



An ISO 9001  
Company

## Bharat Heavy Electricals Limited

(High Pressure Boiler Plant)

Tiruchirappalli – 620014, TAMIL NADU, INDIA

CAPITAL EQUIPMENT/ MATERIALS MANAGEMENT

### ENQUIRY

### NOTICE INVITING TENDER

Phone: +91 431 257 70 49

Fax : +91 431 252 07 19

Email : [csguna@bheltry.co.in](mailto:csguna@bheltry.co.in)

Web : [www.bhel.com](http://www.bhel.com)

#### TWO PART BID

Tender to be submitted in two parts.

**Enquiry  
Number:**

**2620900174**

**Enquiry  
Date:**

**07.09.2009**

**Due date for submission  
of quotation:**

**21.10.2009**

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

Please note that under any circumstances both **delayed offer** and **late offers** will not be considered. Hence vendors are requested to ensure that the offer is reaching physically our office before 14.00 hrs on the Date of tender opening.

Item	Description	Quantity
10	<b>CNC Pipe End Chamfering Machine – 600 mm</b> as per the technical specification, general guidelines instructions & commercial conditions applicable (to be downloaded from web site <a href="http://www.bhel.com">www.bhel.com</a> or <a href="http://tenders.gov.in">http://tenders.gov.in</a> )	<b>2 Nos.</b>

#### Important points to be taken care during submission of offer

1. Delivery required 13 months from the date of purchase order.
2. Grace period of 3 months beyond the above delivery period will be considered.
3. Checklist to be filled and enclosed along with the offer failing which, the offer will not be considered for evaluation.

BHEL's General guidelines / instructions (refer MM/CE/GT/001) including bank guarantee formats and list of consortium banks, commercial terms check-list can be downloaded from BHEL web site <http://www.bhel.com> or from the Government tender website <http://tenders.gov.in> (public sector units > Bharat Heavy Electricals Limited page) under Enquiry reference "2620900174".

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

Yours faithfully,  
For BHARAT HEAVY ELECTRICALS LIMITED

Sr.Manager / MM / Capital Equipment

**PART A**  
**CNC PIPE END CHAMFERING M/C – 600 MM**

**SECTION – I : QUALIFYING CRITERIA**

The BIDDER has to compulsorily meet the following requirements to get qualified for considering the technical offer :

S. No.	REQUIREMENTS	VENDOR's RESPONSE
1	<p>Only those vendors (OEMs), who have supplied and commissioned at least <b>ONE CNC PIPE END CHAMFERING MACHINE FOR PIPE DIAMETERS 600 MM OR MORE</b> in the past ten years (from the date of opening of Tender) and such machine is presently working satisfactorily for more than one year after commissioning (from the date of opening of Tender) should quote.</p> <p>However, if such machine had already been supplied to BHEL, then that machine should be presently working satisfactorily for more than six months after its commissioning and acceptance (from the date of opening of Tender).</p>	
<b>The vendor should submit following information where similar machine has been supplied for qualification of their offer.</b>		
1.1	Name and postal address of the customer or company where similar machine is installed.	
1.2	Name and designation of the contact person of the customer.	
1.3	Phone, FAX no and email address of the contact person of the customer.	
1.4	Month and Year of commissioning of the machine.	
1.5	Application for which the machine is supplied	
1.6	Performance certificate from the customer regarding satisfactory performance of machine supplied to them.	
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.	
2.0	<b>DELIVERY</b> - The bidder shall quote the best possible delivery. However the delivery shall not exceed 13 months with an additional grace period of 3 months. The additional grace period will attract a penalty which is explained in the commercial terms of the enquiry. The delivery period shall be reckoned from date of purchase order to despatch from the vendor works.	

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**SECTION – I I**

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

<b>S. No.</b>	<b>REQUIREMENTS</b>	<b>VENDOR's RESPONSE</b>
3.0	The BIDDER/VENDOR to furnish Reference List of Customers, with full address, details of contact person, where CNC PIPE END CHAMFERING MACHINES have been supplied in the past.	
4.0	Details of CNC PIPE END CHAMFERING MACHINES supplied to other BHEL units, if any. (Year of commissioning, Spindle size of machine, Spindle motor power)	
5.0	Details on SERVICE-AFTER-SALES Set-Up in India including the Address of Agents / Service Centers in South India.	
6.0	Any Additional Data to supplement the manufacturing capability of the BIDDER for the subject equipment.	

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**SECTION – III**

The BIDDER to note:

<b>S. No.</b>	<b>PARTICULARS</b>	<b>VENDOR'S RESPONSE</b>
7.0	The BIDDER / VENDOR shall submit the offer in TWO PARTS. 1. Technical Offer [with PART A & PART B] 2. Commercial and Price Bid.	
8.0	The Technical Offer shall contain a comparative statement of Technical <b>Specifications demanded by BHEL</b> and <b>Offer Details submitted by the Bidder</b> , against each clause. A just 'CONFIRMED' or 'COMPLIED' or 'YES' or 'NO-DEVIATION' or similar words in the technical comparative statement may lead to disqualification of the Technical Offer.	
9.0	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.	
10.0	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.	
11.0	For obtaining the performance certificate from the customer, a suggestive format is provided in <b>SECTION – IV</b>	

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**SECTION – IV**

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

**PERFORMANCE CERTIFICATE**

1. Supplier of the machine		
2. Make & Model of the M/C		
3. Month & Year of Commissioning		
4. Application for which M/C is used		
5	a) Face plate diameter b) Max. size of Pipe dia. c) Spindle Power d) CNC System	
6. Performance of the Machine (Strike off whichever is not applicable)		Satisfactory / Good / Average / Not Satisfactory
7. Any Other remarks		
Date: _____ Signature & Seal of the Authority Issuing the Performance Certificate		

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**PART – B****TECHNICAL SPECIFICATION FOR HEAVY DUTY CNC PIPE EDGE PREPARATION MACHINE 600 MM – 2NOS.**

<b>S.No</b>	<b>PARTICULARS AND BHEL SPECIFICATION</b>	<b>BIDDER'S OFFER (With complete Technical Details)</b>
<b>1.0</b>	<b>PURPOSE &amp; WORKPIECE MATERIAL:</b>	
1.1	The machine is meant for Facing and edge preparation of straight & bend pipes which form high pressure components for Power Boilers, and Industrial boilers of Process Industries. The machine shall be capable of generating various profiles of edge preparation on the above said components. The Edge preparation of the above jobs shall be done by tool mounted on a rotating chuck, keeping the work piece stationary by clamping it on self-centering Electric / Hydraulic pipe clamping vice. The edge preparation profile is obtained by vectorial combination of longitudinal movement of chuck and transverse movement of the tool slide under CNC control.	
<b>1.2</b>	<b>Material specification:</b>	
	<b>A) CARBON STEEL:</b> SA 106 Gr.B /Gr C (ASTM), AP15L Gr B (ASTM) <b>B) ALLOY STEEL:</b> SA 335 P11, P12 & P22, P91 SA 312 TP304H, SA 312 TP316 L	

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S.No	PARTICULARS AND BHEL SPECIFICATION				BIDDER'S OFFER (With complete Technical Details)
1.3	<b>Material Sizes</b>				
1.3.1	The machine shall be suitable for pipe size OD from 219mm to 610 mm and thickness from 6.0 mm to 125.0 mm. The standard sizes are furnished below. Max.Length of the pipe 8000 mm.				
1.3.2		Sl. No.	Pipe Size (OD), mm	Wall Thickness Range, mm	
		1	219.1 (8")	6.32 to 40.0	
		2	273 (10")	6.35 to 50.0	
		3	323.9 (12")	6.4 to 65.0	
		4	355.6 (14")	40.0 to 92.0	
		5	368 (14.4")	50.0	
		6	406.4 (16")	6.35 to 93.4	
		7	457.2 (18")	12.7 to 79.4	
		8	508 (20")	6.0 to 125.0	
		9	558.8 (22")	6.35 to 72.0	
		10	609.6 (24")	14.27 to 125	
1.4	<b>Edge Preparation Styles</b>				
	Edge Preparation Profile Styles to be machined As per ANNEXURE .I				

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S.No	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER (With complete Technical Details)
<b>2.0</b>	<b>MACHINE DETAILS:</b>		
<b>2.1</b>	<b>HEADSTOCK:</b>		
2.1.1	Geared Head stock unit shall be of fully enclosed type with Integral facing unit mounted on the spindle nose	Vendor to Confirm	
2.1.2	Minimum & Maximum Facing diameter	219mm to 610 mm	
2.1.3	Min. & Max. wall thickness	6 mm & 125 mm	
2.1.4	Maximum turning diameter	610 mm	
2.1.5	Maximum weight of the job	4,000 kgs.	
2.1.6	Maximum boring & turning length	175 mm	
2.1.7	Headstock longitudinal travel (Min 500mm)	Vendor to Specify	
2.1.8	Feed rate of Headstock longitudinal travel (steplessly variable)	0.5mm /min – 1500mm/min	
2.1.9	Torque of the AC servomotor for Headstock traverse.	Vendor to Specify	
2.1.10	Spindle speed (Infinitely variable)	10 to 600 rpm	
2.1.11	No. of speed ranges	Vendor to Specify	
2.1.12	Spindle speed range selection - Electro Hydraulic system through CNC (Hydraulic cylinders to be located conveniently for easy maintenance.)	Vendor to confirm	
2.1.13	KW rating of AC spindle motor (S1duty) (Vendor to furnish complete technical details along with offer)	Minimum 22 kW Vendor to Specify	
2.1.14	Torque-Power-Speed characteristics of the spindle system to be submitted by the vendor along with offer	Vendor to furnish	

