

PART- A		
CNC HORIZONTAL BORER - SPINDLE Φ 130mm		
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 - 130MM		
SL NO	REQUIREMENTS	VENDOR'S RESPONSE
1.0	Only those vendors (OEMs), who have supplied and commissioned at least one CNC HORIZONTAL BORING MACHINE of same (Spindle Diameter 130mm, Spindle Travel 700mm) 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. The following information should be submitted by the vendor about the companies where referred machine (s) 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 similar CNC HORIZONTAL BORING MACHINES have been supplied in the past.	
3.0	Specify details of CNC HORIZONTAL BORING MACHINES supplied to other units of BHEL, if any. (Year of commissioning, Spindle Dia, Spindle travel et etc.)	

CNC HBM : SPINDLE DIA - 130MM

SL NO	REQUIREMENTS	VENDOR'S RESPONSE
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		
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	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

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 HORIZONTAL BORING MACHINE-130mm - (TOTAL QTY: 4 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 = 4

4. MACHINE No.1 **with** component prove-out (Qty - 1 No for Gas Turbines Division)

5. MACHINE No.2 **without** component prove-out (Qty - 1 No. for Gas Turbines Division)

6. MACHINE No.3 **without** component prove-out (Qty - 2 Nos. for Oil Rigs & Pulverizers Divisions)

7. All Features & Requirements specified below are for **ONE** machine and shall be applicable independently for each machine unless mentioned as "**Clause No __ to __ Applicable for MACHINE No__ only**". Breakup prices are to be quoted by vendor for items mentioned as "**Clause No__ to __ Applicable for MACHINE No__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-130mm** complying with specification as below.

SL NO.	BHEL TECHNICAL SPECIFICATION	VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
1.0	PURPOSE & WORK PIECE MATERIAL	
1.1	PURPOSE/APPLICATION: The proposed 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 confirm

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
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	
2.0	SPECIFICATION:		
2.1	MACHINE CONFIGURATION: CNC Table Type Horizontal Boring Machine. Table Rotation B-axis, Table linear movement left & right X-axis, Column moving to & fro in W-axis, Head stock moving vertically up & down Y-axis and spindle movement to & fro Z-axis.	Vendor to confirm	
2.2	HEAD STOCK		
2.2.1	Boring spindle diameter (Min.)	130 mm	
2.2.2	Spindle motor power (Continuous Rating - S1) AC.	35KW or more	
2.2.3	Spindle motor make, model etc.	Vendor to submit details	
2.2.4	Spindle speed (Infinitely variable)	10 or less to 3000 rpm or more	
2.2.5	No. of speed ranges	2 or More Steps	
2.2.6	Max torque on the boring spindle (N-m)	Vendor to specify	
2.2.7	Max torque on the milling spindle (N-m)	Vendor to specify	
2.2.8	Spindle taper (DIN 69871)	ISO-50	
2.2.9	Torque-Power-Speed characteristics of the spindle system to be submitted by the vendor.	Vendor to submit	
2.2.10	Lowest spindle position from table top	Vendor to specify	
2.2.11	The spindle bearings shall be life time lubricated	Vendor to confirm	
2.2.12	Oriented spindle stop (any position)	Vendor to confirm	
2.2.13	Head stock shall be provided with forced lubrication system	Vendor to confirm	
2.3	TRAVERSES:		
2.3.1	Table Cross Travel (X-axis)	3500 mm or more	
2.3.2	Headstock Vertical Travel (Y-axis)	2500 mm or more	
2.3.3	Column Transverse Travel (W-axis)	1500 mm or more	
2.3.4	Spindle stroke (Z-axis)	700 mm or more	
2.3.5	Table Rotation (B-axis)	360000 positions	
2.4	FEED RATES:		
2.4.1	Feed rate for X, Y, Z and W axes (Infinitely variable)	0 - 5000 mm/min or more	
2.4.2	Rapid feed for all linear axes	10000 mm/min or more	
2.4.3	Table rotation speed	0.5 or less - 1.5 rpm or more	
2.4.4	Resolution for (X,Y,Z and W) axes	0.001 mm	

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.4.5	Resolution for B-axis	0.001 degree	
2.5	FEED DRIVE SYSTEM:		
2.5.1	Feed drives/ motors for X, Y, Z, W & B 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 submit details	
2.5.2	Type of power transmission: Backlash free re-circulating ball screw with pre-loaded double nut for all linear axes. (Complete description of the aforesaid including diameter & make of Ball Screw for each axis, to be submitted with the offer)	Vendor to submit details	
2.5.3	Maximum thrust rating of all axes	Vendor to submit details	
2.5.4	Mechanism for locking of axes	Vendor to submit details	
2.6.	FEED BACK SYSTEM:		Vendor to submit details
2.6.1	Feed back system for X, Y & W Axes: Heidenhain linear scales with pressurised compressed air cleaning.	Vendor to submit details	
2.6.2	Feed back system for Spindle travel (Z-axis): Rotary Encoder / Linear scale of Heidenhain make.	Vendor to submit details	
2.6.3	Feed back system for Rotary Axis (B-axis): Heidenhain High Resolution Rotary encoder mounted on the table.	Vendor to submit details	
2.6.4	Feed back system for Spindle rotation axis : preferably of Heidenhain make.	Vendor to submit details	
2.7	MACHINE GUIDE WAYS:		
2.7.1	Width of bed guide ways, X, Y & W -axes	Vendor to submit details	
2.7.2	Details of guide ways for X.Y.Z,W - axes	Vendor to submit details	
2.7.3	Metallic Telescopic Covers of rust resistant material to be provided with wipers for X, Y & W axes guide ways. Joints of telescopic covers should be so sealed to avoid mixing of coolant.	Vendor to confirm and provide details	
2.7.4	Centralized auto lubrication shall be provided for all guide ways with metering cartridges, necessary electrical interlock and fail safe systems.	Vendor to confirm and provide details	
2.8	ROTARY TABLE:		
2.8.1	ROTARY TABLE FOR MACHINE No.1 & 2	Vendor to offer " Clause No. 2.8.1.1 to 2.8.1.10 Applicable for MACHINE No.1 & 2 only "	
2.8.1.1	Table size	Length : 1800mm Width :1600mm to 1800mm	

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.8.1.2	Maximum load carrying capacity	12000Kgs or more	
2.8.1.3	Eccentric Loading details on the table	Vendor to specify	
2.8.1.4	Maximum machining torque on B-axis	Vendor to specify	
2.8.1.5	Size of T-slots	Vendor to specify	
2.8.1.6	T-slots pitch (as per DIN standard)	Vendor to specify	
2.8.1.7	Size of bore at the center.	Vendor to specify	
2.8.1.8	Max. Clamping Force on the Table	Vendor to specify	
2.8.1.9	Table locking mechanism shall be hydraulic	Vendor to submit details	
2.8.2	ROTARY TABLE FOR MACHINE No.3	Vendor to offer " Clause No. 2.8.2.1 to 2.8.2.10 Applicable for MACHINE No.3 only "	
2.8.2.1	Table size	Length :2500mm Width :2000mm	
2.8.2.2	Maximum load carrying capacity	20000Kgs or more	
2.8.2.3	Eccentric Loading details on the table	Vendor to specify	
2.8.2.4	Maximum machining torque on B-axis	Vendor to specify	
2.8.2.5	Size of T-slots	Vendor to specify	
2.8.2.6	T-slots pitch (as per DIN standard)	Vendor to specify	
2.8.2.7	Size of bore at the center.	Vendor to specify	
2.8.2.8	Max. Clamping Force on the Table	Vendor to specify	
2.8.2.9	Table locking mechanism shall be hydraulic	Vendor to submit details	
2 9	CONSTRUCTION:		
2.9.1	Vendor to furnish details of material, hardness & constructional details, including explanatory drawings, of various Components/ Assemblies like Column, bed, Head Stock, Spindle, Rotary Table 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	
2.9.3	Head Stock and Column Counter-balancing System. (Details of the offered system to be submitted)	Vendor to submit	

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.10	OPERATOR'S PLATFORM:		
2.10.1	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	
2.10.2	Horizontal movement of complete Platform.	Vendor to specify	
2.10.3	Weight carrying Capacity of the Platform	Vendor to specify	
2.10.4	Minimum Height of Platform from Shop Floor.	Vendor to specify	
2.10.5	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	
2.11	OPERATION AND CONTROL SYSTEM:		
2.11.1	OPERATOR'S PANEL:		
2.11.1.1	Swiveling type operator's panel having complete CNC and machine control system with display monitor 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 submit details	
2.11.2	CNC SYSTEM & FEATURES :	Vendor to note & accept	
2.11.2.1	Make	Siemens or Fanuc	
2.11.2.2	Type	PC based latest version	
2.11.2.3	Model: Latest version & model of CNC system, as available at the time of ordering, should be supplied.	Vendor to offer and submit details	
2.11.2.4	Details of Standard features	Vendor to submit	
2.11.2.5	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	

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.11.2.6	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 telediagnosics, Network ready with LAN and preinstalled system software & other required softwares etc. (Details should be submitted by Vendor)	Vendor to offer and submit details	
2.11.2.7	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, telediagnosics, printer shall be provided. In case only USB ports are provided, suitable hardware/connectors shall be provided to ensure above functionalities.	Vendor to offer and submit details	
2.11.2.8	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	
2.11.2.9	Additionally, a QWERTY keyboard and optical mouse (or equivalent in case of Fanuc) should also be properly interfaced and suitably inhouse in the system's panel on covered sliding type tray for editing/input of programs by programmer.	Vendor to offer	
2.11.2.10	Provision of On-screen PLC logic display on the CNC System for diagnostic purposes.	Vendor to offer	
2.11.2.11	In-cycle hour counter with reset facility shall be provided.	Vendor to offer	
2.11.2.12	Power meter for indicating total energy consumption of the machine shall be provided.	Vendor to offer	
2.11.3	HAND HELD UNIT:		
2.11.3.1	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	
2.11.4	MANUAL CONTROL		

