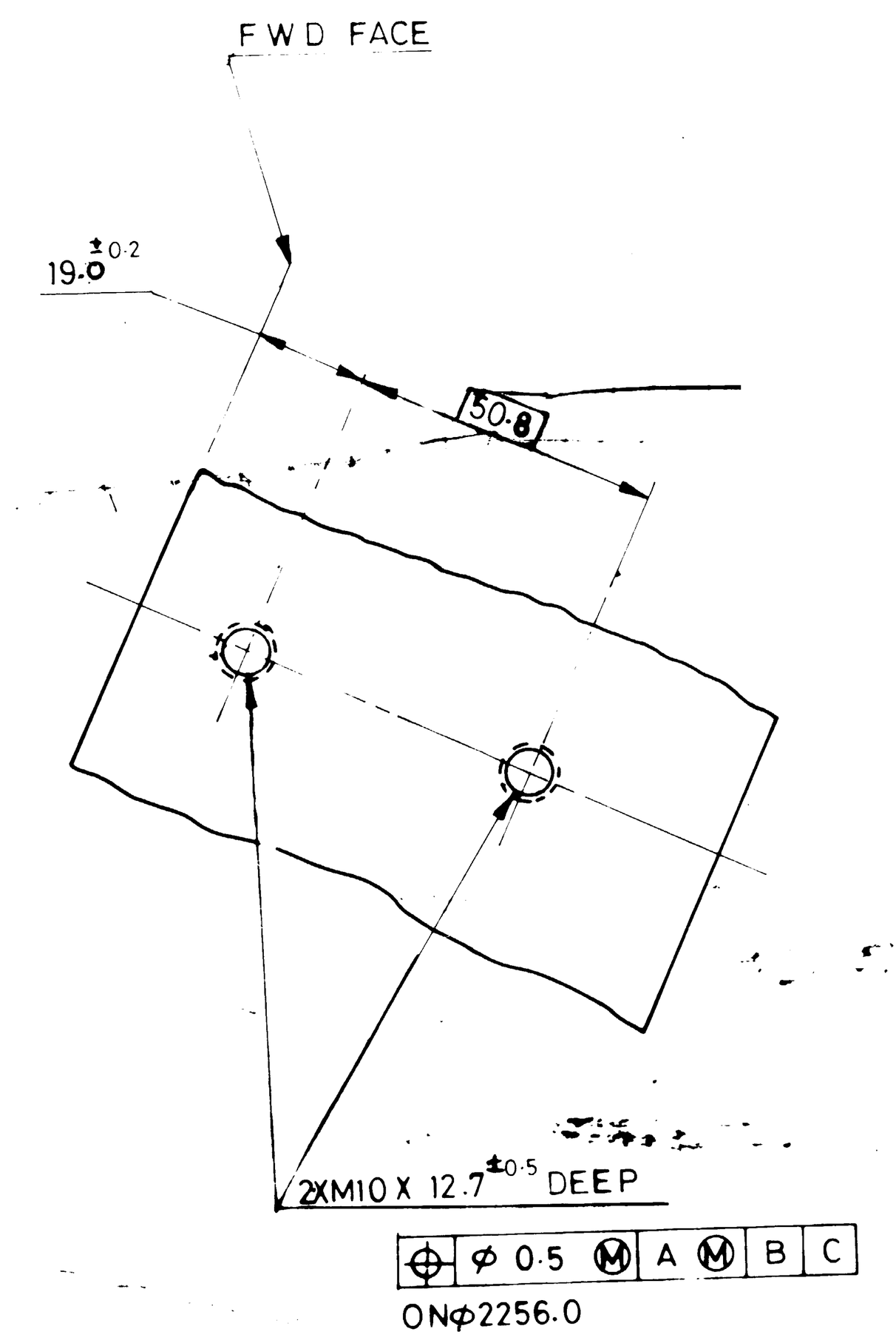
REF DRG NO 109E3275 REV 80



VIEW F-4 (F-4)
2 PLACES AT LOC. "A"



VIEW B-5 (E-4 SH-1)



VIEW B-3 (D-4)
10 PLACES AT LOC 'B'

DRAWING IS IN THIRD ANGLE PROJECTION

Rev 05 DT 6/12/00 ALT (PRP) APPD (SSR)	Rev 04 DT 19/10/00 ALT (PRP) APPD (SSR)	REV 03 DATE 28/1/00 ALTERED S. Rout (SKR) CHECK/APPVD S. Sriram	REV 02 DATE 28/7/98 ALT S. Sriram APPD	Rev 01 DATE 11/12/97 ALTD APPD (SSR)
Revised in Line with Sh-3 DCA No: GT1256	Revised in line with Sh-1 DCA NO: GT 1235	Revised in line with Sh-1 and Sh-3 DCA NO: GT1164	Revised in line with Sh 3	Revised in Line with SH. 1

TYPE OF PRODUCT OR NAME OF CUSTOMER PROJECT: ATS 9001

BHARAT HEAVY ELECTRICALS LTD
HYDERABAD

	NAME	SIGN	DATE
DRN	E. LAXMAN RAO		27-11-96
CHD	S. SRIRAM		27-11-96
APPD	K. R. M. R		27-11-96

DEPT GTD CODE 423 | GRADE OF TOL DIM | SCALE NTS | WEIGHT (kg) SEE | REF. TO ASSY. DRG.