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S.No	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER (With complete Technical Details)
2.1.1 5	Forward and reverse rotation of spindle motor with suitable braking mechanism. (Complete details with drawings, explanations to be submitted along with the offer.)	Vendor to specify	
2.1.1 6	Sliding type Chip guard on the headstock for the safety of the operator, operator's panel and to avoid spillage of chips on shop floor (Details should be furnished in offer)	Vendor to confirm	
<b>2.2</b>	<b>FACING UNIT:</b>		
2.2.1	Heavy steel casting fitted on the nose of main spindle, incorporating the tool holder slide with tool holder for radial feed (Vendor to furnish details in the offer)	Vendor to Confirm	
2.2.2	Diameter of the face plate	Vendor to specify	
2.2.3	Tool holder slide traverse X-Axis	Vendor to Specify	
2.2.4	Min. distance between the faceplate and the clamping vice	Vendor to specify	
2.2.5	Torque of the A.C.servo motor for tool slide	Vendor to specify	
2.2.6	Feed rate of Tool holder slide X-axis (Steplessly variable)	0.5mm /min – 1000 mm/min	
2.2.7	Tool holder slide counter balance arrangement.	Vendor to furnish details	
<b>2.3</b>	<b>MACHINE BED:</b>		
2.3.1	No. Of Guide ways	Vendor to specify	
2.3.2	Bed width across ways	Vendor to specify	
2.3.3	Type of guide ways: (Details should be furnished in the offer)	Vendor to specify	
2.3.4	Hardness of guide ways	Vendor to specify	
2.3.5	<b>Metallic Telescopic Covers</b> of stainless steel material shall be provided with wipers for guide ways. Joints of telescopic covers should be so sealed to avoid ingress of dust.	Vendor to confirm & provide details	

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S.No	PARTICULARS AND BHEL SPECIFICATION	BIDDER'S OFFER (With complete Technical Details)	
2.3.6	<b>OPTIONAL</b> - Chip conveyor system suitable to transport the metallic chips to be incorporated in the machine.	Vendor to confirm & provide details	
<b>2.4</b>	<b>FEED DRIVE SYSTEM:</b>		
2.4.1	Feed drives/ motors for X & Z axes [AC servo motors] shall be digital type of either Siemens or Fanuc or any other reputed make acceptable to BHEL (Details of model, make, type etc. to be furnished in the offer)	Vendor to furnish details	
2.4.2	Maximum feed force for all axes	Vendor to specify	
2.4.3	Feed back system for X & Z axes: Siemens/Fanuc/Heidenhain Linear scale / Rotary encoders. (Details of type of encoder offered & model no. to be furnished in the offer)	Vendor to specify & furnish details	
2.4.4	Feed back system for Spindle rpm: Seimens / Fanuc / Heidenhain Rotary Encoders (Details to be submitted by the vendor with offer)	Vendor to specify	
2.4.5	<b>Type of power transmission:</b> Pre-loaded backlash-free re-circulating ball screw drive for X & Z axes. (Complete description of the aforesaid including diameter of Ball Screw for each axis, to be furnished in the offer)	Vendor to specify	
<b>2.5</b>	<b>STRAIGHT PIPE AND PIPE BEND CLAMPING SYSTEM:</b>		
2.5.1	The clamping system shall be suitable for centering and clamping straight pipes as well as bends (Complete details should be furnished in the offer)	Vendor to Confirm	

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<b>S.No</b>	<b>PARTICULARS AND BHEL SPECIFICATION</b>		<b>BIDDER'S OFFER (With complete Technical Details)</b>
2.5.2	The clamping system shall be equipped with a horizontally moving electric / hydraulically operated self-centering vice. The Vice shall incorporate “V” type jaws which can be moved up & down for job centering.	Vendor to Confirm	
2.5.3	Diameter range	219 mm to 610 mm	
2.5.4	Bed width	Vendor to specify	
2.5.5	Bed length	Vendor to specify	
2.5.6	Clamping force /pressure	Vendor to specify	
2.5.7	Min straight length of the job for clamping - As the machine is intended for end chamfering of bent pipes also, the minimum straight length for clamping shall preferably be around 300 mm. Vendor to indicate the minimum straight length required for clamping. However the min. straight length required for clamping shall not exceed 500 mm.	Vendor to specify	
2.5.8	Clamping force/ pressure should be able to be selected automatically by the system “thro” CNC for different combination of pipes OD and thickness mentioned in our specification. (Clause no 1.3) The vendor should design and specify the clamping force/ pressure according to our material sizes to avoid pipes deformation due to clamping.	Vendor to confirm. Details to be provided after ordering.	
2.5.9	Pipe clamping operation	Through CNC.	
2.5.10	Pipe clamping jaws type	“V” type horizontal	
2.5.11	Safety system to prevent the rotation of the cutting tool unless the horizontal vice is properly clamped. (Details should be furnished in the offer)	Vendor to confirm.	

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S.No	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER (With complete Technical Details)
2.5.12	Motorized longitudinal and vertical movement of the clamping jaws for job centering. Motor to be provided with chip guard (Vendor to furnish details of the system, motor capacity etc in the offer)	Vendor to confirm	
<b>2.6</b>	<b>PIPE SUPPORTING STEADY:</b>		
2.6.1	3 Nos. Electrically operated Vertically adjustable "V" type supports for supporting the free end of pipes and bends. The supports shall have facility to be moved to accommodate different lengths of pipes & bends. (Vendor to submit complete details with drawings of the supports in the offer)	Vendor to confirm	
<b>2.7</b>	<b>CONSTRUCTION:</b>		
2.7.1	Vendor to furnish details of material, hardness & constructional details including explanatory drawings of various components/assemblies like Headstock, Facing Unit, Tool Holder Slide, Machine Bed, Feed Transmission System, Pipe & Pipe Bend Clamping System, Feedback System etc. of the machine along with the offer	Vendor to furnish details	
2.7.2	Video images on CD hard copy of literature with photographs, drawings explaining the technical features should be enclosed with the offer	Vendor to Confirm	

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S.No	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER (With complete Technical Details)
<b>2.8</b>	<b>OPERATION AND CONTROL SYSTEM:</b>		
<b>2.8.1</b>	<b>OPERATOR'S PANEL:</b>		
2.8.1.1	Operator's panel having complete CNC and machine control system with CRT of required configuration shall be provided for convenient and efficient operation. All switches should be within reach of operator. All displays/indications should also be conveniently placed (Layout showing complete details should be submitted with the offer)	Vendor to Confirm & furnish details	
<b>2.8.2</b>	<b>CNC SYSTEM &amp; FEATURES:</b>		
2.8.2.1	Make: Fanuc / Siemens.	Vendor to specify	
2.8.2.2	Type: PC based latest version	Vendor to specify	
2.8.2.3	Model (Suitable and Latest version, as available at the time of ordering, should be supplied).	Vendor to specify	
2.8.2.4	Details of Standard features	Vendor to specify	
2.8.2.5	Details of optional features available in the offered CNC	Vendor to specify	
2.8.2.6	Details of optional features recommended by vendor.	Vendor to specify	
2.8.2.7	The system should have full alphanumeric keyboard, TFT colour display (10.4" or more), additional draw-out type Qwerty Key Board and mouse in suitable enclosure, RS232C serial interfaces, parallel interface for printer, COM port for tele diagnostics, electronic hand wheels for all axes (MPG), compact disc drive unit for data input/output, hard disk of sufficient capacity ( <b>Largest size available at the time of order shall be supplied</b> ), graphic simulation and preinstalled system software & other required soft wares etc (Details should be furnished by the Vendor in the offer)	Vendor to Confirm	

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S.No	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER (With complete Technical Details)
<b>2.8.3</b>	<b>HAND HELD UNIT:</b>		
2.8.3.1	Hand held unit for axis selection, and movement with pulse generator & display is to be offered. This is required for job setting. Make, model no. and literature of the offered hand held unit shall be furnished.	Vendor to furnish	
<b>2.9</b>	<b>MACHINE LIGHTS:</b>		
2.9.1	Machine Lights for sufficient illumination of complete working area should be provided for clear visibility. (Details should be furnished in the offer)	Vendor to Confirm & furnish details	
2.9.2	A 24 V hand lamp with about 5 mtrs. long cable should also be provided.	Vendor to Confirm	
2.9.3	All light fittings, consumables, adapters/receptacles should have compatibility with Indian equivalents	Vendor to Confirm	
2.9.4	Flashing / rotary type End of Cutting and Program Stop Light.	Vendor to Confirm	
<b>2.10</b>	<b>AIR CONDITIONERS:</b>		
2.10.1	Air Conditioners with Dehumidifiers of suitable capacity to be provided for all Electrical / Electronic Panels / Cabinets including Operator's Panel considering specified ambient conditions. <b>Make:</b> Rittal / Warner & Finley or any other reputed make acceptable to BHEL. Detailed specifications to be submitted.	Vendor to indicate the make & submit details	

