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 Web : www.bhel.com

TWO PART BID Tender to be submitted in two parts.	**Enquiry Number:** **2620900154**	**Enquiry Date:** **24.08.2009**	**Due date for submission of quotation:** **08.10.2009**

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	**Tube Bending Machine** as per the technical specification, general guidelines instructions & commercial conditions applicable (to be downloaded from web site www.bhel.com or http://tenders.gov.in)	**01 No.**

Important points to be taken care during submission of offer

1. **Delivery required 12 months from the date of purchase order.**
2. **Grace period of 2 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 "2620900154".

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
PIPE TO PIPE/FITTING WELDING STATION
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	Only those vendors (**OEMs**), who have supplied and commissioned at least **ONE CNC TUBE BENDING MACHINE of suitable size** in the past ten years (from the date of opening of Tender) and such equipment is presently working satisfactorily for more than one year after commissioning (from the date of opening of Tender) should quote. However, if such equipment had already been supplied to BHEL, then that machine should be presently working satisfactorily for more than six months after it's commissioning and acceptance (from the date of opening of Tender).	
	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 equipment 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 equipment.	
1.5	Application for which the equipment is supplied	
1.6	Along with the Technical offer, the Vendor should submit one Performance certificate from the customer for the satisfactory performance of the equipment supplied to them. For obtaining the Performance certificate, a suggestive format is provided in **SECTION – IV.**	
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	**DELIVERY** - The bidder shall quote the best possible delivery. However the delivery shall not exceed 12 months with an additional grace period of 2 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.	

SECTION – I I

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

S. No.	REQUIREMENTS	VENDOR's RESPONSE
3.0	The BIDDER/VENDOR to furnish Reference List of Customers, with full address, details of contact person, where CNC Tube bending machine similar to offered have been supplied in the past.	
4.0	Details of CNC Tube bending machine supplied to other BHEL units, if any. (Year of commissioning, tube diameter, thickness)	
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.	

SECTION – III

The BIDDER to note:

S. No.	PARTICULARS	VENDOR'S RESPONSE
7.0	The BIDDER / VENDOR shall submit the offer in TWO PARTS. 1. Technical Offer [with PART A & PART B] & commercial offer 2. Price Bid.	
8.0	The Technical Offer shall contain a comparative statement of Technical **Specifications demanded by BHEL** and **Offer Details submitted by the Bidder**, against each clause. A just 'CONFIRMED' or 'COMPLIED' or 'YES' or 'NO-DEVIATION' or similar words in the technical comparative statement where specific details are required 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.	

SECTION – IV

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

PERFORMANCE CERTIFICATE

(On Customer's Letter Head)

1. Supplier of the machine :

2. Make & Model of the Equipment :

3. Month & Year of Commissioning :

4. Application :

5. a) Machine type : CNC Tube bending machine
   b)Max size of pipe (Dia X thick) : 88.9mm,12.5mm thick carbon/alloy Steel

6. Performance of the Machine :
   (Strike off whichever is not applicable) Satisfactory /
   Good /
   Average /
   Not Satisfactory

7. Service after Sales:
   (Strike off whichever is not applicable) Satisfactory /
   Good /
   Average /
   Not Satisfactory

Date: Signature & Seal of the Authority
Issuing the Performance certificate

A.N A.A R.D'S A.J M.D

TECHNICAL SPECIFICATIONS for CNC TUBE BENDING MACHINE

S. No.	PARTICULARS	BHEL SPECIFICATIONS	BIDDER's OFFER [with Complete Technical Details]
1.	Area of Application	The machine is meant for the cold bending of seamless steel tubes in multi-plane axes to form high-pressure components for Power Boilers and Industrial boilers for Process Industries. The bending system shall be Draw-Bending type by Electro-Hydraulic means and with CNC mode of operation.	

2.TUBE SIZES: All are OD (outer diameter) Controlled tubes with thickness tolerance of Maximum +12½ %