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.11.4.1	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.	
2.11.5	DIAGNOSTIC SYSTEMS		
2.11.5.1	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) and USB Adaptors for connecting PCMCIA card/Memorycard/Hard disk to the PC note book. 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	
2.11.5.2	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	
2.11.5.3	Help guide should be provided to use both diagnostic systems	Vendor to offer & submit	
2.11.6	NETWORKING		
2.11.6.1	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	
2.11.6.2	The machine shall appear as a node in the Entire Network. (Network Neighbourhood)	Vendor to offer	
2.11.6.3	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	
2.11.6.4	The program transfer between CNC system and network should also be possible in CNC Mode.	Vendor to offer	
2.11.6.5	Portable Data Input-Output Device : PC Note book for bi-directional program and data transfer along with all required hardware, software, interfaces, cables, protection cover etc.	Vendor to offer	
2.11.7	MACHINE MONITORING SYSTEM (MMS) SIGNALS		

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.11.7.1	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	
2.11.7.2	Control ON	Vendor to offer	
2.11.7.3	Cycle ON	Vendor to offer	
2.11.7.4	Spindle Running	Vendor to offer	
2.11.7.5	Feed Active (Any of the axes moving)	Vendor to offer	
2.11.7.6	M30 (Program Stop)	Vendor to offer	
2.12	UPS FOR CNC SYSTEM :		
2.12.1	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	
2.13	MACHINE LIGHTS		
2.13.1	Machine Lights for sufficient illumination of complete working area including operator's panel should be provided for clear visibility.	Vendor to offer	
2.13.2	A magnetic base portable spot light with sufficiently long cable should also be provided.	Vendor to offer	
2.13.3	Any lights required in the foundation/ pit area shall also be foreseen and supplied by the vendor.	Vendor to offer	
2.13.4	All light fittings, consumables, adapters/receptacles should have compatibility with Indian equivalents	Vendor to offer	
2.13.5	Flashing/Rotary type light indicating end of cutting, program stop, alarm etc. at a easily visible & suitable place.	Vendor to offer	
2.14	AIR CONDITIONERS		
2.14.1	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	
2.14.2	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	
2.15	HYDRAULIC SYSTEM (DETAILS TO BE SUBMITTED BY THE VENDOR) :		
2.15.1	The Hydraulic System shall be of Re-circulating Type. Hydraulic Tank should be preferably placed at shop floor.	Vendor to offer and confirm	

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.15.2	Pumps, Valves, Switches (Pressure & Flow) should be of Make : Rexroth / Vickers / Parker / Hawe.	Vendor to offer and confirm	
2.15.3	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	
2.15.4	Failure indication	Vendor to offer	
2.15.5	Automatic shut off provision, Details should be submitted.	Vendor to offer	
2.15.6	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	
2.15.7	Hydraulic pump capacity (flow / pressure)	Vendor to inform	
2.15.8	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	
2.15.9	Complete hydraulic system should be designed to avoid any leakage or spillage.	Vendor to confirm	
2.15.10	Sufficient stages/nos. of filters should be used to avoid frequent clogging of the filters and other maintenance related problems.	Vendor to offer	
2.16	FIRST FILLING OF OILS		
2.16.1	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	
2.17	COOLANT SYSTEM :		
2.17.1	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.	Vendor to confirm	
	a) Recirculating Type Flood Coolant System with nozzles around spindle.		
	b) High Pressure Coolant thru Spindle (20 bar or more)		
2.17.2	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	
2.17.3	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	

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.17.4	Coolant Filtration System: Recirculating type coolant system with Vacuum Rotary drum type Filtration System with magnetic separator & oil skimmer.	Vendor to confirm and submit details.	
2.17.5	Coolant Flow Diagram showing filters, pumps, valves, tanks etc. to be submitted with the offer.	Vendor to submit	
2.17.6	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.	
2.17.7	Coolant Tank Capacity. Coolant Tank may preferably be placed on the Floor Level. The details of the system, including requisite sump, pump etc., should be clearly indicated.	Vendor to specify	
2.17.8	Coolant pump & motor details for all variants of coolant system are to be submitted with the offer.	Vendor to submit	
2.17.9	The coolant tank should be fitted with skimmer for regular cleaning of coolant from contamination with tramp oil.	Required.	
2.18	ELECTRICAL :		
2.18.1	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	
2.18.2	Tropicalisation: All electrical / electronic equipment shall be tropicalized.	Vendor to offer	
2.18.3	All electrical & electronic control cabinets & panels should be dust and vermin proof.	Vendor to offer	
2.18.4	All electrical components in the cabinets should be mounted on DIN Rail.	Vendor to offer	
2.18.5	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	
2.18.6	All motors shall conform to IEC or Indian Standards	Vendor to offer	
2.18.7	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	

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.18.8	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	
2.19	SAFETY ARRANGEMENTS (FOLLOWING SAFETY FEATURES IN ADDITION TO OTHER STANDARD SAFETY FEATURES SHOULD BE PROVIDED ON THE MACHINE):	Vendor to offer	
2.19.1	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	
2.19.2	A detailed list of all alarms / indications provided on machine should be submitted by the supplier.	Vendor to submit	
2.19.3	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	
2.19.4	All the rotating parts used on machine should be statically & dynamically balanced to avoid undue vibrations & noise.	Vendor to confirm	
2.19.5	Emergency Switches at suitable locations as per International Norms should be provided.	Vendor to offer	
2.19.6	Oil & water pipe lines should not run with electrical cable in the same trench.	Vendor to offer	
2.2	ENVIRONMENTAL PERFORMANCE OF THE MACHINE (THE MACHINE SHOULD CONFORM TO THE FOLLOWING FACTORS RELATED TO ENVIRONMENT) :		
2.20.1	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	
2.20.2	There shall not be any emissions from the machine except fumes of cutting fluid during machining.	Vendor to confirm	
2.20.3	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	
2.20.4	No hazardous chemicals shall be required to be used in the machine.	Vendor to confirm	
2.20.5	If any safety / environmental protection enclosure is required it should be built in the machine by the vendor.	Vendor to confirm	
2.20.6	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
2.21	CHIP CONVEYOR :		
2.21.1	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	
2.21.2	Type of chip conveyor	Hinged type or superior	
2.21.3	Width of conveyor	Vendor to specify	
2.21.4	Elevation of chip conveyor for chip bin	Vendor to specify	
2.21.5	Material of chip conveyor (to be rust resistant)	Vendor to specify	
2.21.6	Provision for smooth flow of chips to the conveyor.	Vendor to confirm	
2.21.7	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	
2.21.8	Layout showing location of chip conveyor to 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		
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	

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
2.24.4	Refrigerant used	Vendor to inform	
2.25	COMPRESSED AIR POINTS		
2.25.1	Suitably located Compressed Air Point near machine 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	ACCURACY TESTS:		
2.26.1	GEOMETRICAL ACCURACIES :		
2.26.2	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	
2.26.3	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	
2.27	MACHINE POSITIONING & REPEATABILITY ACCURACIES : SHOULD BE MEASURED AS PER VDI/DGQ 3441 (LATEST REVISION) USING LASER INTERFEROMETER.		
2.27.1	Positioning uncertainty (Pa per 1000mm) for X,Y,Z,W axes	0.01 mm	
2.27.2	Positioning uncertainty Pa for B-axis	10 secs	
2.27.3	Positional scatter (Ps per 1000mm) for X,Y,Z,W axes	0.005 mm	
2.27.4	Positional scatter Ps for B-axis	8 secs	
2.27.5	Total positioning error P for entire travel for X,Y,Z,W axes	Vendor to specify	
2.27.6	Total positioning error P for B-axis	Vendor to specify	
2.27.7	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 & ACCESSORIES		
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 (2 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	
3.1.5	2 Nos of Angle plates of size 500mm width x1400mm height or more	Vendor to offer	
3.2	TOOLING FOR COMPONENT PROVE-OUT (AS PER CLAUSE 7.0)		

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
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	
4.0	ACCESSORIES:		
4.2	MANUAL UNIVERSAL MILLING HEAD (POSITIONING BY HAND) : TYPICAL CONFIGURATION AS PER ANNEXURE-II		
4.2.1	Power	25KW or more	
4.2.2	Max torque	Vendor to specify	
4.2.3	Speed Range	Vendor to specify	
4.2.4	Speed ratio	Vendor to specify	
4.2.5	Spindle taper	ISO50	
4.5.6	Traverse Range of A-axis	± 90 deg or more	
4.5.7	Resolution of A-axis	1 deg.	
4.5.6	Traverse Range of C-axis	360 deg.	
4.5.7	Resolution of C-axis	1 deg.	
4.2.6	Torque-Power-Speed characteristic diagram to be submitted.	Vendor to submit	
4.2.7	Weight of the head	Vendor to inform	
4.2.8	Coolant system: External coolant facility with requisite flexible pipes on its snout is to be provided.	Vendor to confirm	

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
4.2.9	Catalog showing mounting details of the Head to be provided along with offer.	Vendor to submit	
4.5	MANUAL RIGHT ANGLE MILLING HEAD: (POSITIONING BY HAND)		
4.5.1	Power	25KW or more	
4.5.2	Max torque	Vendor to specify	
4.5.3	Speed Range (Infinitely Variable)	Vendor to specify	
4.5.4	Speed ratio	Vendor to specify	
4.5.5	Spindle taper	ISO50/BT50	
4.5.6	Traverse Range of C-axis	360 deg.	
4.5.7	Resolution of C-axis	1 deg.	
4.5.8	Torque-Power-Speed characteristic diagram to be submitted.	Vendor to submit	
4.5.9	Wt. of the head	Vendor to inform	
4.5.10	Coolant system: External coolant facility with requisite flexible pipes on its snout is to be provided.	Vendor to confirm	
4.5.11	Catalog showing mounting details of the Head to be provided along with offer.	Vendor to submit	
4.6	PROGRAMMABLE BORING & FACING HEAD:	Vendor to offer " Clause No. 4.6.1 to 4.6.19 Applicable for MACHINE No.3 only "	
4.6.1	Model No. (Preferably D'Andrea UT3-325S or equivalent)	Vendor to offer & confirm	
4.6.2	Head body diameter	325mm or less	
4.6.3	Speed Range	Vendor to specify	
4.6.4	Radial axis independent positioning	Vendor to confirm	
4.6.5	Radial traverse	100mm	
4.6.6	Slide feed rate	Vendor to confirm	
4.6.7	Machining range in Boring for internal diameter	Max 600mm. Min to be indicated by Vendor	
4.6.8	Accuracy of Bore Size (Bore Tolerance)	H7	
4.6.9	Diameter range for machining external diameter indicating max. depth	Vendor to specify	
4.6.10	Machining range in facing indicating maximum depth.	Vendor to specify	
4.6.11	Maximum boring depth without entry of Boring Head.	Vendor to specify	
4.6.12	Minimum boring depth with entry of Boring Head.	600mm	
4.6.13	Maximum torque	Vendor to specify	
4.6.14	Maximum cutting force in boring	Vendor to specify	
4.6.15	Maximum cutting force in facing	Vendor to specify	
4.6.16	Slide Counter Balance mechanism (if available)	Vendor to offer	