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S.No	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER (With complete Technical Details)
<b>2.11</b>	<b>HYDRAULICS</b>		
2.11.1	The System should be centralized, modular / stacked valve construction having minimum number of pipes / pipe joints and located on ground level with easy accessibility of components for maintenance.	Vendor to Furnish Details	
2.11.2	Pumps, valves, accessories etc shall be of Rexroth / Vickers or equivalent reputed make acceptable to BHEL. (Details to be submitted). The seals used in cylinders shall be of Merkel / Parker / Bushak + Shamban / Hunger / Simrit make.	Vendor to confirm & furnish details	
2.11.3	Each pump should have an independent motor. Tandem pumps shall be avoided.	Vendor to confirm	
2.11.4	Suitable filtration system should be provided with Duplex / standby filter units. It is preferable to use re-usable type of filter elements in the system. The filter unit shall be of Hydac / Parker / Rexroth or equivalent reputed make acceptable to BHEL. (Details to be submitted).	Vendor to confirm & furnish details	
2.11.5	The flexible hoses used in the system shall be of Gates / Aeroquip / Parker or any other reputed make acceptable to BHEL.	Vendor to specify	
2.11.6	Failure indication for oil level, temperature, pressure, filter clogging should be provided	Vendor to confirm & furnish details	

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S.No	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER (With complete Technical Details)
2.11.7	Refrigerated type cooling system of sufficient capacity to maintain complete Hydraulic System at a temperature not exceeding 50 deg C irrespective of the ambient conditions. BHEL prefers to have direct cooling of oil in the chiller rather than indirect water cooling type. Complete details should be submitted with the offer.	Vendor to confirm & furnish details	
2.11.8	It should be possible to replace hydraulic elements like valves, manifolds etc without disturbing the associated pipelines. The positioning of hydraulic elements should allow easy maintenance	Vendor to furnish details	
2.11.9	Maximum Operating Pressure of hydraulic system	Vendor to specify	
2.11.10	Main Pump flow in lpm and Motor Power in kW	Vendor to specify	
2.11.11	Reservoir capacity (in litres)	Vendor to specify	
2.11.12	All oil pipelines shall be of seamless steel and should undergo pickling process.	Vendor to confirm	
2.11.13	Pressure measuring minimess check points (preferably with ¼" BSP stud end) shall be provided for important pressure measurements from operation, trouble shooting and maintenance point of view. Two sets of hand held minimess pressure gauge of suitable range with minimess hose (1.0 to 1.5m length) also to be supplied along with the power pack.	Vendor to furnish details	
2.11.14	All cylinders used in the machine should have standard bore and rod sizes. The piston rod shall be hard chrome plated.	Vendor to furnish details	
2.11.15	Suitable stand-by pump unit, filter unit, etc shall be provided for critical areas	Vendor to furnish details	

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S.No	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER (With complete Technical Details)
2.11.16	The Power pack should be designed taking into account the energy efficiency (Hi-low pump system, proper unloading during idling, etc.). The motor used for pumps shall be energy efficient ones.	Vendor to furnish details	
2.11.17	All the pipe / hose end fittings shall be of standard weld nipple with O-ring seating type (DIN 3865 or equivalent) - female swivel nut with 24 <sup>0</sup> cone and o-ring and no ferrule joints are to be used in the hydraulic system. All threaded connections shall be of metric sizes	Vendor to confirm	
2.11.17	Suitable vibro-mounts, compensators (flexible bellows), flexible hose at the pump outlet, polypropylene clamps for pipes & hoses, etc are to be provided to minimize the vibration induced and transmitted to the hydraulic joints.	Vendor to confirm	
2.11.19	The oil to be used shall be of standard ISO Viscosity Grades – 32 / 46 / 68	Vendor to specify	
2.11.20	The maximum pressure of the system should preferably not to exceed 310 bar	Vendor to specify	
2.11.21	The control voltages for all the Solenoids of the valves shall be of 24-V DC and all solenoid operated DC valves should have manual over-ride provision and light indicating solenoids.	Vendor to specify	
2.11.22	The pipelines to be painted with standard colours as per the colour coding accepted internationally for hydraulic systems.	Vendor to furnish details	
2.11.23	All hydraulic pipelines, hoses and electrical control cables to be neatly laid out with proper clamps and flexible hose conveyors wherever required.	Vendor to confirm	

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S.No	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER (With complete Technical Details)
2.11.24	Suitable leakage oil collection metallic tray to be provided wherever required.	Vendor to confirm	
2.11.25	All the components in the hydraulic power pack shall be provided with identification numbers, as per the hydraulic circuit and should be pasted with metallic identification number plates.	Vendor to confirm	
2.11.26	<b>First filling of all required Oils &amp; Grease etc.</b> should 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 confirm & provide Indian equivalents.	
<b>2.12</b>	Machine lubrication: Automatic centralized lubrication system with timer control and suitable metering cartridges to be supplied.	Vendor to confirm & provide details	
<b>2.13</b>	<b>ELECTRICAL:</b>		
2.13.1	415V + 10% / -10%, 50HZ +/-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 cables, connections, circuit breakers etc. required for connecting BHEL's power supply during construction of foundation.	Vendor to confirm	
2.13.2	Tropicalization: All electrical / electronic equipment shall be tropical zed.	Vendor to confirm	
2.13.3	All electrical & electronic control cabinets & panels should be dust and vermin proof	Vendor to confirm	
2.13.4	All electrical components in the cabinets should be mounted on DIN Rail	Vendor to confirm	

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S.No	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER (With complete Technical Details)
2.13.5	All electrical and electronic panels including operator's panel should be provided with fluorescent lamps for sufficient illumination and power receptacles of 220Volts, 5/15 Amp AC. All adapters /receptacles should have compatibility with Indian equivalents.	Vendor to confirm	
2.13.6	Motors & other electrical components shall conform to IEC or Indian Standards	Vendor to confirm	
2.13.7	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 confirm	
2.13.8	Vendor should ensure the proper earthing for the machine and its peripherals.	Vendor to confirm	
2.13.9	In-cycle hour counter with reset facility should be provided.	Vendor to confirm	
2.13.10	All Electric enclosures shall have IP 54 protection	Vendor to confirm	
<b>2.14</b>	<b>SAFETY ARRANGEMENTS:</b>		
2.14.1	Following safety features in addition to other standard safety features should be provided on the machine:	Vendor to confirm	
2.14.2	Machine should have adequate and reliable safety interlocks / devices to avoid damage to the machine, work piece and the operator due to the malfunctioning or mistakes. Machine functions should be continuously monitored and alarm / warning indications through lights/ alarm number with messages (on CNC display and panels) should be available.	Vendor to confirm & provide details	
2.14.3	A detailed list of all alarms / indications provided on machine should be submitted by the Vendor.	Vendor to specify	

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S.No	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER (With complete Technical Details)
2.14.4	All the pipes, cables etc. on the machine should be well supported and protected. These should not create any hindrance to machine operator's movement for effective use of machine.	Vendor to Confirm	
2.14.5	All the rotating parts used on machine should be statically & dynamically balanced to avoid undue vibrations and suitably guarded.	Vendor to Confirm	
2.14.6	Emergency Switches at suitable locations as per International Norms should be provided.	Vendor to Confirm	
2.14.7	All lubricated parts like Bed, guide ways shall have provision for collecting the used Lubrication oil from machine guide ways and preventing them from spilling over on to the ground.	Vendor to Confirm	
<b>2.15</b>	<b>ENVIRONMENTAL PERFORMANCE OF THE MACHINE:</b>		
2.15.1	The Machine should confirm to following factors related to environment:	Vendor to Confirm	
2.15.2	Noise level shall not exceed 85 dB(A) at normal load condition, 1meter away from the machine with correction factor for back ground noise.	Vendor to demonstrate compliance to noise level,	
2.15.3	There shall not be any emissions from the machine except fumes of cutting fluid during machining.	Vendor to confirm	
2.15.4	If any safety / environmental protection enclosure is required it should be built in the machine by the vendor.	Vendor to confirm	

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S.No	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER (With complete Technical Details)
2.15.5	Paint of the machine should be oil / coolant resistant and should not peel off and mix up with coolant.	Vendor to confirm	
<b>3.0</b>	<b>SERVO VOLTAGE STABILIZER (SVS) :</b>		
3.1	Indian make Oil / Air Cooled servo Controlled Voltage Stabilizer suitable for complete machine, CNC, drives, controls, PLC etc with no undesirable Harmonics in the stabilizer output.	Vendor to confirm	
3.2	Make. : NEEL / AEI / SERVO MAX	Vendor to confirm	
3.3	Model & Rating (Suitable for the machine load. Vendor to specify the noise level also)	Vendor to Specify	
3.4	Spares Package for the Voltage Stabilizer for 2 years working should also be offered.	Vendor to submit	
3.5	Catalogue of the Voltage Stabilizer shall be submitted with the offer.	Vendor to submit	
3.6	First fill of oil, if the SVS is oil cooled	Vendor to confirm	
<b>4.0</b>	<b>ULTRA ISOLATION TRANSFORMER</b>		
4.1	Indian make Ultra Isolation Transformer suitable for complete machine, CNC, drives, controls, PLC etc. shall be supplied	Vendor to confirm	
4.2	Make. : NEEL / AEI / SERVO MAX	Vendor to confirm	
4.3	Model and Rating	Vendor to specify and noise level also	
4.4	Spares Package for the Ultra Isolation Transformer for 2 years working should also be offered.	Vendor to submit	