Sl.No	OUTER-DIAMETER in mm	WALL THICKNESS RANGE in mm (Tolerance: Max. +12½ %)
1	**31.8**	3.2 / 3.6 / 4.0 / 5.0
2	**38.1**	3.2 / 4.0 / 5.0 / 6.3/8.1/9.0/9.5
3	**41.3**	7.4
4	**42.4**	8.6/9.1
5	**44.5**	4.0 /4.2/ 4.5 / 5 /5.6/ 6.3 /7.6/ 8 /8.1/ 9 / 10
6	**47.63**	5 / 6.3 / 8 / 10
7	**48.3**	8.1
8	**51.0**	3.6 / 4 / 4.5 / 5 / 6.3 / 8 / 10 / 12
9	**54.0**	3.6 / 4 / 4.5 / 5 / 6.3 / 8 / 10 / 12
10	**57.0**	4 / 5 / 6.3 / 8 / 10
11	**60.3**	4 / 5 / 6.3 / 8 / 10 / 12.5
12	**63.5**	4.8 / 5.6 / 6.3 / 10 / 12.5
13	**76.1**	7.1 / 10 / 12.5
14	**88.9**	4 / 5.5 / 6.3 / 12

3. MATERIALS:

a	**CARBON STEEL :**	**SA 192, SA 209 Gr. T1, SA 210 Gr.A1/Gr.C (ASTM)**
b	**ALLOY STEEL :**	**SA 213 Gr.T2, T11, T12, T22, T91 (ASTM)**
c	**STAINLESS STEEL :**	**SA 213 304H, 316L, 347H (ASTM)**
d.	**GOST Standards: 12X1Mϕ / Steel 20**	

4. RADII OF BENDS:

Sl.No	TUBE OUTER DIAMETER in mm	RADIUS OF BENDS in mm
1	**31.8**	R 48, 60, 65, 100
2	**38.1**	R 65, 80, 100, 114, 125, 151
3	**44.5**	R 65, 75, 80, 90, 100, 114, 143
4	**47.63**	R 71.5, 76.5, 80, 114, 152
5	**51.0**	R 76.2, 90,100, 114, 121, 151
6	**54.0**	R 65, 114, 165
7	**57.0**	R 100, 151
8	**60.3**	R 160, 200
9	**63.5**	R 160, 200
10	**76.1**	R 160, 200, 225, 300
11	**88.9**	R 240

S. No.	PARTICULARS	BHEL SPECIFICATIONS		BIDDER's OFFER [with Complete Technical Details]
5	**TOLERANCES FOR BENDS:**			
5.1	VISUAL DEFECTS	It shall be free from harmful surface visual defects, such as scoring marks, wrinkles, tool marks and depressions.		
5.2	PERCENTAGE OVALITY	% Ovality = {(Max. OD - Min. OD)/ nominal OD} x100	To be Less than 10%	
5.3	PERCENTAGE THINNING	% Thinning = {(t1 - t2)/ t1} x 100 Where, t1 – nominal wall thickness before bending t2 – minimum wall thickness after bending	Maximum allowed Thinning is 10%	
5.4	FLATNESS	Cold bending operation	No flatness allowed	
5.5	TUBE OD AFTER BENDING	Min.Actual OD higher than (0.895Xnominal OD+0.233Xminimum Wall thickness)	Vendor to confirm	
5.6	FLOW AREA	>80% %=Actual flow areaX100/Nominal flow area	Vendor to confirm	
5.7.1	STRAIGHT PORTION	Tolerance on straight portion encompassing bends	± 5 mm	
5.7.2		Tolerance on straight portion for end limbs of multiple bends	± 5 mm	
5.7.3		Acceptance limit for Wrinkles	Wrinkles not permitted	

S. No.	PARTICULARS	BHEL SPECIFICATIONS		BIDDER's OFFER [with Complete Technical Details]
5.8	BENDING ANGLE		± 0.5 °	
5.9	BEND RADIUS	For Radius < 300 mm	± 3 mm	
6	**OPERATING PARAMETERS:**			
6.1	Tube Diameter	Minimum: 31.8 mm Maximum: 88.9mm		
6.2	Tube Wall Thickness	As given in the table (refer Sl.No. 2)		
6.3	Reference Tube Size for establishing the machine capacity	**(Diameter x Thickness)** 76.1 x 12mm; 51x3.6mm (Alloy Steel)		
6.4	Tube Clamping Length required	50mm for tubes upto OD 51mm 1D for tubes above OD 51mm		
6.5	End Limb Length	50mm for tubes upto OD 51mm 1D for tubes above OD 51mm		
6.6	Tube length handled	Minimum : 200mm Maximum: 3500mm		
6.7	Bending Radius	Minimum: 48 mm Maximum: 300 mm		
6.8	R/d ratio required	Less than or equal to 1.2		
6.9	Bending Angle to be obtained on Job	0° to 180°		
6.10	Multi Plane Turning Angle	360°		
6.11	Bending Direction	Clockwise		
6.12	Most frequently used Tube sizes	OD 44.5 x 5 / R 143 / SA106 Gr C		