TITLE: CASE, COMPRESSOR DISCH.

CARD CODE | DRAWING NO 0-35105-97004 | REV 05
SHEET NO 5 | NO SHEETS 5

NOTES:—

1. UNLESS OTHERWISE SPECIFIED ALL CAST FILLETS TO BE R25.4 & CAST EDGES TO BE R6.3
2. INSPECT PER ITEM-2.
3. THE FOUNDRY SHALL PREPARE SURFACE FOR PAINTING PER ITEM 3 TYPE 6 & PAINT PER ITEM 4
4. BLEND ALL SURFACES TO FORM SMOOTH CONTOURS.
5. BH CHECK AREA INDICATED BY ✱ ON THE VERTICAL ℄ ON OUTSIDE OF CASTING. B H CHECK AREA INDICATED BY ✱ ON ONE STRUT ONLY. HARDNESS READING MUST MEET THE REQUIREMENTS OF THE MATERIAL SPEC.
6. THE SAME CASTING WILL BE USED TO MACHINE THE DISCHARGE CASING FOR THE MS 9001 B AND MS 9001E MACHINES.
7. ~~INSPECT PER ITEM 2, 7 & 8 02 ONLY.~~
8. MACHINE SURFACE TO CAST FILLET ONLY IF NECESSARY (4 PLACES)
9. NO TOOL MARKS PERMISSIBLE. BLENDING ALLOWED IF NECESSARY.

VAR NO.	GE REF.	DESCRIPTION	REMARKS
01		CASTING UH	CAST WEIGHT 7550 KG. APPROX
		MATERIAL HY19774 (B50A684)	AFTER MACHINING 6010 KG. APPROX
02		CASTING LH	CAST WEIGHT 7870 KG. APPROX
		MATERIAL HY19774 (B50A684)	AFTER MACHINING 6270 KG. APPROX
03	109E3275 G001	CASE COMP. DISCH ASSY	APPLY VIEW M-11 OMIT SECTION K-2 (SH2)
04	109E3275 G007	CASE COMP DISCH ASSY	APPLY VIEW M-11 SH 1 of 5 OMIT SECTION K-2 (SH2)

ITEM NO	DESCRIPTION	GE REF NO	BHEL REF NO
~~5.~~	~~HELICOIL~~	~~164C2823~~	—
4.	PROCESS (PAINTING)	P6C-AG25	GT10112
3.	SURFACE PREPARATION	P4A-AG5	GT10110
2.	INSPECTION	P29A-AG...	GT10232
1.	APPLIED PRACTICE	11...	HY0230261

REV	DATE	ALTERED / CHKD & APPVD	DESCRIPTION
03	28/1/2000	S. Rao (SKR) / S. Sriram (SSR)	ZONE E-4 ϕ1893.4 $^{+0.1}_{-0.0}$ was ϕ1893.71 $^{+0.2}_{-0.0}$ DCA NO. GT1164
02	28/7/98	S. Sriram / (SSR)	Revised in line with details on Sh3
01	11/12/97	S. Sriram / (SSR)	ϕ1893.71 $^{+0.2}_{-0}$ was ϕ1893.4 ... increase for collective decision of ... in order to ... DCA NO: GT0928