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S.No	PARTICULARS AND BHEL SPECIFICATION	BIDDER'S OFFER (With complete Technical Details)	
4.5	Catalogue of the Ultra Isolation Transformer shall be submitted with the offer.	Vendor to submit	
<b>5.0</b>	<b>TOOLING:</b>		
5.1	Tooling system shall consist of a. A base tool holder mounted on faceplate slide using Standard ISO Indexable carbide inserts capable of generating all edge preparation styles indicated in ANNEXURE-1 b. Cutting Parameters: - Cutting Speed : 100-150 metres /minute Depth of Cut : 5-15 mm Cutting Feed : 0.2-0.6 mm / revolution	Vendor to specify	[2 Nos. of Tool Holders, sufficient quantity of adapters etc. recommended by the BIDDER for complete machining of prove out components (at BHEL Works) shall be offered and included in the Scope of Supply].
5.2	Details of special cuttings tools to suit the actual profiles to be machined (ref Clause No 1.4), Tool size for different tool holders	Vendor to specify	
5.3	Limitation regarding length & weight of tool / tool holder clamped in different tool holders for trouble free operation	Vendor to specify	
5.4	2 sets of tool holders, sufficient quantity of adapters, 50 nos. of each type of insert etc. recommended by vendor for complete machining of prove out components should be offered.	Vendor to confirm	

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S.No	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER (With complete Technical Details)
<b>6.0</b>	<b>DIAGNOSTIC SYSTEM</b>		
<b>6.1</b>	<b>TELE-DIAGNOSTIC SERVICE:</b>		
6.1.1	Tele-diagnostic service should be provided through International telephone lines along with required Hardware / Software package for the supplied CNC system for remote diagnosis and correction of the problems in both CNC System and PLC of the machine. This should be provided free of charge for the guarantee period. The Vendor should inform terms and conditions for the service after guarantee period. Subsequently, it should be possible to use other platforms, such as Internet or ISDN, subject to their availability in future. BHEL will provide the necessary telephone line near the machine.	Vendor to confirm	
<b>6.2</b>	<b>FAULT DIAGNOSTIC SYSTEM:</b>		
6.2.1	Vendor's own diagnostic system with required hardware and software should be supplied and installed on the CNC system. This should include customized auto-diagnostic system with supporting hardware and software, which shows detailed cause, and remedy for the fault on the display for faults related to mechanical and electrical maintenance.	Vendor to confirm	
6.2.2	Help guide should be provided to use both diagnostic systems	Vendor to confirm	

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S.No	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER (With complete Technical Details)
<b>7.0</b>	<b>LEVELING &amp; ANCHORING SYSTEM</b>		
7.1	Complete anchoring system including foundation bolts, anchoring materials, fixators, leveling shoes etc should be supplied	Vendor to specify	
<b>9.0</b>	<b>SPARES:</b>		
9.1	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: <b>(Unit Price of each item of spare should be offered)</b>	Vendor to confirm	
9.2	<b>Mechanical &amp; Hydraulic Spares:</b> All types of Pumps, Valves, Pressure Switches, Transducers, Flow Switches, Filters, Seals, O-rings, Hydraulic Hoses etc.	Vendor to confirm	
9.3	<b>Electrical /Electronic / CNC Spares:</b> All types of Relays, Contactors, Proximity Switches, Push Buttons, Indicating Lamps, Semiconductor Fuses, Special Fuses, Circuit Breakers, Main Power Switch, Encoders, , spares for CNC, Servo Motors for Feed Drives, Power Module & Control Cards for Main Drive as well as Feed Drives etc.	Vendor to confirm	

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S.No	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER (With complete Technical Details)
9.4	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	
9.5	Recommended set of spares for all attachments are to be offered with details.	Vendor to confirm	
9.6	Spares listed in Annexure – II shall be offered.	Vendor to confirm	
<b>10.0</b>	<b>DOCUMENTATION:</b>		
10.1	Set of Documents <b>to be submitted along with the Offer</b> for technical evaluation:	Vendor to confirm	
10.1.1	General Lay-out of the machine with major and critical dimensions in line with the specification	Vendor to furnish	
10.1.2	General Assembly drawing of the machine with bill of materials and critical dimensions	Vendor to furnish	
10.1.3	Sub-assembly drawings with bill of materials and critical dimensions for all the major sub-assemblies in the machine.	Vendor to furnish	
10.1.4	List of bought out items with make and specification along with catalogues: Motors, Gear boxes, Controllers, Drives, Cylinders, Seals, CNC system, PLC, etc.	Vendor to furnish	
10.1.5	Hydraulic / Pneumatic Circuit with Bill of Materials giving specification and make of components used.	Vendor to furnish	
10.1.6	Lubrication / Coolant Circuit with Bill of Materials giving specification and make of components used.	Vendor to furnish	

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S.No	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER (With complete Technical Details)
10.1.7	Electrical Circuit with Bill of Materials giving specification and make of components used.	Vendor to furnish	
10.1.8	Video images on CD /Hard copy of literature with photographs & drawings explaining the technical features.	Vendor to furnish	
10.2	Set of Documents <b>to be submitted after placement of order</b> for approval / verification before manufacturing:	Vendor to confirm	
10.2.1	General Lay-out of the machine with major and critical dimensions in line with the specification and Preliminary Foundation drawing.	Vendor to confirm	
10.2.2	General Assembly drawing of the machine with bill of materials and critical dimensions	Vendor to confirm	
10.2.3	Sub-assembly / Arrangement drawings with bill of materials and critical dimensions for all the sub-assemblies in the machine.	Vendor to confirm	
10.2.4	Hydraulic / Pneumatic Circuit with Bill of Materials giving specification and make of components used.	Vendor to confirm	
10.2.5	Lubrication / Coolant Circuit with Bill of Materials giving specification and make of components used.	Vendor to confirm	
10.2.6	Electrical Circuit with Bill of Materials giving specification and make of components used.	Vendor to confirm	
10.2.7	Quality plan	Vendor to confirm	
10.3	Set of Documents <b>to be submitted along with machine:</b>	Vendor to confirm	

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S.No	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER (With complete Technical Details)
10.3.1	<b>Three sets</b> of following documents as Hard copies and 1 set of all documents including bought out item catalogues – soft copy in CD in English Language should be supplied along with the machine.	Vendor to confirm	
10.3.2	<b>One set</b> of complete documents as Hard copy and complete documents in CD / Pen drive to be submitted during inspection at supplier's works for verification. This forms part of acceptance criteria at supplier's works.	Vendor to confirm	
10.3.3	Operating Manuals of Machine & CNC system	Vendor to confirm	
10.3.4	Programming Manuals for the machine & CNC system.	Vendor to confirm	
10.3.5	Detailed Maintenance manual of machine with all drawings of machine assemblies/sub-assemblies/parts including Electrical /PCB circuit diagrams/ Pneumatic/ Hydraulic Circuit Diagrams. All Assembly/ Sub Assembly Drawings shall be supplied with the part list / Bill of Materials giving complete specification and make of components.	Vendor to confirm	
10.3.6	Hydraulic / Pneumatic Circuit with Bill of Materials giving specification and make of components used. Function diagram of the Hydraulic / Pneumatic system to be provided with the circuit.	Vendor to confirm	
10.3.7	Lubrication / Coolant Circuit with Bill of Materials giving specification and make of components used.	Vendor to confirm	
10.3.8	Electrical Circuit with Bill of Materials giving specification and make of components used.	Vendor to confirm	
10.3.9	Maintenance, Interface & Commissioning Manuals for for CNC system, spindle & feed drives.	Vendor to confirm	

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S.No	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER (With complete Technical Details)
10.3.10	Manufacturing drawings for all wearing components like bushes, pulleys, gears, clutch plates, etc.	Vendor to confirm	
10.3.11	Manufacturing drawings for all supplied tool holders, cutting tools, adapters, sleeves, fixtures etc.	Vendor to confirm	
10.3.12	Catalogues, O&M Manuals of all bought out items including drawings, wherever applicable highlighting the specific model used in the supplied machine.	Vendor to confirm	
10.3.13	Detailed specification of all rubber items, hoses, fittings, etc. List of bearings, belts used to be provided.	Vendor to confirm	
10.3.14	Operating Manuals, Maintenance Manuals & Catalogues for all supplied Accessories including Voltage stabilizer, Isolation transformer, etc.	Vendor to confirm	
10.3.15	Complete Master List of parts used in the equipment.	Vendor to confirm	
10.3.16	Complete list of spares for equipments and accessories, along with item part no / specification / type / model, and name & address of the spare supplier shall be furnished.	Vendor to confirm	
10.3.17	PLC program printouts with comments in English.	Vendor to confirm	
10.3.18	PLC program on CD, NC data & PLC data on CD	Vendor to confirm	
10.3.19	Complete back up of hard disk on CD and clear written Instructions (3 copies) to take back up and reloading of a new hard disk.	Vendor to confirm	
<b>11.0</b>	<b>TRAINING:</b>		
11.1	The Vendor shall train Three BHEL's Engineers in Operation and Maintenance (Mechanical, Electrical/ Electronics and CNC System) of the Machine at Vendor's works for a period of 5 working days.	Vendor to confirm	