S. No.	PARTICULARS	BHEL SPECIFICATIONS	BIDDER's OFFER [with Complete Technical Details]
6.13	Use of the machine	Each lot will have maximum of 50 tubes for a particular bend configuration.	
6.14	Production Output required-Single bends in each tube	500 bends / shift (8 hrs) in OD 44.5 x 5mm tube, Radius - 143mm	
6.15	'S' bend configuration (zero distance between bends)	Angles as given in **Annexure - 2**	
6.16	Mandrels	Mandrels not required	
6.17	Tube Working Height	Maximum - 1200mm from ground level	
6.18	Maximum Bending Speed	Vendor to specify with calculation.	
6.19	Minimum Reverse Speed	Vendor to specify with calculation.	
6.20	Clamp & Pressure Slide Stroke	Vendor to specify with calculation.	
6.21	Follower Slide Stroke	Vendor to specify with calculation.	
6.22	Traveling Speed of Carriage	Vendor to specify with calculation.	
6.23	Maximum Bending Torque	Vendor to specify with calculation.	
6.24	Maximum section modulus that can be bent on the machine	Vendor to specify with calculation.	
6.25	Total Power Requirement in kVA	Vendor to specify	

S. No.	PARTICULARS	BHEL SPECIFICATIONS	BIDDER's OFFER [with Complete Technical Details]
7	**CNC AXES SPECIFICATIONS:**		
7.1	**SPEEDS:**		
7.1.1	Y-axis: Tube Feed/Transport Speed	Vendor to specify with calculation.	
7.1.2	B-axis: Tube Rotation Speed (range)	Vendor to specify with calculation.	
7.1.3	C-axis: Bending Speed (range)	Vendor to specify with calculation.	
7.2	**RESOLUTION:**		
7.2.1	Y-axis: Tube Feed/Transport	Vendor to specify	
7.2.2	B-axis: Tube Rotation	Vendor to specify	
7.2.3	C-axis: Bending	Vendor to specify	
7.3	**REPEATABILITY:**		
7.3.1	Y-axis: Tube Feed/Transport	Vendor to specify	
7.3.2	B-axis: Tube Rotation	Vendor to specify	
7.3.3	C-axis: Bending	Vendor to specify	

S. No.	PARTICULARS & BHEL SPECIFICATIONS		BIDDER's OFFER [with Complete Technical Details]
8.0	**GENERAL DESIGN & CONSTRUCTIONAL FEATURES:**		
8.1	**Foundation:**		
8.1.1	Vendor to provide the general arrangement and details of the foundation of the machine. The required foundation materials including foundation bolts, rails, leveling pads to be supplied along with the machine. If there is no foundation, the machine shall be placed on anti-vibratory pads.	Vendor to confirm with details	
8.2	**Controls:**		
8.2.1	The three controls viz, bending angle, rotation angle and distance between bends of 3-Axes – shall be CNC programmable type. Collet axis centering, in line with CLR of bend die shall also be through CNC programme.	Vendor to confirm	
8.2.2	Machine shall be operated in three modes viz., Automatic, semi-Automatic and Manual.	Vendor to confirm	
8.2.3	Boosting facility shall be available to control thinning. The extent of boosting shall be set through CNC program by operator	Vendor to confirm	
8.2.4	CNC System operator panel shall be Self Standing - PC Based Touch Screen type control panel with 10m long cable having protective sheathing and plug-in connectors.	Vendor to confirm	
8.2.5	All feedback systems & elements including bending angle encoder shall have easy accessibility for maintenance	Vendor to confirm	
8.2.6	All control logics used in the machine to be detailed out in the manual.	Vendor to confirm	
8.2.7	Carriage movement sensor shall be of non-contact type. Separate Precision position switch to be provided for referencing the machine.	Vendor to confirm	