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: MS 9001

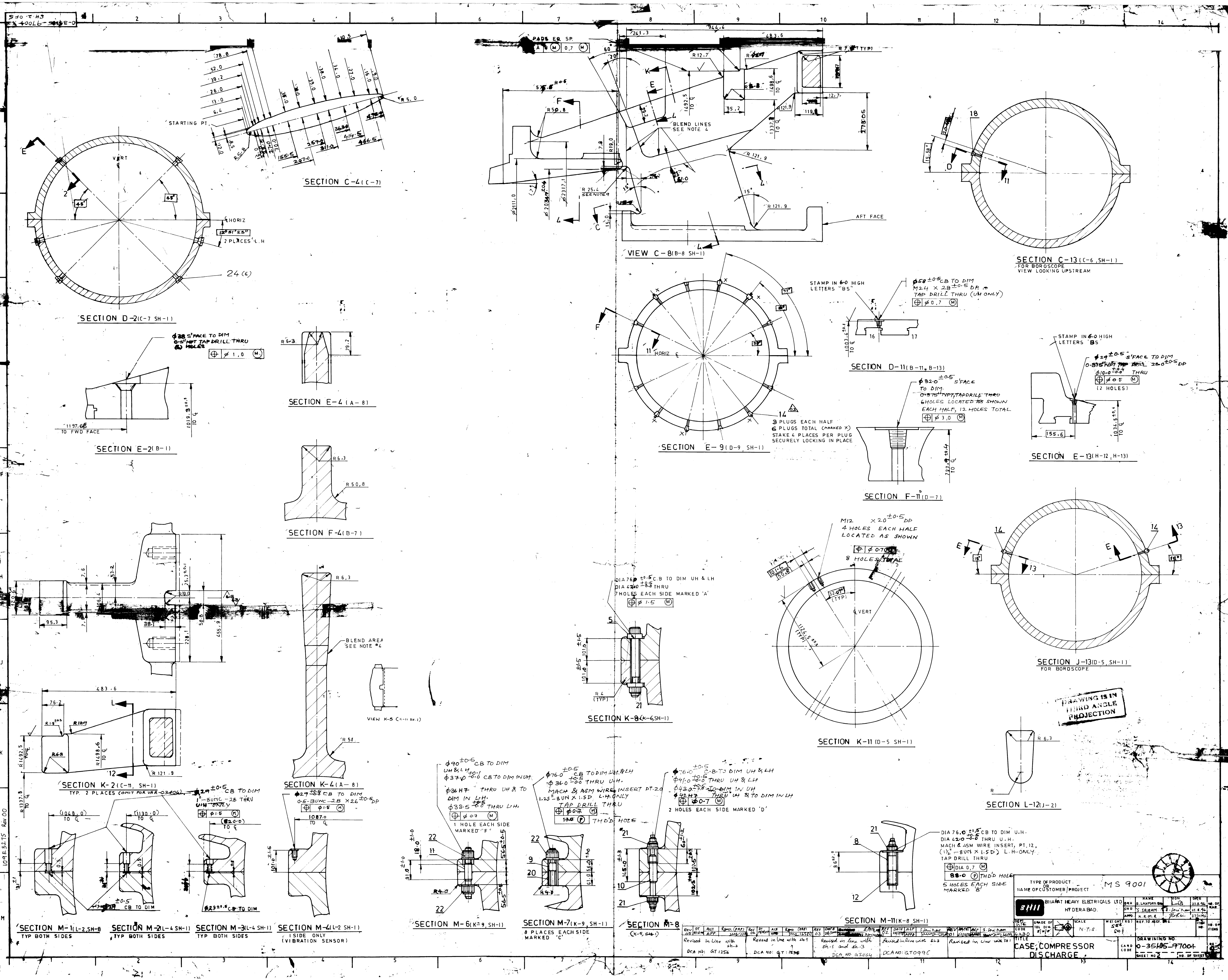
BHARAT HEAVY ELECTRICALS LTD
HYDERABAD

E. LAXMAN — 27.11.96
S. SRIRAM — 27/11/96
KRMR — 27.11.96

DEPT STD CODE 423.0 — GRADE OF TOL. DIM: M/F — SCALE: NTS.

TITLE: CASE, COMPRESSOR DISCHARGE

DRG. NO: 0-351-05-97004 — REV 05 — SHEET NO: 1 OF 5



SECTION C-4 (C-7)
VIEW C-8 (B-8 SH-1)
SECTION C-13 (C-6, SH-1)
FOR BOROSCOPE
VIEW LOOKING UPSTREAM
SECTION D-2 (C-7 SH-1)
SECTION D-11 (B-11, B-13)
SECTION E-2 (B-1)
SECTION E-4 (A-8)
SECTION E-9 (D-9, SH-1)
SECTION E-13 (H-12, H-13)
SECTION F-4 (B-7)
SECTION F-11 (D-7)
SECTION J-13 (D-5, SH-1)
FOR BORDSCOPE
SECTION K-2 (C-11, SH-1)
SECTION K-4 (A-8)
VIEW K-5
SECTION K-8 (K-6, SH-1)
SECTION K-11 (D-5 SH-1)
SECTION L-12 (J-2)
SECTION M-1 (L-2, SH-1)
TYP BOTH SIDES
SECTION M-2 (L-4 SH-1)
TYP BOTH SIDES
SECTION M-3 (L-4 SH-1)
TYP BOTH SIDES
SECTION M-4 (L-2 SH-1)
1 SIDE ONLY (VIBRATION SENSOR)
SECTION M-6 (K-9, SH-1)
SECTION M-7 (K-9, SH-1)
8 PLACES EACH SIDE MARKED 'C'
SECTION M-8
SECTION M-11 (K-8 SH-1)
BLEND LINES SEE NOTE 4
BLEND AREA SEE NOTE #4
AFT FACE
STARTING PT.
3 PLUGS EACH HALF
6 PLUGS TOTAL (MARKED X)
STAKE 4 PLACES PER PLUG SECURELY LOCKING IN PLACE
DRAWING IS IN THIRD ANGLE PROJECTION
TYPE OF PRODUCT OR NAME OF CUSTOMER / PROJECT
MS 9001
BHARAT HEAVY ELECTRICALS LTD HYDERABAD.
TITLE
CASE, COMPRESSOR DISCHARGE
DRAWING NO.
0-35105-97004