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S.No	PARTICULARS AND BHEL SPECIFICATION	BIDDER'S OFFER (With complete Technical Details)
11.2	The Vendor shall impart training to BHEL's Machine Operators and Maintenance crew in Operation and Maintenance after the commissioning of the Machine at BHEL works for 6 working days	Vendor to confirm
11.3	Airfare, boarding & lodging for the trainees shall be borne by BHEL.	Vendor o Confirm
11.4	Competent, English speaking experts shall be arranged by the vendor during training for satisfactory & effective training of BHEL personnel	Vendor to Confirm
11.5	Vendor to quote for training on per man per week basis for training at vendor's work	Vendor to confirm
<b>12.0</b>	<b>FOUNDATION:</b>	
12.1	Vendor shall submit the preliminary layout drawing for getting BHEL's approval within one month from the date of P.O. Complete Foundation / dynamic load shall be submitted by the Vendor within three months after getting BHEL's approval. The layout should consist of all requirements pertaining to complete machine including space requirement for Voltage Stabilizer, Isolation Transformer, & any other accessories. BHEL shall construct complete foundation for the machine as per the Vendor's recommendation and drawing.	Vendor to submit

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S.No	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER (With complete Technical Details)
12.2	Vendor should arrange equipments required for the testing of foundation, if required by the Vendor. The Vendor shall also indicate detailed specifications of grouting compound and Grouting procedure etc. for foundation bolts of the machine	Vendor to confirm	
<b>13.0</b>	<b>ERECTION &amp; COMMISSIONING</b>		
13.1	Vendor to take full responsibility for supervision of the erection, vendor shall start up, test the machine, it's control & all types of other supplied equipment, carrying out machining of test pieces etc. Service requirement like power, air & water shall be provided by BHEL at only one point to be indicated by Vendor 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	
13.2	Erection & Commissioning of Voltage stabilizer, Isolation Transformer & Air Compressor shall also be responsibility of the Vendor.	Vendor to confirm	
13.3	Successful proving of BHEL components by the Vendor shall be considered as part of commissioning. All tests, as mentioned in (clause 17.0) shall form part of the commissioning activity.	Vendor to confirm	
13.4	Tools, Tackles, Test Mandrels, instruments and other necessary equipment including Laser equipment required to carry out all above activities should be brought by the Vendor.	Vendor to confirm	

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S.No	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER (With complete Technical Details)
13.5	Necessary tools like Torque Wrench, Spanners, Keys, grease guns etc. for operation and maintenance of the machine should be supplied. List of such tools should be submitted with offer		
13.6	Special equipments, like test mandrel, straight edge, dial indicators etc., should be supplied along with the machine.		
13.7	Commissioning spares, required for commissioning of the machine within stipulated time, shall be brought by the Vendor.	Vendor to confirm	
13.8	Portion, if any, of the machine, accessories and other supplied items where paint has rubbed off or peeled during transit or erection should be repainted and merged with the original surrounding paint by the vendor. For this purpose, the Vendor should supply sufficient quantity of touch-up paint of various colours of paint used.	Vendor to confirm	
13.9	Schedule of Erection and Commissioning shall be submitted with the offer.	Vendor to confirm	
13.10	Charges, duration, terms & conditions for E&C should be furnished in detail separately by Vendor along with offer.	Vendor to confirm	
<b>14.0</b>	<b>ACCURACY TESTS:</b>		
<b>14.1</b>	<b>GEOMETRICAL ACCURACY</b>		
14.1.1	Geometrical Accuracy Tests shall be in accordance with applicable standard recommended by the Vendor. Detailed Test Charts for the same, clearly showing the accuracies to be achieved on the machine, shall be submitted with the offer.	Vendor to confirm	

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S.No	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER (With complete Technical Details)
14.1.2	All other accuracies shall confirm to Vendors Test chart.	Vendor to confirm	
14.1.3	All the above accuracies should be demonstrated to BHEL engineers during pre-acceptance at Vendors works and during Erection & Commissioning at BHEL Works.	Vendor to confirm	
<b>14.2</b>	<b>MACHINE POSITIONING ACCURACIES &amp; REPEATABILITY:</b>	Vendor to confirm	
14.2.1	Positioning accuracy in X axis (Pa) per 1000 mm	+/-0.2mm vendor to specify	
14.2.2	Positioning accuracy in Z axis (Pa) per 1000 mm	+/- 0.2mm vendor to specify	
14.2.3	Repeatability in X axis (Ps)	+/- 0.15mm Vendor to specify	
14.2.4	Repeatability in Z axis (Ps)	+/- 0.15mm Vendor to specify	
14.2.5	All the above accuracies should be demonstrated to BHEL engineers during pre-acceptance at Vendors works and during Erection & Commissioning at BHEL Works	Vendor to confirm	

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S.No	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER (With complete Technical Details)
15.0	<b>AMBIENT CONDITIONS &amp; THERMAL STABILITY:</b>		
15.1	Total machine including CNC system and all supplied items should work trouble free and efficiently under following operating conditions and should give specified accuracies. Power Supply: Voltage: 415 V $\pm$ 10% Frequency: 50 Hz $\pm$ 3%, 3 Phase The machine shall be suitable for an ambient temperature of +50 ° C and relative humidity of 85 % respectively, but both do not occur simultaneously	Vendor to confirm that machine is suitable for above and details of provisions on the machine for the same are to be furnished by Vendor	
15.2	Weather conditions are tropical, Atmosphere may be dust laden during some part of the year. Machine shall be kept in the normal shop floor condition	Vendor to confirm that machine is suitable for above and details of provisions on the machine for the same are to be furnished by Vendor	
15.3	Thermal Stability of the complete machine keeping in view specified Ambient Conditions and accuracy requirements of BHEL components and vendor should ensure trouble free operation of the machine.	Vendor to confirm that machine is suitable for above and details of provisions on the machine for the same should be furnished by Vendor	

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S.No	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER (With complete Technical Details)
15.4	The machine, including attachments and accessories, should be suitable for 24 hrs. Continuous operation to its full capacity for 24 hour a day and 7 days a week throughout.	Vendor to Confirm	
<b>16.0</b>	<b>PROVEOUT OF BHEL COMPONENTS:</b>		
16.1	The prove-out trials of the edge preparation shall be for the straight and bend pipes for sizes given by BHEL during the technical discussions / at the time of releasing the Purchase Order. The pipe ends subjected to facing and edge preparation will be either <b>flame cut or saw cut. 3 jobs in the size range &amp; edge preparation style specification</b>	Vendor to confirm	
<b>17.0</b>	<b>MACHINE ACCEPTANCE: (Tests/Activities to be Performed by Vendor)</b>		
<b>17.1</b>	<b>Tests/Activities to be carried out at Vendor's works on the machine before dispatch:</b>		
17.1.1	Geometrical accuracies as per applicable standard test chart recommended by the Vendor	Vendor to confirm	
17.1.2	Positioning accuracies as per Applicable standard method recommended by the Vendor.	Vendor to confirm	
17.1.3	Full load test to demonstrate the maximum power & cutting capacity of the machine.	Vendor to confirm	
17.1.4	Demonstration of all features of the machine, control system & accessories	Vendor to confirm	
17.1.5	Machining of test pieces to perform the edge preparation profiles (as per S.No 1.4). Test pieces & toolings to be arranged by vendor.	Vendor to confirm	

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S.No	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER (With complete Technical Details)
17.2	<b>Tests / Activities to be carried out at BHEL works while commissioning the machine:</b>	Vendor to confirm	
17.2.1	Geometrical accuracies as per. Applicable standard test chart recommended by the Vendor	Vendor to confirm	
17.2.2	Positioning accuracies as per Applicable standard method recommended by the Vendor.	Vendor to confirm	
17.2.3	Full load test to demonstrate the maximum power & cutting capacity of the machine.	Vendor to confirm	
17.2.4	Demonstration of all features of the machine, control system & accessories to the satisfaction of BHEL for efficient and effective use of the machine	Vendor to confirm	
17.2.5	Demonstration by actual use of all supplied attachments and accessories to their full capacity.	Vendor to confirm	
17.2.6	Machining of test pieces to perform the edge preparation profiles ( <b>as per S.No 1.4</b> ). Test pieces will be provided by BHEL. Tooling shall be provided by vendor.	Vendor to confirm	
17.2.7	The prove-out trials <b>as per Clause 16.0</b>	Vendor to confirm	
17.2.8	Supervision by vendors of independent operation of machine by BHEL after job prove out during the training period of 6 working days	Vendor to confirm	
<b>18.0</b>	<b>PACKING:</b>		
18.1	Sea worthy & rigid packing for all items of complete machine, CNC System, all accessories and other supplied items to avoid any damage/loss in transit. When machine is dispatched in containers, all small loose items shall be suitably packed in boxes	Vendor to confirm	