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
4.6.17	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 submit	
4.6.18	Catalogue of the offered Head is to be submitted with the offer.	Vendor to submit	
4.6.19	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 confirm	
4.7	SPINDLE GUIDING SUPPORT (SHORT)	Vendor to specify	
4.8	SPINDLE GUIDING SUPPORT (LONG)	Vendor to specify	
5	SPARES :	Vendor to confirm	
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	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	

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
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	

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
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	

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
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 ON MACHINE NO.1	Vendor to offer " Clause No. 7.1 to 7.2 Applicable for MACHINE No.1 only "	
7.1	Drawings of proveout components are enclosed. Job setting plan, Machining process plan & Requirement of Special tools & Job holding fixtures 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). Machining of prove out components detailed at Clause 7.1.1 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 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 two months of placement of order.	Vendor to accept & offer	
7.1.1	Component Name : Frame-6 Compressor Casing Machining Drawing : 03510267001-02 Casting Drawing : 03510267001-05 Raw Material : Gray Cast Iron OPERATION DETAILS : Rough & finish machining of Horizontal Joint of Upper & Lower halves of Compressor casing including Drilling/ Counter-boring, Reaming & Threading of all holes.	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	
8	TRAINING & PRE-DISPATCH INSPECTION :		

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
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. SI.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 SI.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		
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 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 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		

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
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		
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	

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
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 SI.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 the 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	

SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
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 the test piece.	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 for MACHINE No.1 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 for MACHINE No.1 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	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-Traversal & 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	

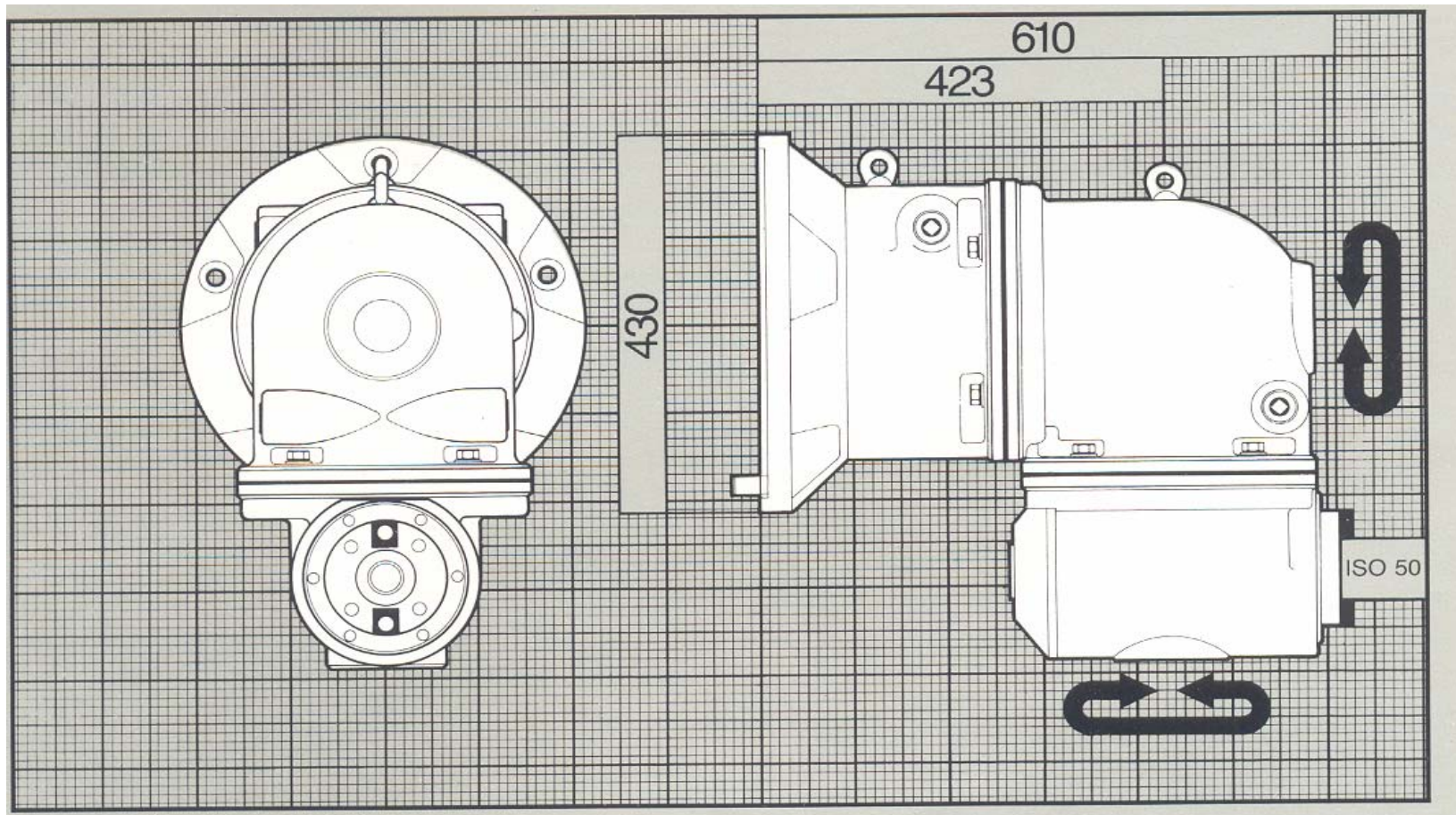
SL NO.	BHEL TECHNICAL SPECIFICATION		VENDOR'S OFFER WITH TECHNICAL DETAILS & REMARKS
15.7	Weight of the heaviest assembly/ subassembly of the Machine	Vendor to specify	
15.8	Dimensions of largest part/ subassembly/ assembly of the machine	Vendor to specify	
15.9	Vendor to submit, along with offer, the 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	
16	OPTIONAL ACCESSORIES (VENDORS TO NECESSARILY QUOTE)		
16.1	ROTARY TABLE FOR MACHINE NO.3	Vendor to offer & quote " Clause No. 16.1.1 to 16.1.10 Applicable for MACHINE No.3 only "	
16.1.1	Table size	Length :2200mm Width :1800mm	
16.1.2	Maximum load carrying capacity	20000Kgs or more	
16.1.3	Eccentric Loading details on the table	Vendor to specify	
16.1.4	Maximum machining torque on B-axis	Vendor to specify	
16.1.5	Size of T-slots	Vendor to specify	
16.1.6	T-slots pitch (as per DIN standard)	Vendor to specify	
16.1.7	Size of bore at the center.	Vendor to specify	
16.1.8	Max. Clamping Force on the Table	Vendor to specify	
16.1.9	Table locking mechanism shall be hydraulic	Vendor to submit details	