S. No.	PARTICULARS & BHEL SPECIFICATIONS		BIDDER's OFFER [with Complete Technical Details]
8.3	**Carriage Construction:**		
8.3.1	Carriage to be provided with a Tube Gripping Device - Collet Type, for feeding Tubes into the machine. Collet design should ensure anti-slip gripping of tubes.	Vendor to confirm	
8.3.2	Vendor to give details of the different collet arrangements and their ranges that will be used for various diameters as per our specification.	Vendor to specify	
8.3.3	Carriage shall be of rigid construction with capability of handling the entire range of tubes mentioned.		
8.4	**Lubrication**		
8.4.1	Centralised timer controlled Automatic Lubricating System to be provided with metallic tubings, tank with level indicator. Suitable metering cartridges to be provided to control the required flow of lubrication in different parts of the machine. Vendor to provide details	Vendor to specify	
8.5	**Bend die construction**		
8.5.1	Size of bend die mounting plate shall be designed such that there is no interference while bending multi-plane bend configurations	Vendor to confirm	
8.5.2	Bend die mounting shall be of quick type with only hand tightening.	Vendor to confirm	
8.5.3	Independent Bend dies for the following tube size and radii shall be quoted item-wise separately in the offer 1. Dia 38.1 X R65 2. Dia 44.5 X R143 3. Dia 63.5 X R160 4. S Bend Dia 63.5 X R160	Vendor to confirm	
8.5.4	Split die actuation to be provided in the machine.	Vendor to confirm	

S. No.	PARTICULARS & BHEL SPECIFICATIONS		BIDDER's OFFER [with Complete Technical Details]
8.5.5	Design of the DIE-BOSS (Bending Table) on which the BENDING FORMER is mounted has to suit the FORMER Mounting Details given in **Annexure – 3.** (This is required to enable use of bending formers available with BHEL.)	Vendor to confirm	
8.6	**Follower jaw construction**		
8.6.1	Follower jaw shall be provided in two segments and to be mountable independently. One segment with sufficient length for bending upto 120^0 and the smaller segment with sufficient length for bending 60^0	Vendor to confirm	
8.6.2	Independent Follower jaws for each diameter shall be quoted, for all diameters as given in the specification. There shall NOT be any pads to change over diameters.	Vendor to confirm	
8.6.3	Follower jaws shall be easily removable and mountable with least effort by the operator.	Vendor to confirm	
8.7	**Clamping and Clamp Jaw construction**		
8.7.1	The bending machine shall have swing arm type of tube bending arrangement. Note: NO overhead clamping type	Vendor to confirm	
8.7.2	Clamp jaw shall be easily removable and mountable with least effort by hand tightening by the operator preferably with quick clamping mechanism.	Vendor to confirm	
8.7.3	Independent clamp jaws for each diameter shall be quoted, for all diameters as given in the specification. Clamp jaws for clamping curved portion for making zero distance between bends ('S' bends) shall also be quoted. There shall NOT be any pads to change over diameters.	Vendor to confirm	
8.7.4	Clamping shall be of standard Straight movement of clamp jaw	Vendor to confirm	
8.7.5	Height adjustment for adjusting the clamp jaw height to be provided	Vendor to confirm	

S. No.	PARTICULARS & BHEL SPECIFICATIONS		BIDDER's OFFER [with Complete Technical Details]
8.8	**Sliding surfaces**		
8.8.1	All Sliding surfaces shall be provided with hardened guide ways and Linear Motion bearings. No pads or Hylam strips to be used.	Vendor to confirm	
8.9	**HYDRAULIC SYSTEM**		
8.9.1	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 specify	
8.9.2	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 specify	
8.9.3	Each pump should have an independent motor. Tandem pumps shall be avoided.	Vendor to specify	
8.9.4	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 specify	
8.9.5	The flexible hoses used in the system shall be of Gates / Aeroquip / Parker or any other reputed make acceptable to BHEL.	Vendor to specify	
8.9.6	Failure indication for oil level, temperature, pressure, filter clogging should be provided	Vendor to specify	
8.9.7	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 specify	

S. No.	PARTICULARS & BHEL SPECIFICATIONS		BIDDER's OFFER [with Complete Technical Details]
8.9.8	Servo valves, if any, should be mounted close to their actuators	Vendor to confirm	
8.9.9	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 specify	
8.9.10	Maximum Operating Pressure of hydraulic system.	Vendor to specify	
8.9.11	Main Pump flow in lpm and Motor Power in kW	Vendor to specify	
8.9.12	Reservoir capacity (in litres)	Vendor to specify	
8.9.13	All oil pipelines shall be of seamless steel and should undergo pickling process.	Vendor to specify	
8.9.14	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 specify	
8.9.15	All cylinders used in the machine should have standard bore and rod sizes. The piston rod shall be hard chrome plated.	Vendor to specify	
8.9.16	Suitable stand-by pump unit, filter unit, etc shall be provided for critical areas	Vendor to specify	
8.9.17	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 of energy efficient ones.	Vendor to specify	
8.9.18	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 24^0 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	