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S.No	PARTICULARS AND BHEL SPECIFICATION		BIDDER'S OFFER (With complete Technical Details)
<b>19.0</b>	<b>GUARANTEE:</b>		
19.1	12 months from the date of acceptance of the machine Or 18 months from dispatch, whichever is earlier.	Vendor to confirm	
<b>20.0</b>	<b>GENERAL:</b>		
20.1	Machine Model No.	Vendor to specify	
20.2	Total connected load (KVA):	Vendor to specify	
20.3	Floor area required (Length, Width, Height) for complete machine & accessories	Vendor to specify	
20.4	Machine lubrication	Automatic centralized lubrication system.	
20.5	Painting of machine / electrical panel	RAL6011 Resada Green (Polyurethane paint)	
20.6	All gears are to be hardened and ground	Vendor to specify.	
20.7	Total weight of the machine	Vendor to specify	
20.8	Weight of heaviest part of machine	Vendor to specify	
20.9	Weight of the heaviest assembly / sub-assembly of the Machine	Vendor to specify	
20.10	Dimensions of largest part/ sub-assembly/ assembly of the machine	Vendor to specify	
20.13	Hydraulic, Pneumatic & oil piping should be preferably metallic except places where flexible piping is essential. All the pipes required for the same shall be included in the standard scope of the machine.	Vendor to confirm	

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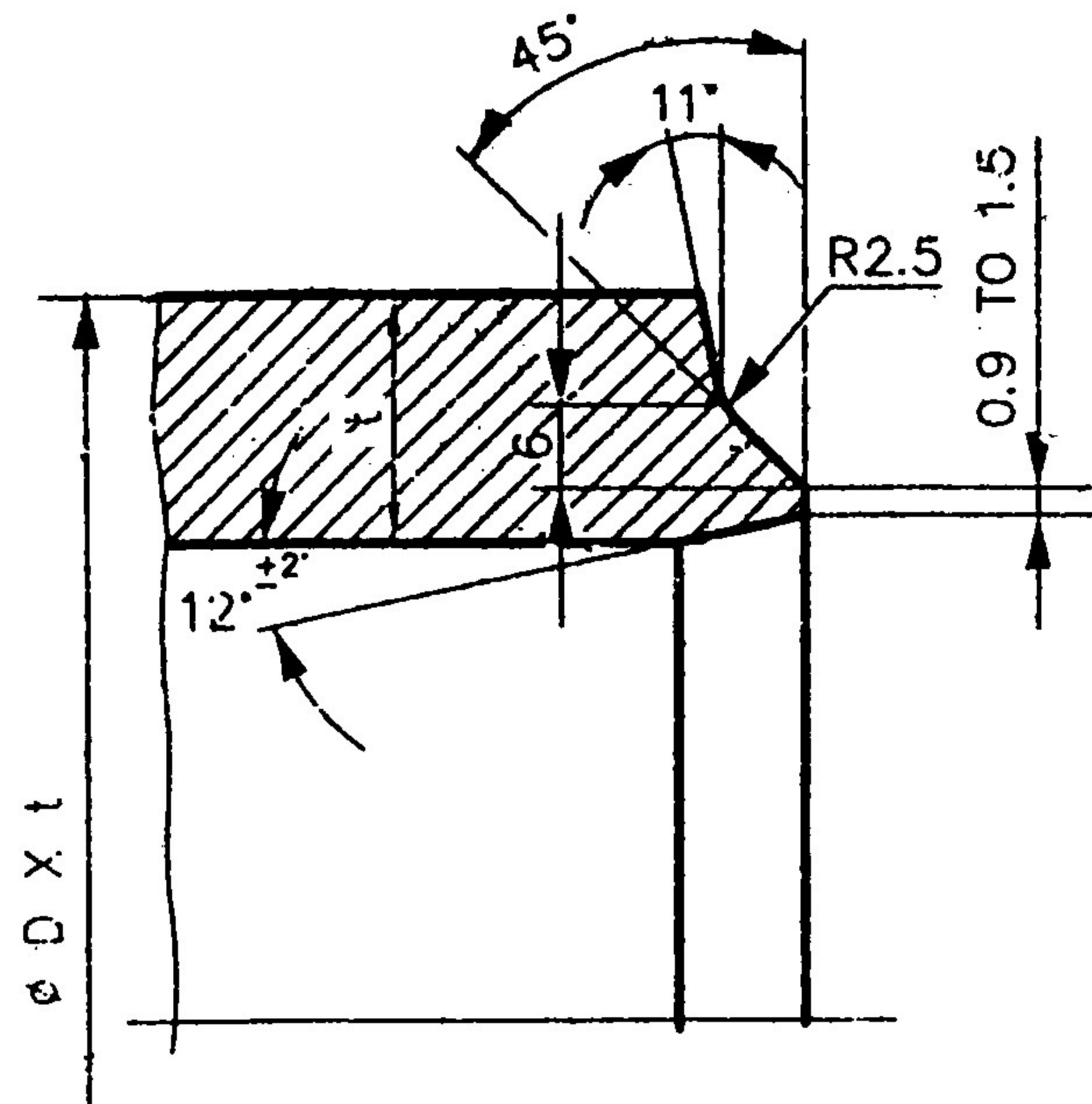
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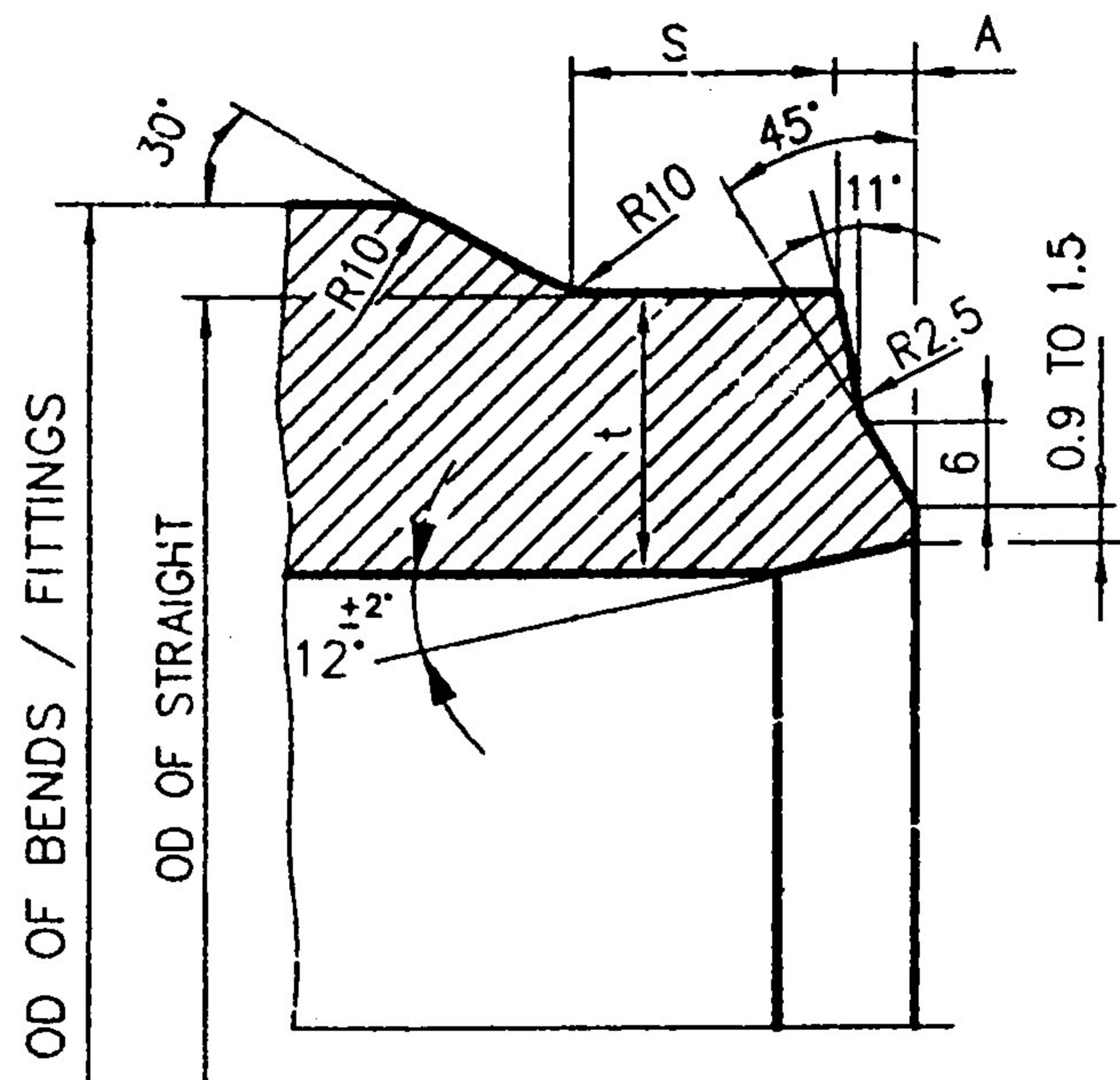


USE WHEN  $t \geq 14.2$  mm.

STYLE - P

**ANNEXURE - 1**  
**Drg No. CABS-1-16 - 01**  
**BHEL, Tiruchirappalli**

02. WHEN  $t < 65$   $S + A = 65$  Min. &  $t > 65$ ,  $S = 65$  Min.  
 WHERE  $t = \text{THK OF CONN. PIPE (STRAIGHT)}$ .