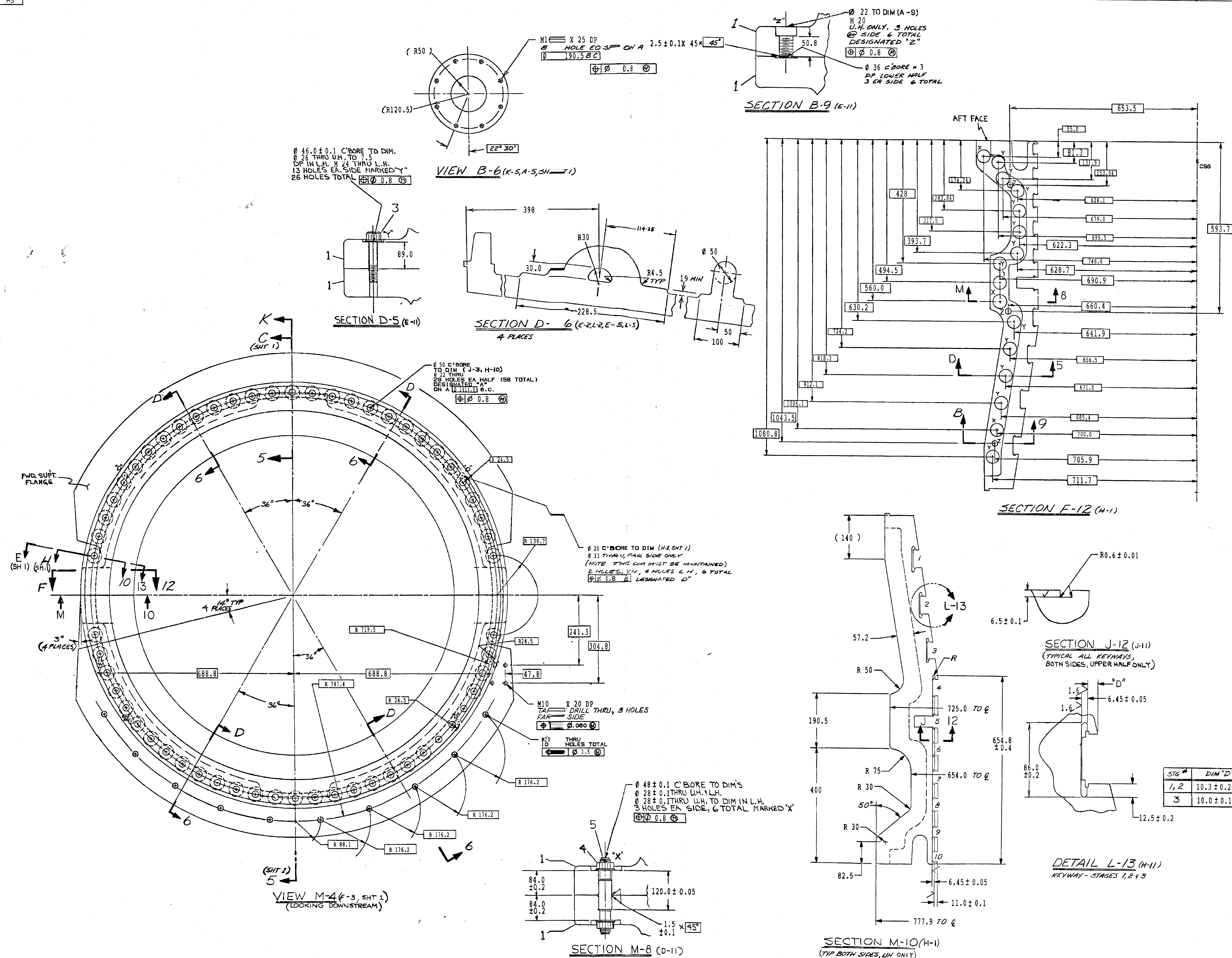
CNC HBM : SPINDLE DIA - 130 MM

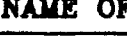
ANNEXURE - I			
TOOLING LIST FOR CNC HBM : 130MM			
SNO	TOOL DESCRIPTION	QTY	REMARKS
1	Stub Arbor – $\phi 22, 27, 32$ & 40 mm.	2 Each	Taper : ISO-50
2	Combi milling holders – $\phi 16, 22, 27, 32, 40$ mm	2 Each	Taper : ISO-50
3	Collet Chuck with Chucking range : $\phi 3.0$ to 26.0 mm	2 Each	Taper : ISO-50
4	Collets size : $\phi 3.0$ to 26.0 mm in steps of 1.0 mm	2 Each	
5	End Mill Holders (Weldon Type) : $\phi 6, 8, 10, 12, 16, 20, 25, 32$ and 40 mm.	2 Each	Taper : ISO-50 (With coolant through flange)
6	Morse Taper Holder with tang for MT-1, MT-2, MT-3, MT-4, MT-5	2 Each	Taper : ISO-50
7	Pull Studs without coolant hole	10 Nos	Taper : ISO-50
8	Pull Studs with coolant hole	10 Nos	Taper : ISO-50
9	Micro fine grain Solid carbide short End mills : Dia 8.0, 10.0, 12.0, 16.0 and 20.0 mm	4 each	
10	Inserted carbide Face Mills : $\phi 160, 200, 315$,	1 each	Face mills with 45 deg approach angle.
11	Inserted carbide Square shoulder Face Mills : $\phi 50, 63, 80, 100, 125$	1 each	Face mills with 90 deg approach angle.
12	Inserts for the above face mills of Grade GC 4030 & GC 3040 of Sandvik or equivalent grade of other reputed suppliers.	100 Nos each.	
13	Inserted carbide Full Side & Face milling cutters: $\phi 160 \times 12$ thk $\phi 250 \times 12$ thk and $\phi 315 \times 16$ thk	1 each	
14	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	
NOTE: ALL TOOLING SHALL BE OF REPUTED INTERNATIONAL BRANDS LIKE SANDVIK, ISCAR, SECO OR EQUIVALENT ONLY			