S. No.	PARTICULARS & BHEL SPECIFICATIONS		BIDDER's OFFER [with Complete Technical Details]
8.9.19	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	
8.9.20	The oil to be used shall be of standard ISO Viscosity Grades – 32 / 46 / 68	Vendor to specify	
8.9.21	The maximum pressure of the system should preferably not to exceed 310 bar	Vendor to specify	
8.9.22	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	
8.9.23	The pipelines to be painted with standard colours as per the colour coding accepted internationally for hydraulic systems.	Vendor to specify	
8.9.24	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	
8.9.25	Suitable leakage oil collection metallic tray to be provided wherever required.	Vendor to confirm	
8.9.26	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	
8.9.27	**First filling of all required Oils & Grease etc**. 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	

S. No.	PARTICULARS & BHEL SPECIFICATIONS		BIDDER's OFFER [with Complete Technical Details]
8.10	**CNC SYSTEM FEATURES:**		
8.10.1	To provide latest CNC System - Details to be specified in the offer clearly. (with PC Based Touch Screen Control) NOTE: The offered system shall not become obsolete in the next seven years.	Vendor to specify	
8.10.2	System Software to be stored in EPROM along with Flash Memory	Vendor to confirm	
8.10.3	Software back up shall be given by the supplier.	Vendor to confirm	
8.10.4	A standard RS 232 C (V 24) interface to connect IBM compatible computer.	Vendor to confirm	
8.10.5	USB Ports for connectivity to be provided	Vendor to confirm	
8.10.6	Remote access through network - internet, for remote diagnosis shall be provided.	Vendor to confirm	
8.10.7	Additional external standard 104key Keyboard and Optical Mouse.	Vendor to confirm	
8.10.8	Pen-drive of 2GB capacity of reputed make shall be provided with the machine for storing programs	Vendor to confirm	
8.10.9	The system shall have a CD drive	Vendor to confirm	
8.10.10	Real time bending data to be displayed on the screen with details such as bending angle, distance of carriage movement, rotation angle etc.	Vendor to confirm	
8.10.11	Input shall be through either manual data feed or through an external computer.	Vendor to confirm	
8.10.12	Recognition of collision point of the tube rotation device and counter pressure rail	Vendor to confirm	
8.10.13	Auto-Display of machine positions on the screen during manual operation	Vendor to confirm	

S. No.	PARTICULARS & BHEL SPECIFICATIONS		BIDDER's OFFER [with Complete Technical Details]
8.10.14	Auto calculation of co-ordinate conversion from Cartesian co-ordinates into bending machine co-ordinates and vice-versa	Vendor to confirm	
8.10.15	Spring back and Stretch automatic calculation facility.	Vendor to confirm	
8.10.16	Spring back and Stretch automatic compensation facility	Vendor to confirm	
8.10.17	Vendor to provide details of how the stretch compensation is done and the intermediate distance between bends is controlled.	Vendor to specify	
8.10.18	Pre-programming and storage of number of different bending tool-data	Vendor to confirm	
8.10.19	Counter for recording no. of bends produced - data logging of no. of bends per shift	Vendor to confirm	
8.10.20	Automatic diagnostic alarm feature with error display	Vendor to confirm	
8.10.21	Storing and retrieval of all machine operating parameters including spring back applied, stretch compensation applied, bending speed, boosting parameters, tooling data etc with Program search facility sorted on various criteria of bending.	Vendor to confirm	
8.10.22	System shall have the facility to display Memory details.	Vendor to confirm	
8.11	**PAINTING:**		
8.11.1	Painting of machine / electrical panel: RAL6011Apple Green (Polyurethane paint) or IS 5/1994.Shade :(ISC)NO-281	Vendor to confirm	
9.0	**OPTIONAL ACCESSORIES:**		
9.1	AUTOCAD integration - Facility to download AutoCAD drawings of tube bends and convert to operating programs.	Vendor to specify	
9.2	CAD / CAM interface / Compatibility	Vendor to specify	