STYLE - Pa

ANNEXURE - 1  
Drg No. CABS-1-16-02  
BHEL, Tiruchirappalli

NOTES: -

01. APPLICABLE FOR P91 MATERIAL
02. FOR OD MISMATCHING REF. FIGURE-Xa.
03.  $\alpha = 6^\circ$  FOR WALL THICKNESS  $\leq 30$  mm
04.  $\alpha = 10^\circ$  FOR WALL THICKNESS  $> 30$  mm

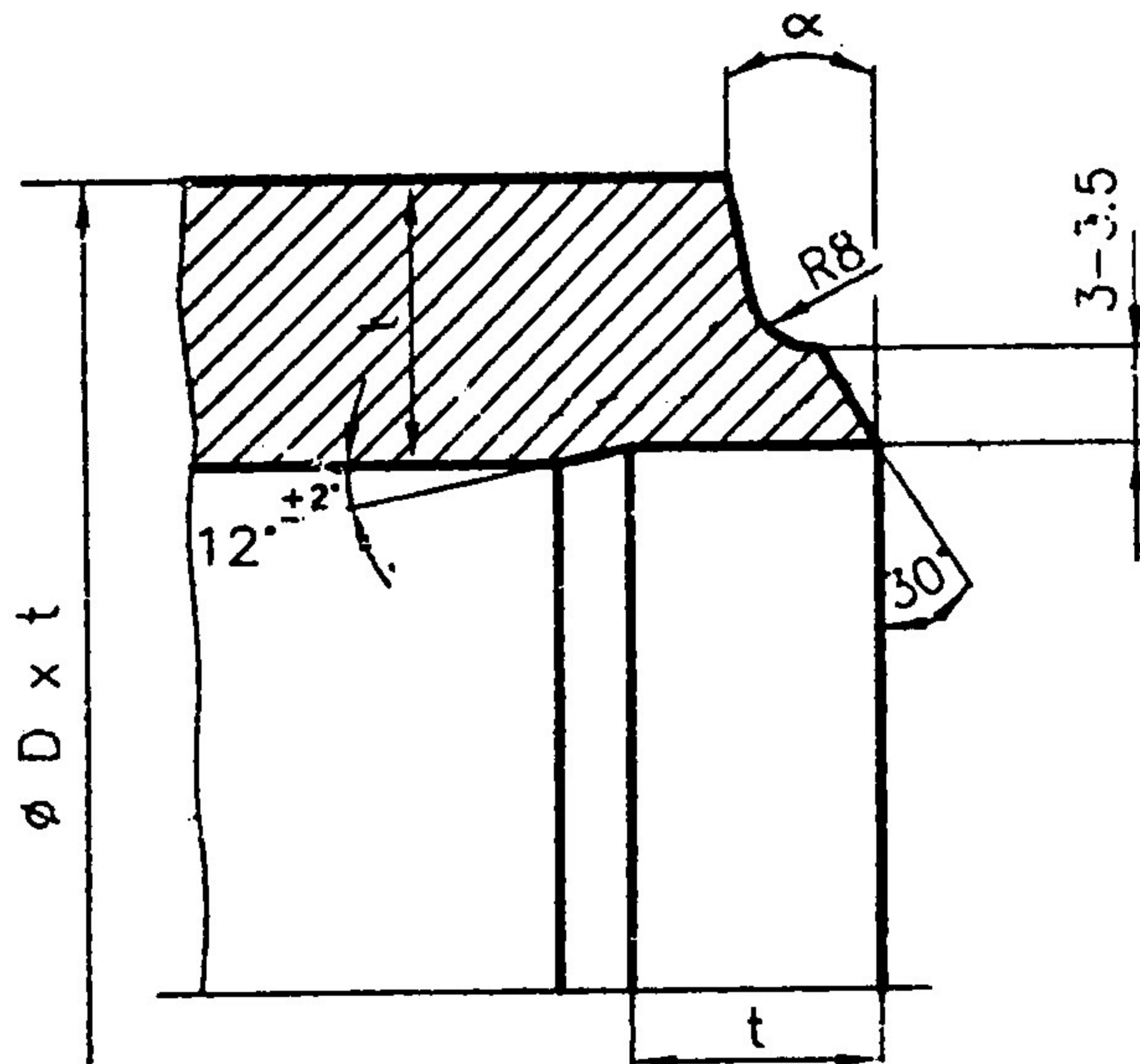


FIGURE - X

NOTES: -

01. OD OF STRAIGHT TO BE PHYSICALLY MEASURED/VERIFIED
02.  $\alpha = 6^\circ$  FOR WALL THICKNESS  $\leq 30$  mm
03.  $\alpha = 10^\circ$  FOR WALL THICKNESS  $> 30$  mm