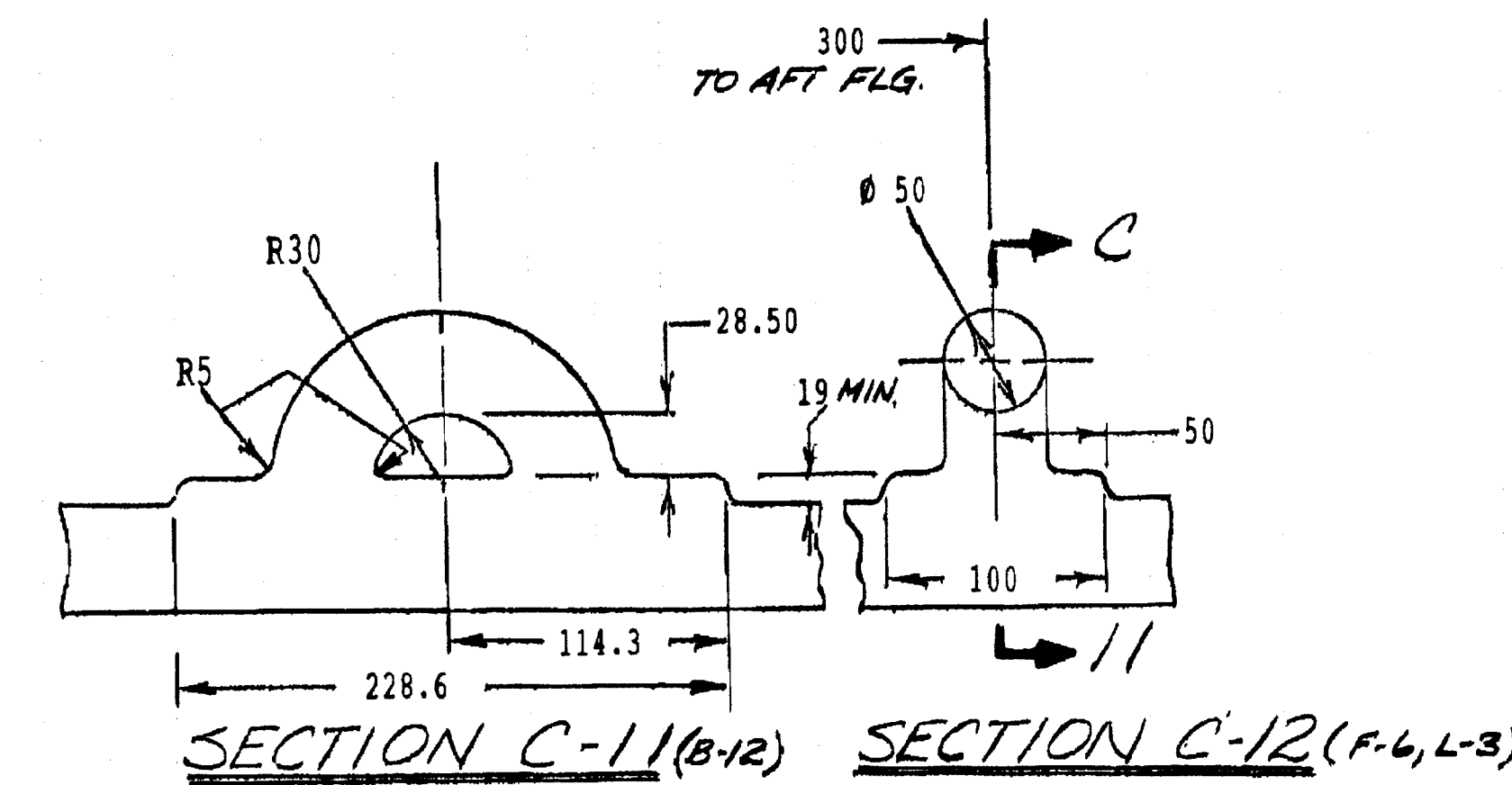
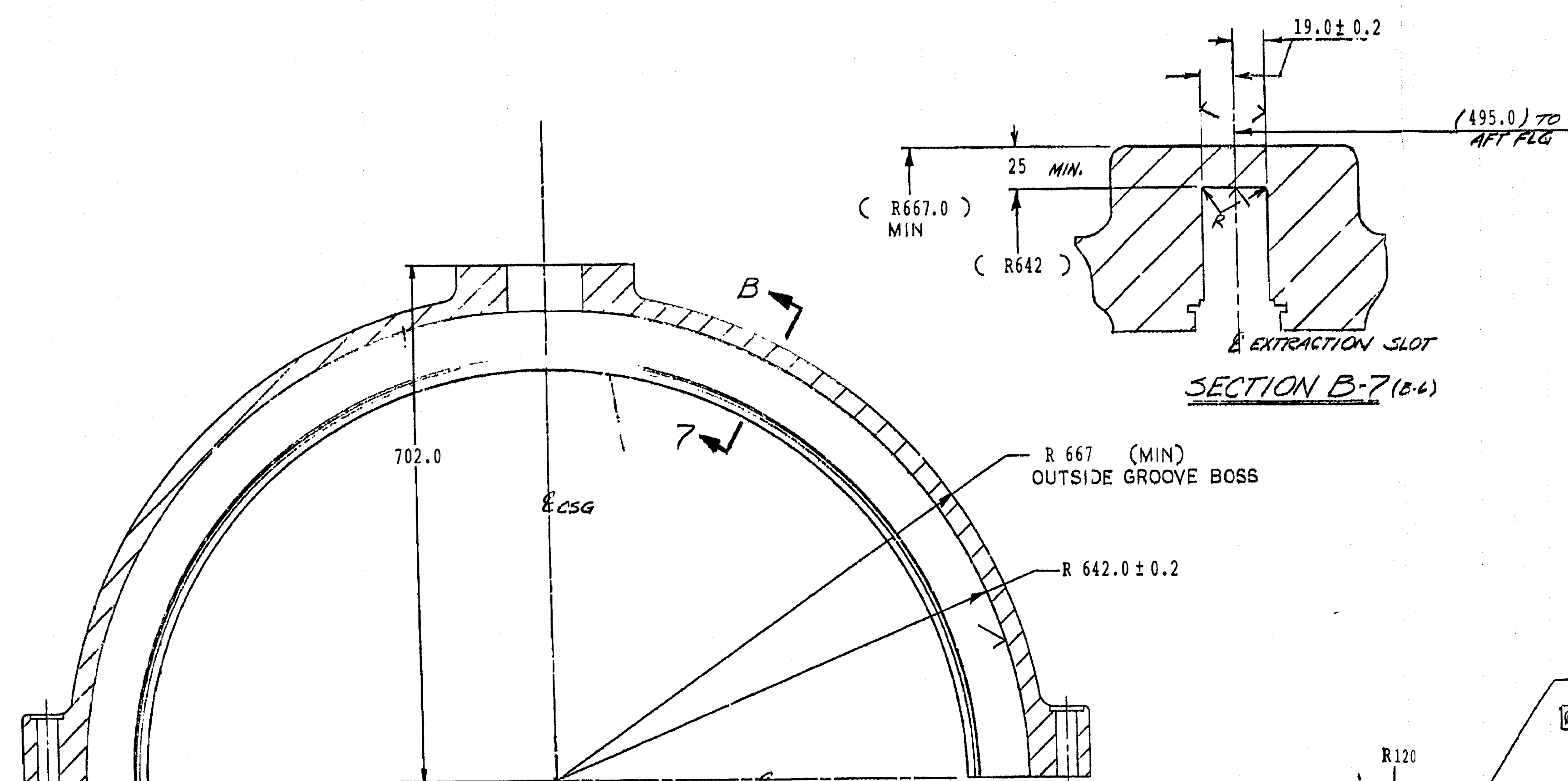
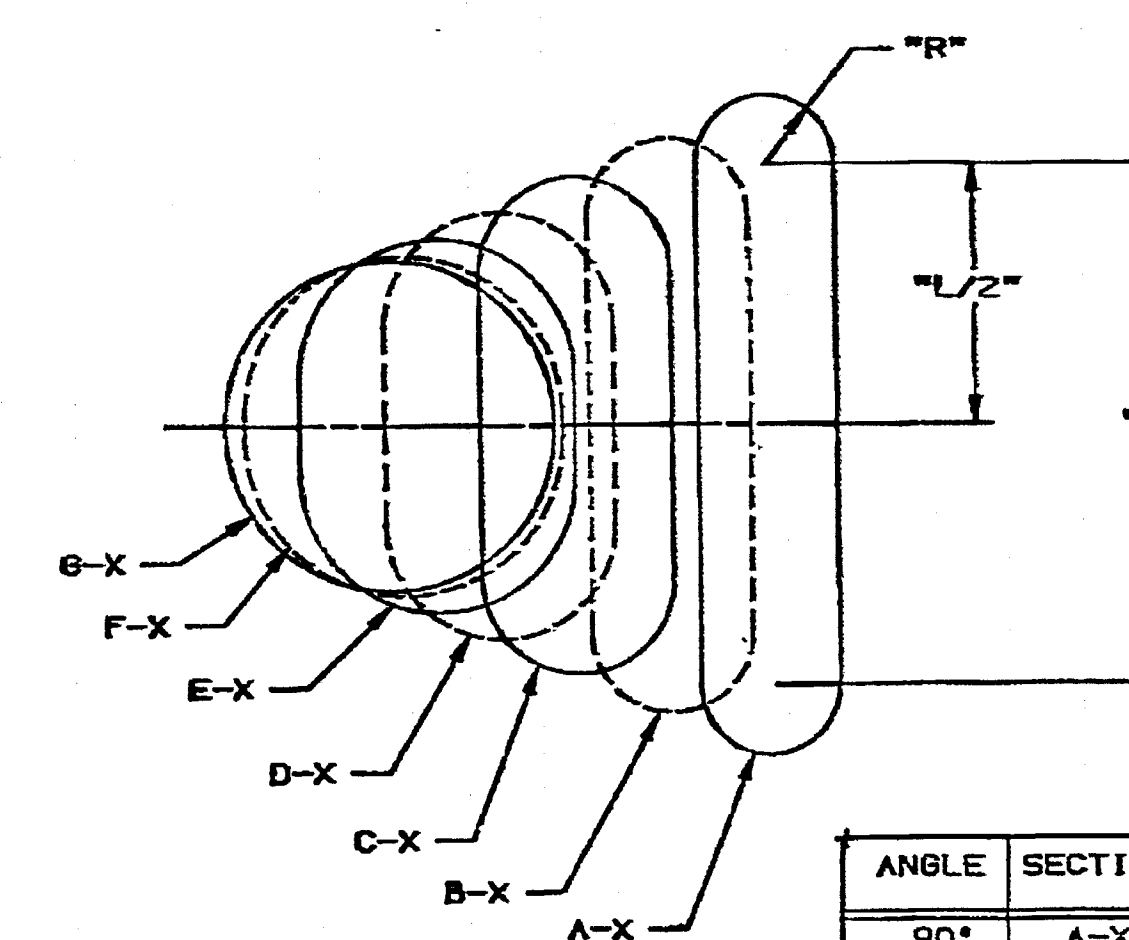
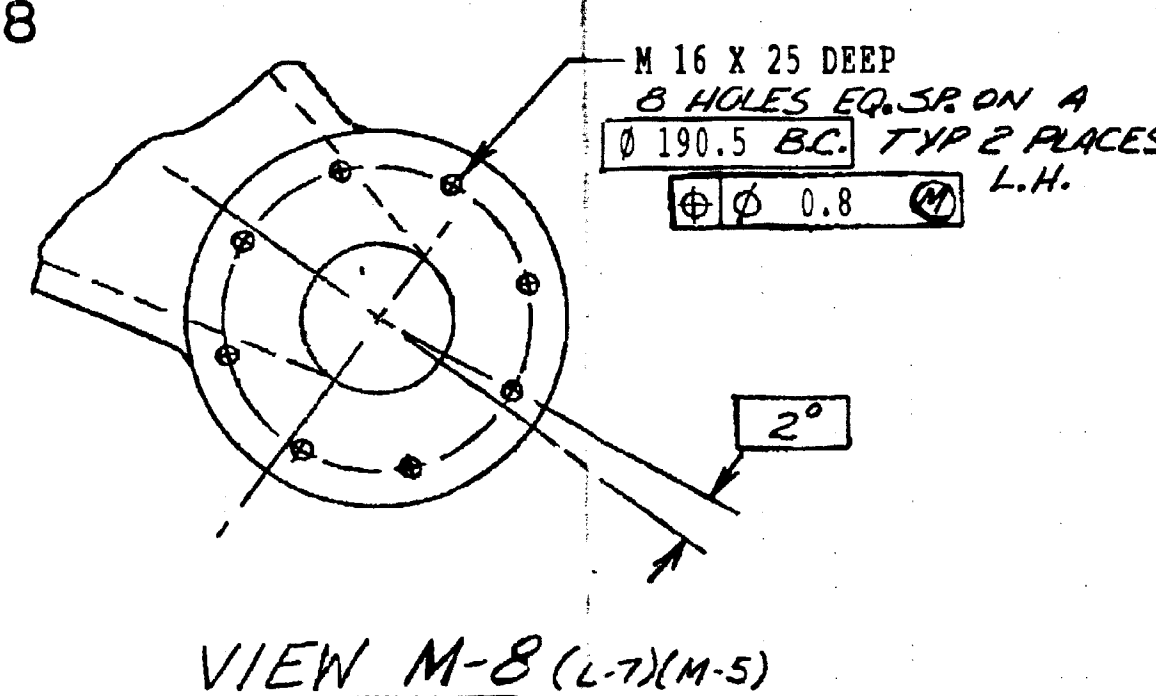