S. No.	PARTICULARS & BHEL SPECIFICATIONS		BIDDER's OFFER [with Complete Technical Details]
10.0	**GENERAL POINTS**		
10.1	Make and Model of the machine to be mentioned. Detailed catalogs of the machine to be sent with the offer		
10.2	List of tooling (Standard Clamp jaws, Bending formers, Follower jaw, 'S' Bend clamp jaws, Mandrels etc) for the sizes mentioned in specification and any optional tooling should be listed and quoted out item wise separately.		
10.3	**Electrical Points:**		
10.3.1	Control panel shall have built in 230V, 5 amps, 3-pin plug.	Vendor to confirm	
10.3.2	Machine panel shall be adequately illuminated for maintenance purpose.	Vendor to confirm	
10.3.3	Control Panels and Operating Panel shall be air-conditioned with any reputed make acceptable to BHEL	Vendor to specify	
10.3.4	The machine shall be suitable for 415V with voltage fluctuation of ± 10%, 50±3% Hz, 3 Phase, 3 wire system	Vendor to confirm	
10.3.5	Electrics shall be tropicalised & shall have IP 54 protection	Vendor to confirm	
10.3.6	All cables should be of copper core	Vendor to confirm	
10.3.7	All the cables, components, devices and wiring to be terminated with proper identification ferrule nos. as per electrical circuit throughout the machine.	Vendor to confirm	
10.3.8	All motors shall be of AC motor from reputed makers like SIEMENS, ABB, and Allen Bradley conforming to IEC Standards.	Vendor to specify	
10.3.9	All the drives for the motors shall be from reputed makes like SIEMENS / ABB / Allen Bradley / Indramat. Vendor to provide the model No. along with offer	Vendor to specify	
10.3.10	All electrics shall be of reputed make like Siemens / SEW / ROCKWELL / Allen Bradley/ Telemechanique /	Vendor to specify	

S. No.	PARTICULARS & BHEL SPECIFICATIONS		BIDDER's OFFER [with Complete Technical Details]
10.4	**Safety**		
10.4.1	SICK laser mechanism to be provided for safety	Vendor to specify	
10.4.2	All other safety features provided in the machine shall be specified by the vendor	Vendor to specify	
10.5	**Ambient Conditions at the Factory location:**		
10.5.1	The machine shall be suitable for an ambient temperature of +45 ° C and relative humidity of 85 % respectively, but both do not occur simultaneously.	Vendor to note	
10.5.2	The offered equipment, CNC System and Hydraulic system have to work in a normal fabrication shop environment in ambient conditions.	Vendor to confirm	
11.0	**DOCUMENTATION:**		
11.1.0	Set of Documents **to be submitted along with the Offer** for technical evaluation:		
11.1.1	General Lay-out of the machine with major and critical dimensions in line with the specification	Vendor to confirm	
11.1.2	General Assembly drawing of the machine with bill of materials and critical dimensions	Vendor to confirm	
11.1.3	Sub-assembly / Arrangement drawings with bill of materials and critical dimensions for the following: a) Y- axis. b) B- axis. c) C- axis. d) Tube clamping	Vendor to confirm	
11.1.4	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 confirm	

S. No.	PARTICULARS & BHEL SPECIFICATIONS		BIDDER's OFFER [with Complete Technical Details]
11.1.5	Hydraulic / Pneumatic Circuit with Bill of Materials giving specification and make of components used.	Vendor to confirm	
11.1.6	Electrical Circuit with Bill of Materials giving specification and make of components used.	Vendor to confirm	
11.1.7	Video images on CD /Hard copy of literature with photographs & drawings explaining the technical features.	Vendor to confirm	
11.2.0	**Set of Documents to be submitted after placement of order for approval / verification before manufacturing**:		
11.2.1	General Lay-out of the machine with major and critical dimensions in line with the specification and Preliminary Foundation drawing.	Vendor to confirm	
11.2.2	General Assembly drawing of the machine with bill of materials and critical dimensions	Vendor to confirm	
11.2.3	Sub-assembly / Arrangement drawings with bill of materials and critical dimensions for all the sub-assemblies in the machine.	Vendor to confirm	
11.2.4	Hydraulic / Pneumatic Circuit with Bill of Materials giving specification and make of components used.	Vendor to confirm	
11.2.5	Electrical Circuit with Bill of Materials giving specification and make of components used.	Vendor to confirm	
11.2.6	Quality plan	Vendor to confirm	
11.3.0	Set of Documents **to be submitted along with machine:**		
11.3.1	**Three sets** 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	
11.3.2	**One set** 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	