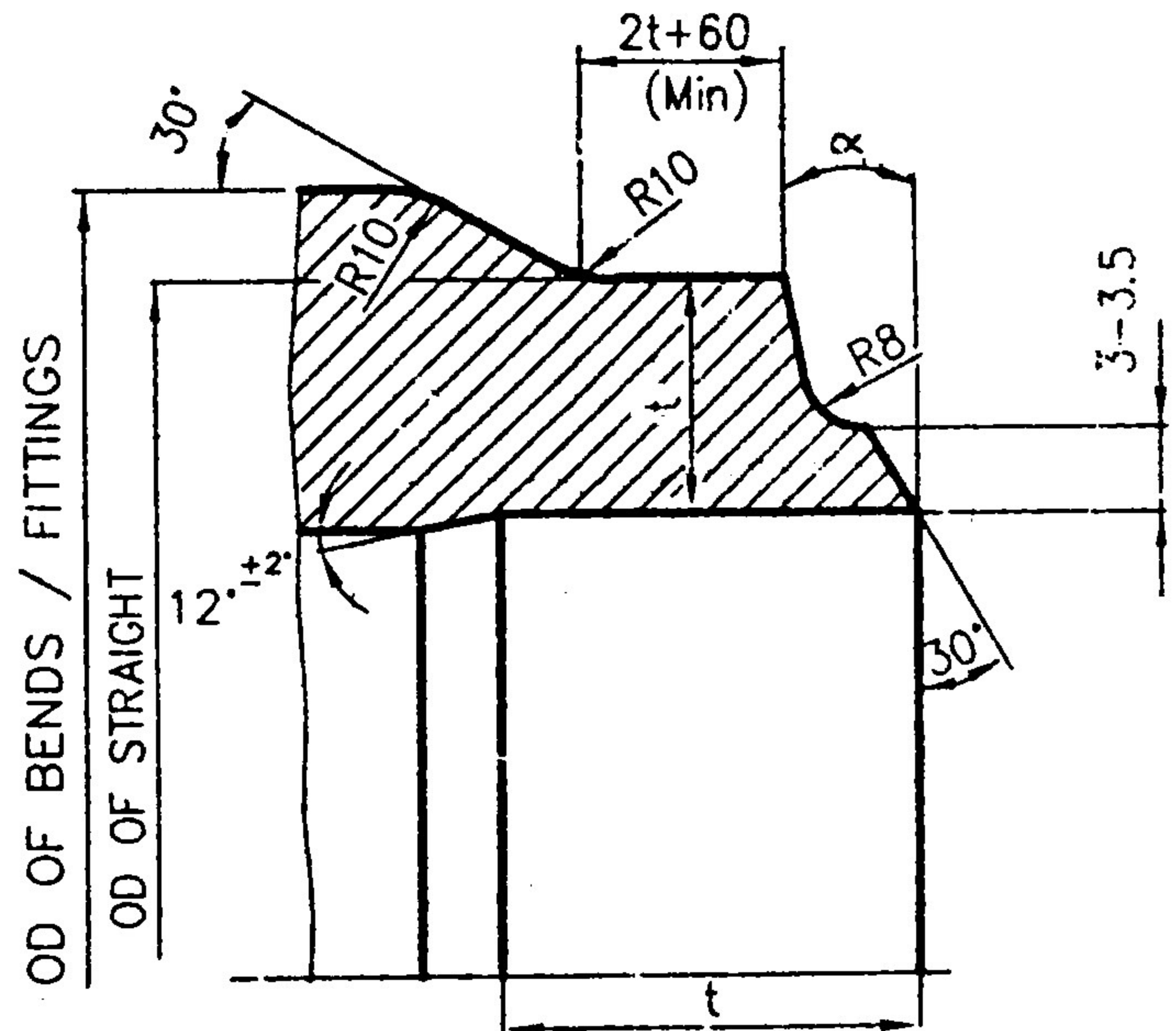


FIGURE - Xa

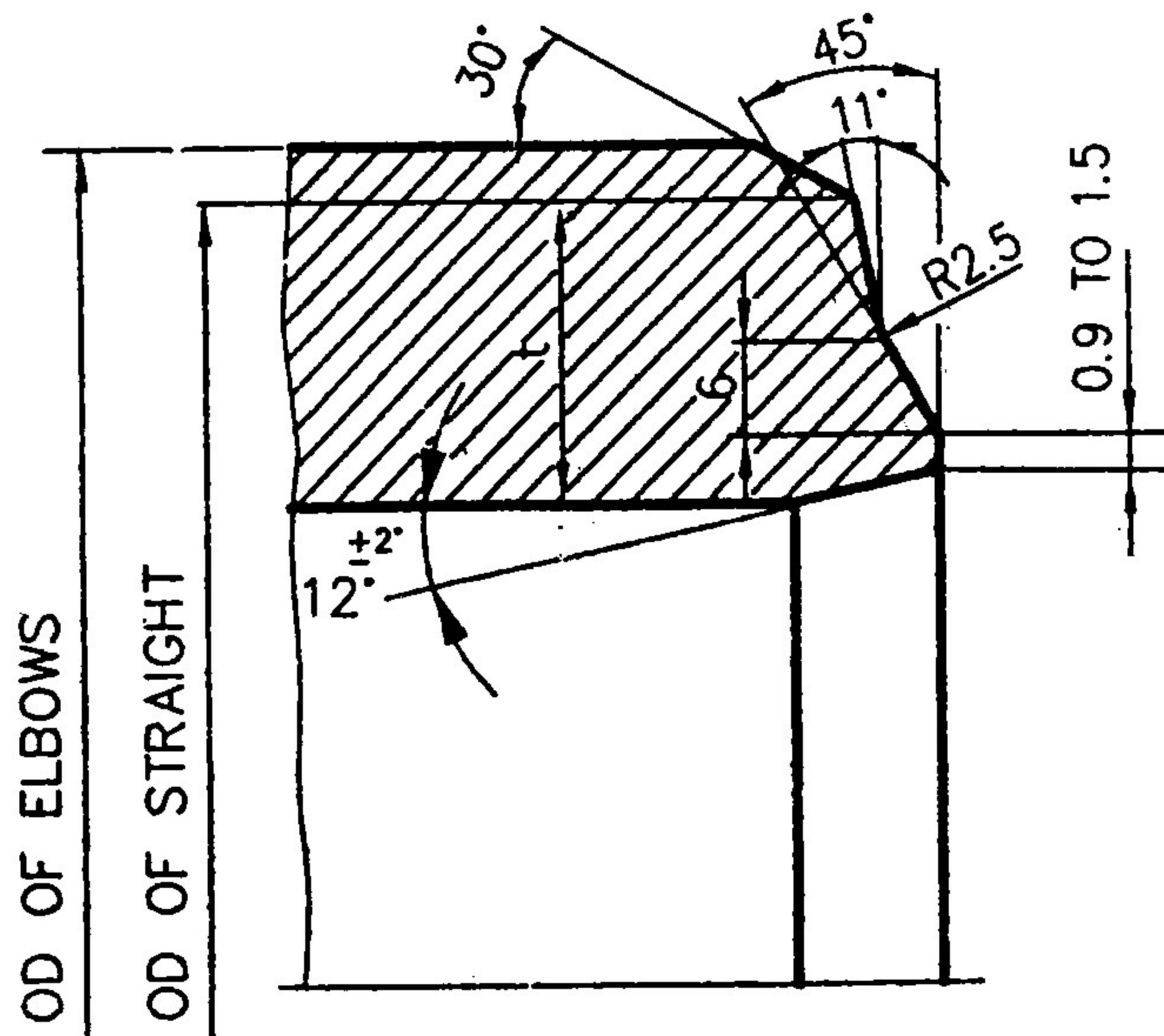
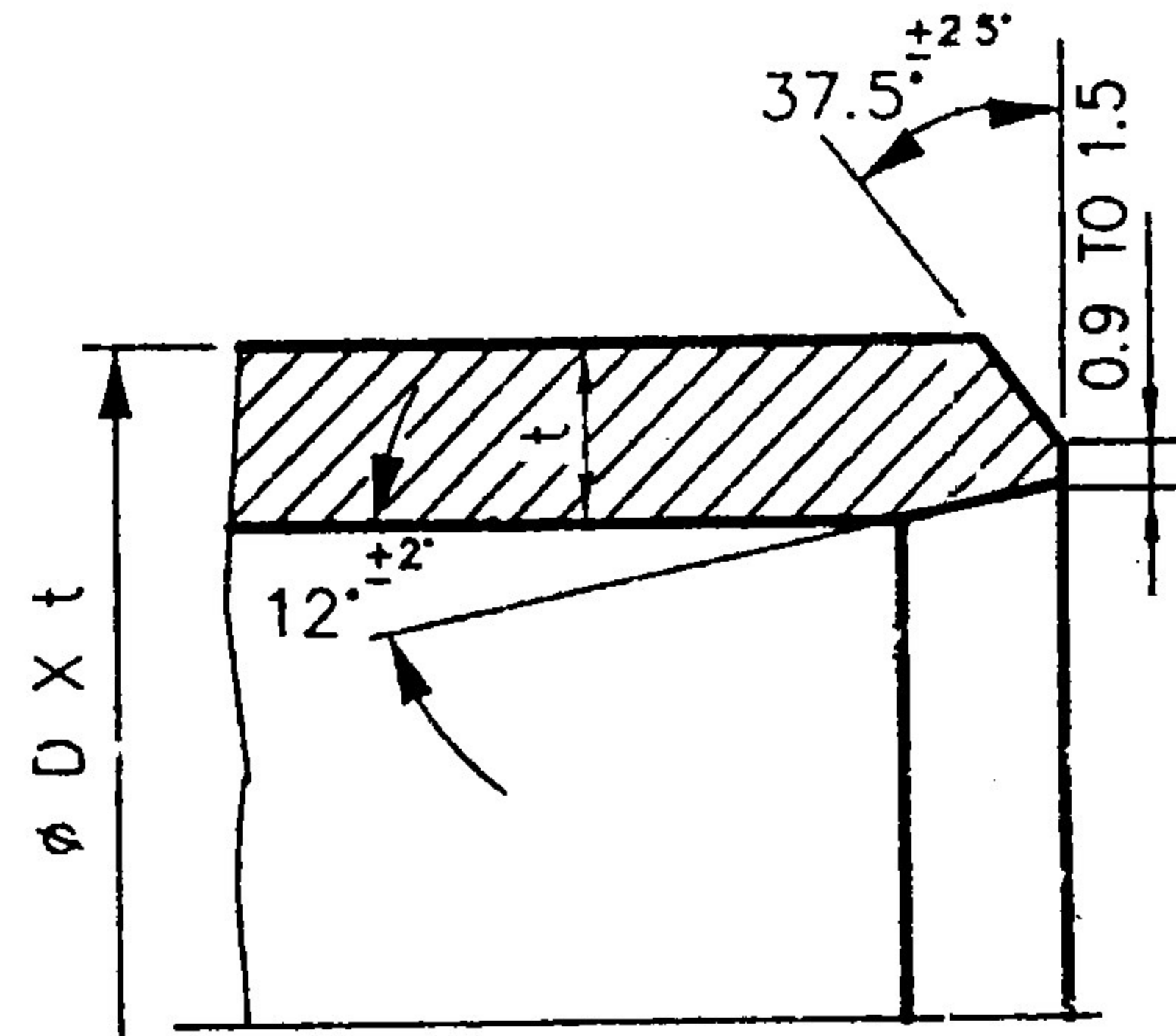


FIGURE - Z



STYLE - D

NOTES: -

01. USE WHEN  $t < 14.2$  mm.

**ANNEXURE - 1**

**Drg No CABS-1-16 - 03**

**BHEL, Tiruchirappalli**



**Annexure- II SPARES LIST (for 2 machines)**

<b>I</b>	<b>MECHANICAL &amp; HYDRAULIC SPARES</b>	
1	Set of gaskets and O rings (for the entire machine) – list to be provided with part nos. at the time of drawing approval stage.	2 Sets
2	Ball screw for Z axis	2 Nos.
3	Toothed belts (for the entire machine)	2 Sets
4	Hydraulic pump – Main pump	2 Nos.
5	Set of contactors, relays and limit switches (for the entire machine) – 1 No. of each type	2 Sets
6	Transducer for head-stock	2 Nos.
7	Hydraulic Valves – 1 No. of each type	2Sets
8	Pressure switches - 1 No. of each type	2 Sets
9	Hydraulic Transducers - 1 No. of each type	2 Sets
10	Flow switches - 1 No. of each type	2 Sets
11	Filter elements - 3 Nos. of each type	2 Sets
12	Hydraulic cylinder Seal kits - 1 No. of each type of cylinder	2 Sets
13	Hydraulic hoses - 1 No. of each type	2 Sets
14	Lubrication pump	2 Nos.
15	Lubrication – metering cartridges – 2 Nos. of each type	2 Sets
16	Spindle bearings - complete set	2 Sets



<b>II</b>	<b>ELECTRICAL, ELECTRONIC AND CNC SYSTEM SPARES</b>	
1	Proximity switches (for the entire machine)	2 Sets
2	Push buttons (for the entire machine)	2 Sets
3	Indicating lamps (for the entire machine)	2 Sets
4	Semiconductor fuses (for the entire machine)	2 Sets
5	Special fuses (for the entire machine)	2 Sets
6	Circuit breakers (for the entire machine)	2 Sets
7	Main power switch	2 Nos.
8	Encoder for Z axis	2 Nos.
9	Encoder for X axis	2 Nos.
10	CNC System spares (list to be provided by vendor)	2 Sets