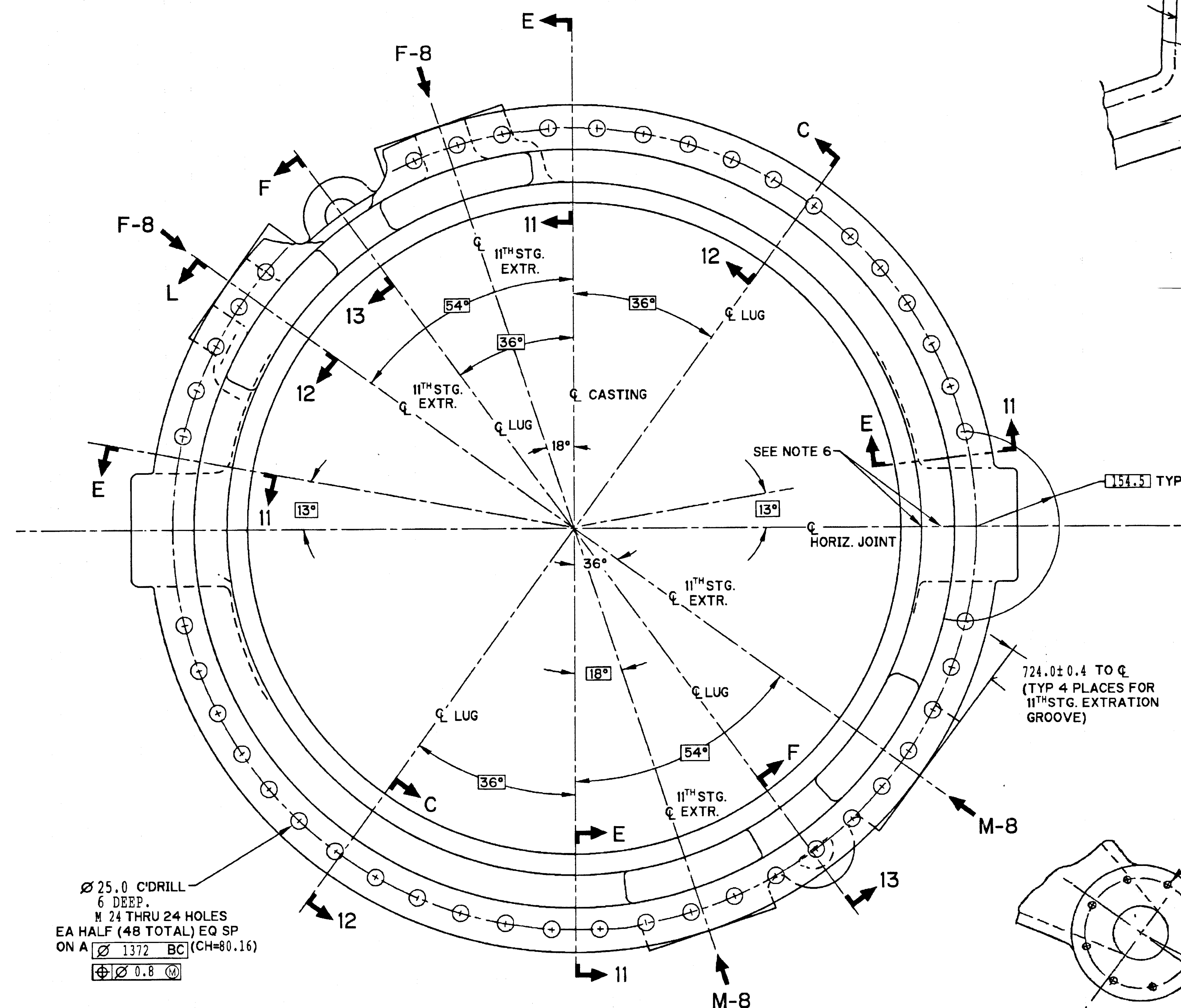
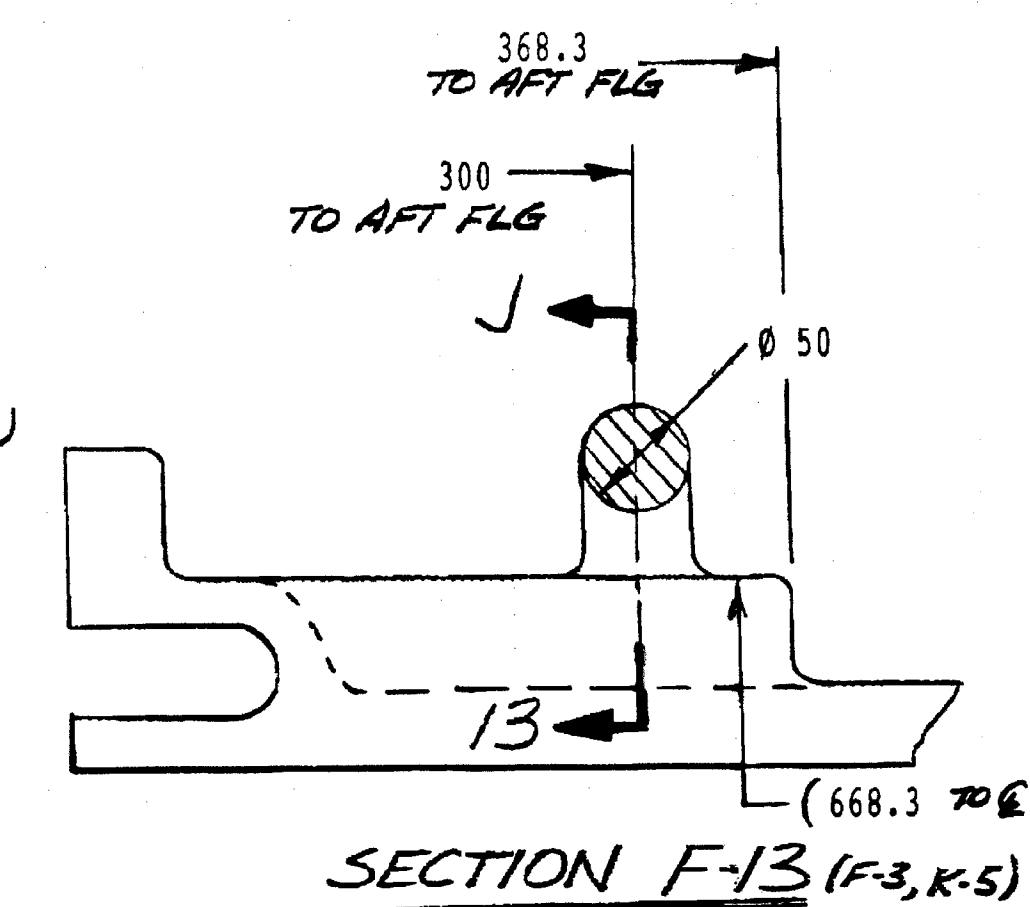
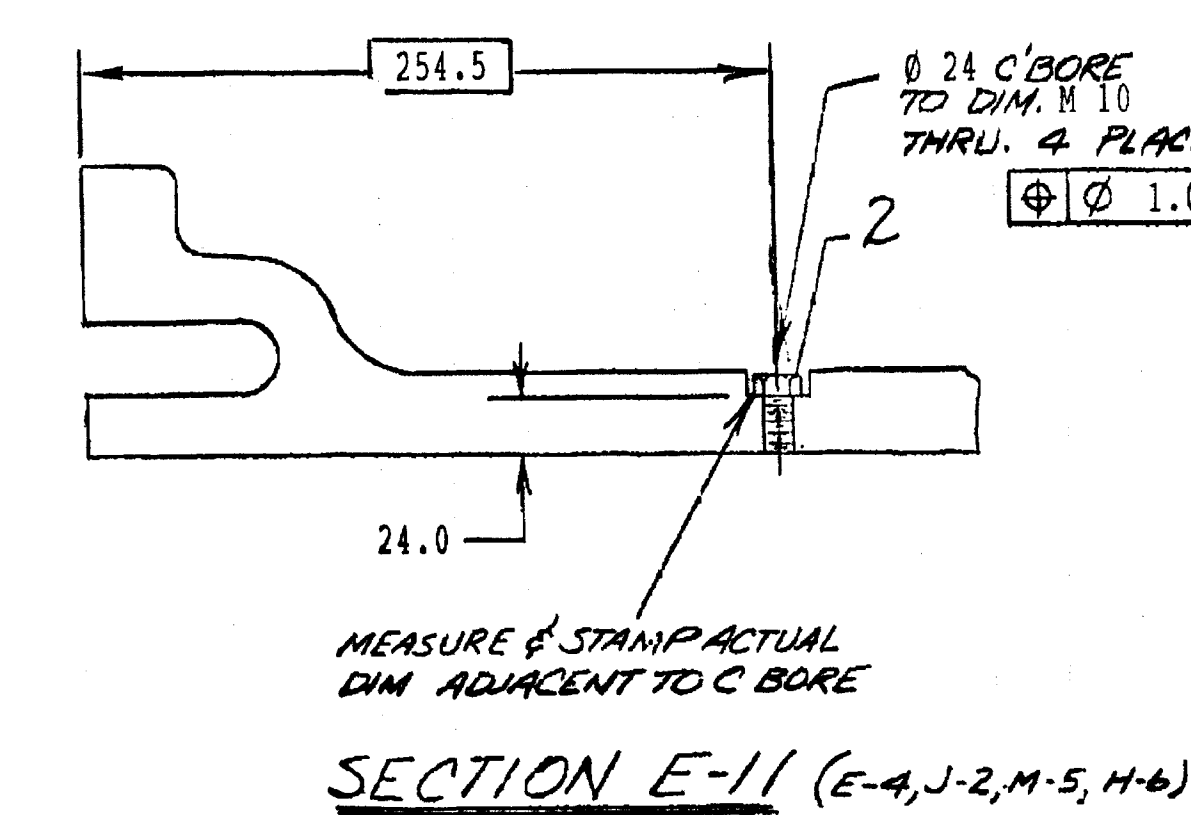
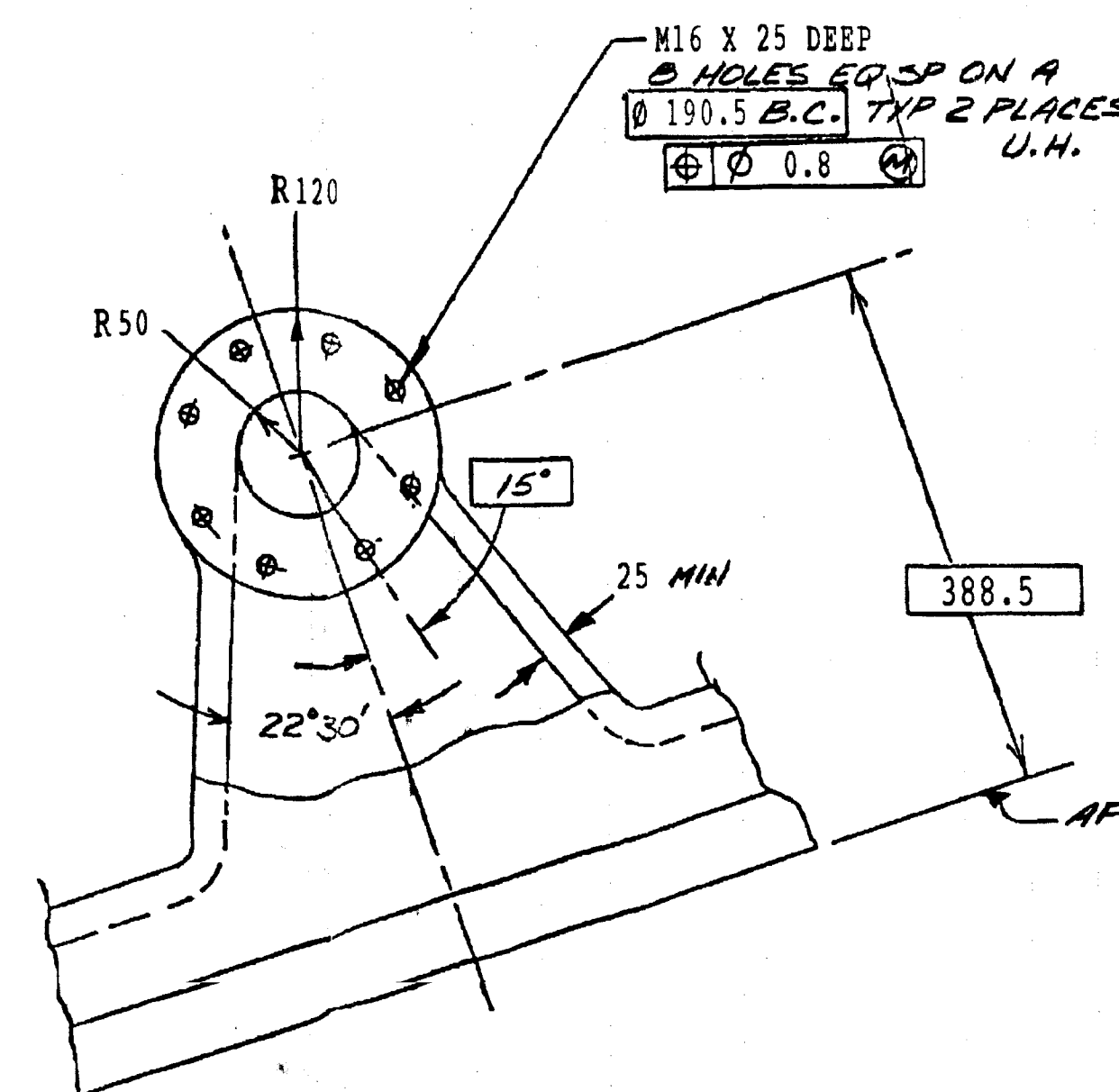
ANNEXURE -II

TYPICAL CONFIGURATION OF UNIVERSAL MILLING HEAD

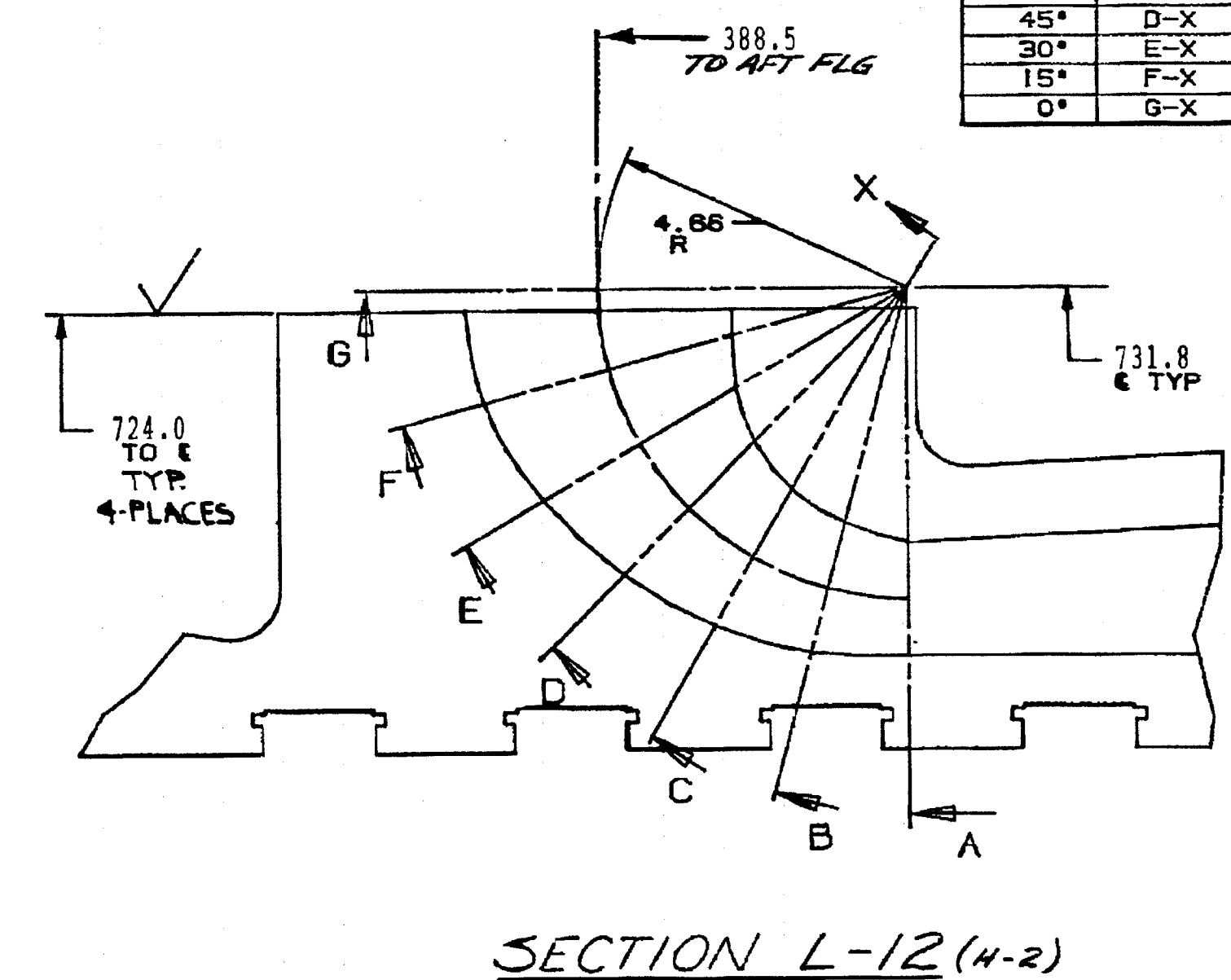




TYPE OF PRODUCT OR					GAS TURBINE FR-6B																				
NAME OF CUSTOMER/PROJECT																									
<div>BHARAT HEAVY ELECTRIC LIMITED</div> <div>HYDERABAD</div>					<table><thead><tr><th>NAME</th><th>SIGN.</th><th>DATE</th><th>NO. OF VAR.</th></tr></thead><tbody><tr><td>SCS</td><td></td><td>29.07.88</td><td>NA</td></tr><tr><td>SRILEKSHY (R&S)</td><td></td><td>29.07.88</td><td>NA</td></tr><tr><td>SRILEKSHY (R&S)</td><td></td><td>29.07.88</td><td>NA</td></tr></tbody></table>					NAME	SIGN.	DATE	NO. OF VAR.	SCS		29.07.88	NA	SRILEKSHY (R&S)		29.07.88	NA	SRILEKSHY (R&S)		29.07.88	NA
NAME	SIGN.	DATE	NO. OF VAR.																						
SCS		29.07.88	NA																						
SRILEKSHY (R&S)		29.07.88	NA																						
SRILEKSHY (R&S)		29.07.88	NA																						
DEPT.	UNIT.	DWS.	SCALE	WEIGHT (KGS)	REF. TO ASSY. DRG.	NO.	NO. OF TUM.																		
GTD	g/m ³ /j		NTS	1800	NA	NA	NA																		
TITLE					CARD CODE	DRAWING NO.																			
CASE, ASSY-COMPR					0-351-02-67001			REV																	
					SHT. NO. 2		NO. OF SHT. 3																		

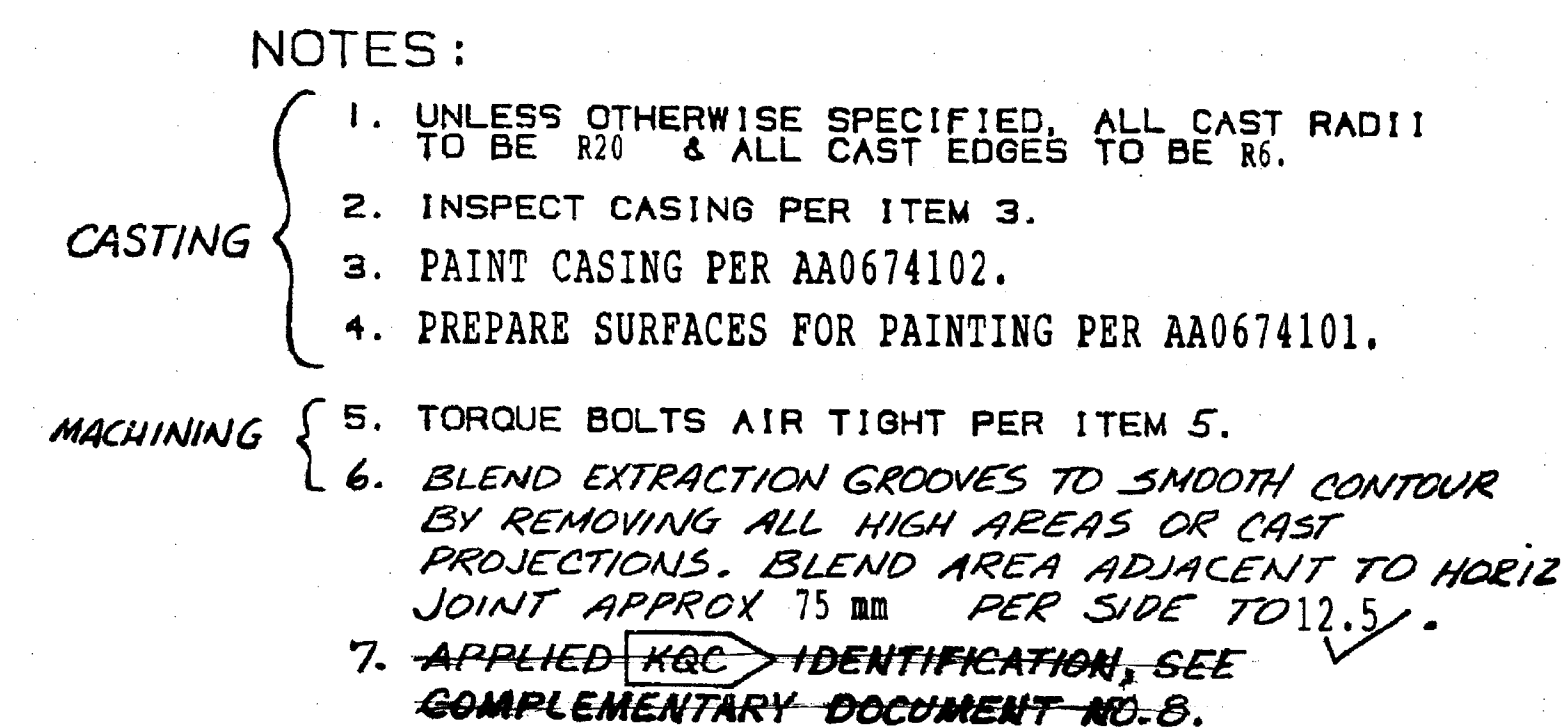
SECTION D-4 (C-5) (SHT 1)
5TH STAGE EXTRACTION SLOT

ANGLE	SECTION	AREA (REF)	R (F-12)	1/2 (F-12)
90°	A-X	8277.5	21.5	80.3
75°	B-X	8296.8	25.0	63.5
60°	C-X	8284.3	29.5	47.0
45°	D-X	8215.3	35.0	30.5
30°	E-X	8200.0	42.0	16.5
15°	F-X	8181.0	48.8	3.5
0°	G-X	8110.0	50.8	0.0



TYPE OF PRODUCT OR		GAS TURBINE FR-6B	
NAME OF CUSTOMER/PROJECT		SCS	
BHARAT HEAVY ELECTRICALS LIMITED		HYDRABAD	
DATE	19.07.88	DATE	19.07.88
REV.	1	REV.	1
CHD/APPD	CHD/APPD	CHD/APPD	CHD/APPD
SCALE	1:1	SCALE	1:1
WEIGHT (KG)	1800	WEIGHT (KG)	1800
REF. TO ASSY. DRG.	NA	REF. TO ASSY. DRG.	NA
DRAWING NO.	0-351-02-67001	DRAWING NO.	0-351-02-67001
CASE, ASSY - COMPR		CASE, ASSY - COMPR	

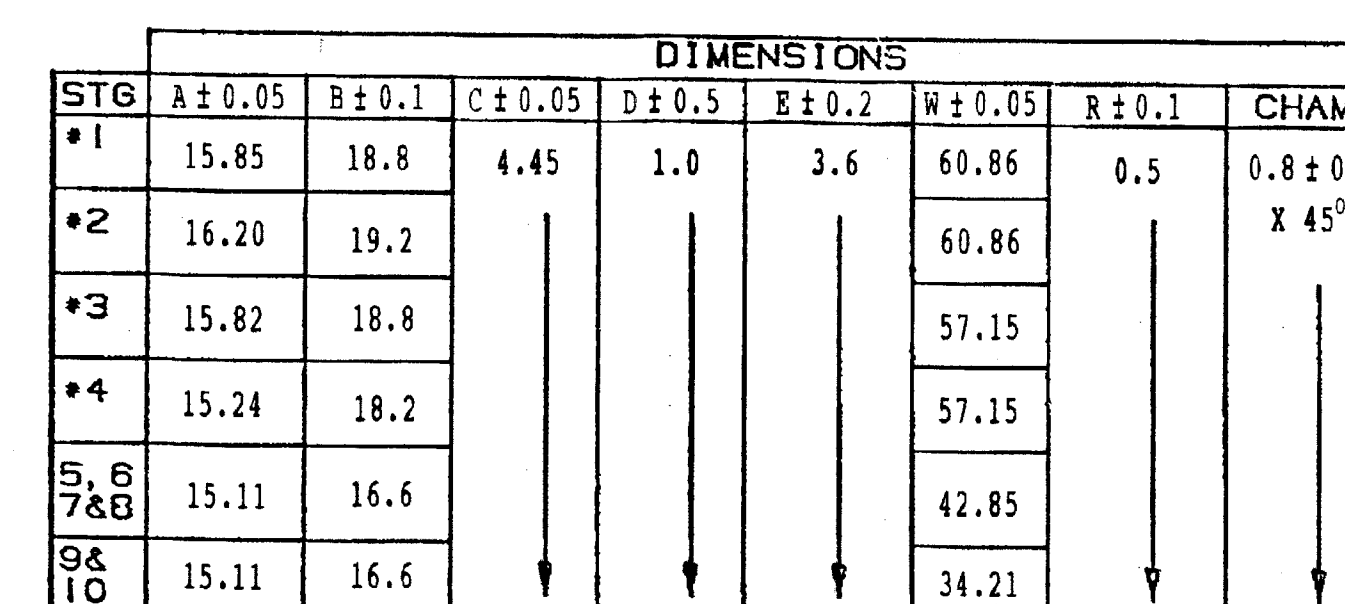
SH. 1 OF 3



DIMENSIONS FOR CASTING

Top View (SHT 3):

- Overall width: 1113.80 ± 0.07
- Overall height: 702.0 ± 0.5 TO ϵ
- Feature 1: $\phi 1289.2 \pm 0.0$
- Feature 2: $\phi 1289.36 \pm 0.05$
- Feature 3: $\phi 1251.76 \pm 0.05$
- Feature 4: $\phi 1240.38 \pm 0.05$
- Feature 5: $\phi 1190.56 \pm 0.05$
- Feature 6: $\phi 1152.90 \pm 0.05$
- Feature 7: $\phi 1130.54 \pm 0.05$
- Feature 8: $\phi 1090.56 \pm 0.05$
- Feature 9: $\phi 1050.56 \pm 0.05$
- Feature 10: $\phi 1010.56 \pm 0.05$
- Feature 11: $\phi 970.56 \pm 0.05$
- Feature 12: $\phi 930.56 \pm 0.05$
- Feature 13: $\phi 890.56 \pm 0.05$
- Feature 14: $\phi 850.56 \pm 0.05$
- Feature 15: $\phi 810.56 \pm 0.05$
- Feature 16: $\phi 770.56 \pm 0.05$
- Feature 17: $\phi 730.56 \pm 0.05$
- Feature 18: $\phi 690.56 \pm 0.05$
- Feature 19: $\phi 650.56 \pm 0.05$
- Feature 20: $\phi 610.56 \pm 0.05$
- Feature 21: $\phi 570.56 \pm 0.05$
- Feature 22: $\phi 530.56 \pm 0.05$
- Feature 23: $\phi 490.56 \pm 0.05$
- Feature 24: $\phi 450.56 \pm 0.05$
- Feature 25: $\phi 410.56 \pm 0.05$
- Feature 26: $\phi 370.56 \pm 0.05$
- Feature 27: $\phi 330.56 \pm 0.05$
- Feature 28: $\phi 290.56 \pm 0.05$
- Feature 29: $\phi 250.56 \pm 0.05$
- Feature 30: $\phi 210.56 \pm 0.05$
- Feature 31: $\phi 170.56 \pm 0.05$
- Feature 32: $\phi 130.56 \pm 0.05$
- Feature 33: $\phi 90.56 \pm 0.05$
- Feature 34: $\phi 50.56 \pm 0.05$
- Feature 35: $\phi 10.56 \pm 0.05$
- Feature 36: $\phi 0.56 \pm 0.05$
- Feature 37: $\phi 0.05 \pm 0.05$
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- Feature 130: $\phi 0.05 \pm 0.05$
- Feature 131:

[illegible]

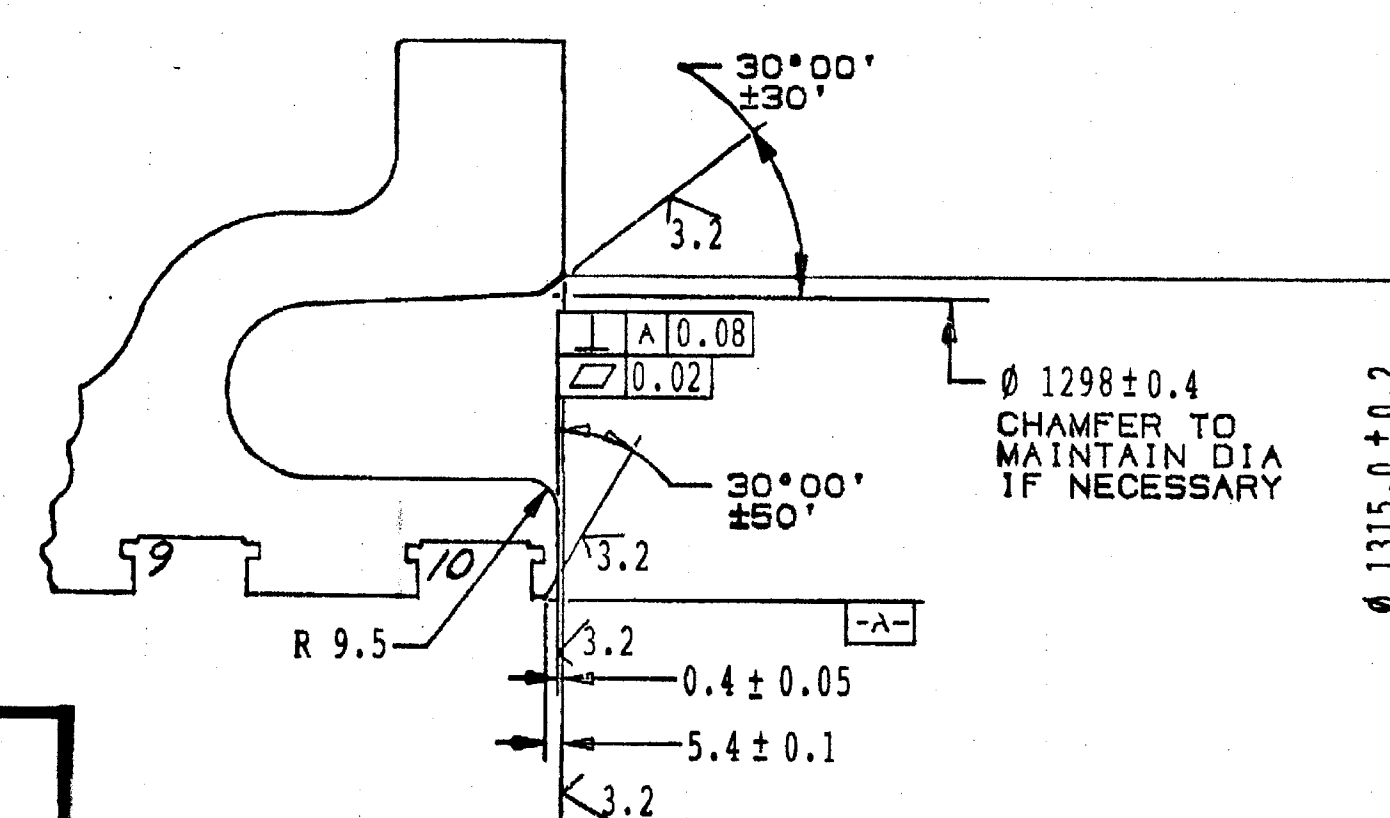
Technical drawing of Section E-13 (H-1, SH) showing a cross-section of a component. The drawing includes the following dimensions and labels:

- Overall width: 38.5 ± 0.5
- Overall height: $\varnothing 1494.0 \pm 0.2$ (MACHINE TO DIM IF NECESSARY)
- Radius: 3.2
- Feature: HOLES "A"

SECTION E-13 (H-1, SH)
(TYP 4 PLACES ONLY)
(VAR 02 & VAR 03)



SECTION K-5 (L-3, SHT 2)

06 (CAST)	AS SHOWN	HY19774 (B50A684)	G2
05 (CAST)	AS SHOWN	AA19702 (B2A1B3)	G1
04 (MACH)	APPLY DETAIL M2 (P4 SH-1) OWSA VAR 01.	AA19702 (B2A1B3)	G3
03 (MACH)	DIFF MATL/PATTERN OWSA VAR 02.	HY19774 (B50A684)	G6
02 (MACH)	OMIT SECTION E-10 (H-1,SH2) & DETAIL M2. APPLY SECTION E-13 (H-1,SH2) OWSA VAR 01.	AA19702 (B2A1B3)	G5
01 (MACH)	AS SHOWN EXCEPT OMIT SECTION E-13 (H-1,SH2) & DETAIL M2, APPLY SECTION E-10 (H-1,SH-2)	AA19702 (B2A1B3)	G4
VAR NO	DESCRIPTION	MATERIAL	GE REF



DETAIL L-10 (D-8)

4	KQC	KQC3001	
7	PROCESS	P14A-AL-0205	GT10334
6	PAINT	P66-AG31	
5	TORQUING	P48A415B	GT10001
4	SURFACE PREP	P44A-AL-1001	
3	INSPECTION	P29A-AG22	GT10077
2	PROCESS	P66-AG25	
I	APPLIED PRACTICES	11805700	HY0230261
II.	DESCRIPTION	GE REF	EBEL SPEC
LIST OF COMPLEMENTARY DOCUMENTS			

TYPE OF PRODUCT OR				GAS TURBINE FR-6B			
NAME OF CUSTOMER/PROJECT							
 HONEYWELL HEAVY ELECTRICALS LIMITED HYDERABAD							
DEPT.	QTY	UNITS		SCALE	WEIGHT (KGS)	REF. TO ASSY. DRG.	ITEM NO.
CODE	QTY	QTY		WTS	1800	NA	QTY
TITLE				CARD CODE	DRAWING NO. 0-351-02-67001		REV.
CAGE, ASSY - COMPR					SHT. NO. 1	NO OF SHT. 3	