S. No.	PARTICULARS & BHEL SPECIFICATIONS		BIDDER's OFFER [with Complete Technical Details]
11.3.3	Operating Manuals of equipments	Vendor to confirm	
11.3.4	Programming Manuals if any for the machine.	Vendor to confirm	
11.3.5	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	
11.3.6	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	
11.3.7	Hydraulic Trainer catalogue from the manufacturer of the hydraulic system (Rexroth / Vickers)	Vendor to confirm	
11.3.8	Electrical Circuit with Bill of Materials giving specification and make of components used.	Vendor to confirm	
11.3.9	Maintenance, Interface & Commissioning Manuals for speed drives.	Vendor to confirm	
11.3.10	Manufacturing drawings for all wearing components like bushes, pulleys, gears, etc.	Vendor to confirm	
11.3.11	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	
11.3.12	Detailed specification of all rubber items, hoses, fittings, etc. List of bearings, belts used to be provided.	Vendor to confirm	
11.3.13	Operating Manuals, Maintenance Manuals & Catalogues for all supplied Accessories including Voltage stabilizer, Isolation transformer, etc.	Vendor to confirm	
11.3.14	Complete Master List of parts used in the equipment.	Vendor to confirm	

S. No.	PARTICULARS & BHEL SPECIFICATIONS		BIDDER's OFFER [with Complete Technical Details]
11.3.15	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	
12.0	**MACHINE SPARES AND CONSUMABLES:**		
12.1	Electrical and Mechanical spares for two years of trouble free operation shall be quoted. List to cover items listed in **ANNEXURE - 1**, enclosed.		
12.2	All types of spares for total station and accessories should be available for at least ten years after supply of the equipment. If equipment / 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		
13	**Acceptance criteria:**		
13.1	All the features of the machines shall be operated and shown as per the specifications, both at supplier's works during inspection and at BHEL work's during commissioning.	Vendor to confirm	
13.2	The prove-out trials shall be for the tube sizes, bend pattern as given by BHEL during the technical discussions or at the time of releasing the Purchase Order.The bends have to pass the quality tests of all parameters (like ovality, thinning, angle, distance between bends etc) as mentioned in the specification. Material for trial to arranged by vendor	Vendor to confirm	
13.3	The production output of the machine shall be proved out by the commissioning Engineer at BHEL works for the Production rate mentioned in the specification. (Sl.No. 6.14)	Vendor to confirm	
13.4	Bending on all thin walled tubes (as per our specification) shall be proved out during commissioning.	Vendor to confirm	

S. No.	PARTICULARS & BHEL SPECIFICATIONS		BIDDER's OFFER [with Complete Technical Details]
14	**Erection and Commissioning:**		
14.1	The supplier shall depute his engineer(s) for supervising the erection and commissioning of the machine at BHEL and prove-out trials.	Vendor to confirm	
14.2	The Vendor shall bring special tools and equipment required for erection of the machine. Necessary tools like Torque Wrench, Spanners, Keys, grease guns etc. for operation and maintenance of the machine should be supplied. List of such tools should be submitted with offer	Vendor to confirm	
14.3	Special equipments required to carry out the geometric accuracy of the machine like Test mandrel, straight edge, dial indicators, etc should be supplied along with the machine.	Vendor to confirm	
14.4	Commissioning spares, required for commissioning of the machine within stipulated time, shall be brought by the Vendor.	Vendor to confirm	
14.5	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	
14.6	Schedule of Erection and Commissioning shall be submitted with the offer.	Vendor to confirm	
15.0	**Training:**		
15.1	The supplier shall train TWO BHEL's Engineers in Operation and Maintenance (Mechanical, Electrical/ Electronics and CNC System) of the Machine at supplier's works for a period not less than 5 working days.	Vendor to confirm	
15.2	The supplier shall impart training to BHEL's Machine Operators and Maintenance crew in Operation and Maintenance (Mechanical, Electrical/ Electronics and CNC System) after the commissioning of the Machine at BHEL works for not less than 10 working days.	Vendor to confirm	

S. No.	PARTICULARS & BHEL SPECIFICATIONS		BIDDER's OFFER [with Complete Technical Details]
15.3	The training shall include specialised coaching in a) Safety b) Operation of the machine c) CNC System Operation, d) Trouble-Shooting, e) Software Application f) All special features of the machine including hydraulics g) Electrical / Mechanical / Electronics systems installed on the machine	Vendor to confirm	
16	**Guarantee:**		
16.1	Equipment has to be guaranteed for its performance, for a minimum of 12 months from the date of commissioning. Or 18 months from the date of supply whichever is earlier	Vendor to confirm	

Enclosures:

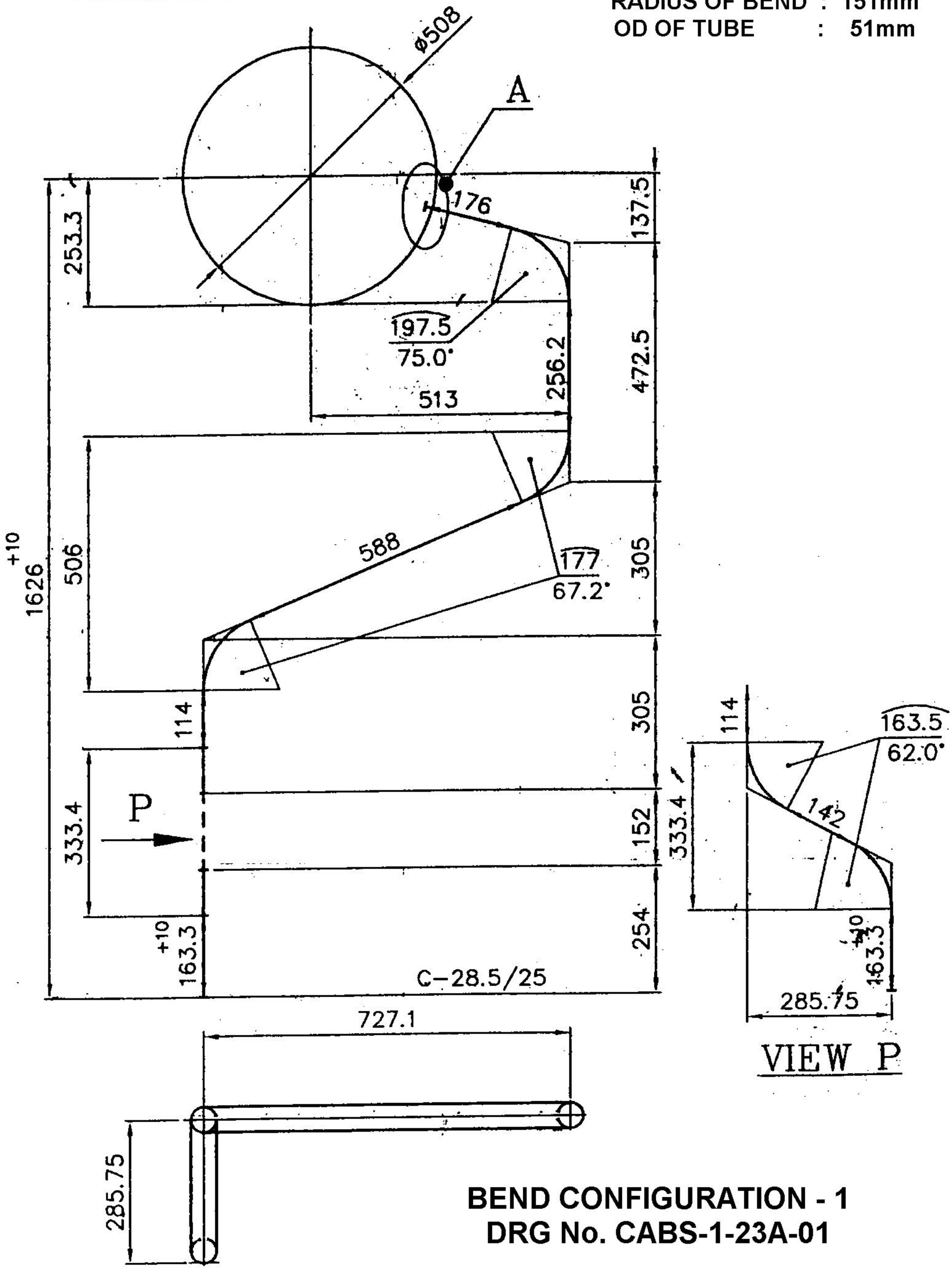
a) **Annexure-1 List of spares.**
b) **Annexure-2 with drawings of 3 different bends configurations.**
c) **Annexure-3 with typical drawings of bends dies.**

Annexure-1- List of spares

a) Seal kit for Hydraulic Cylinders – 1 set for each type of cylinder used in the machine.	1Set each.
b) Main Pump in Hydraulic system.	1 No
c) Hydraulic Valves – 1 No. for each type used in the machine.	1Set
d) Hydraulic & Lubrication Hoses – full quantity used in the machine.	1Set.
e) Hard disk loaded with programme	1 No
f) Encoders – 1 No. for each type used in the machine.	1 set
g) Proximity switches – 1 No. for each type used in the machine.	1 Set
h) Pressure switches – 1 No. for each type used in the machine.	1 Set
i) Wear Strips – full quantity used in the machine.	1 Set

ANNEXURE - 2

RADIUS OF BEND : 151mm
OD OF TUBE : 51mm

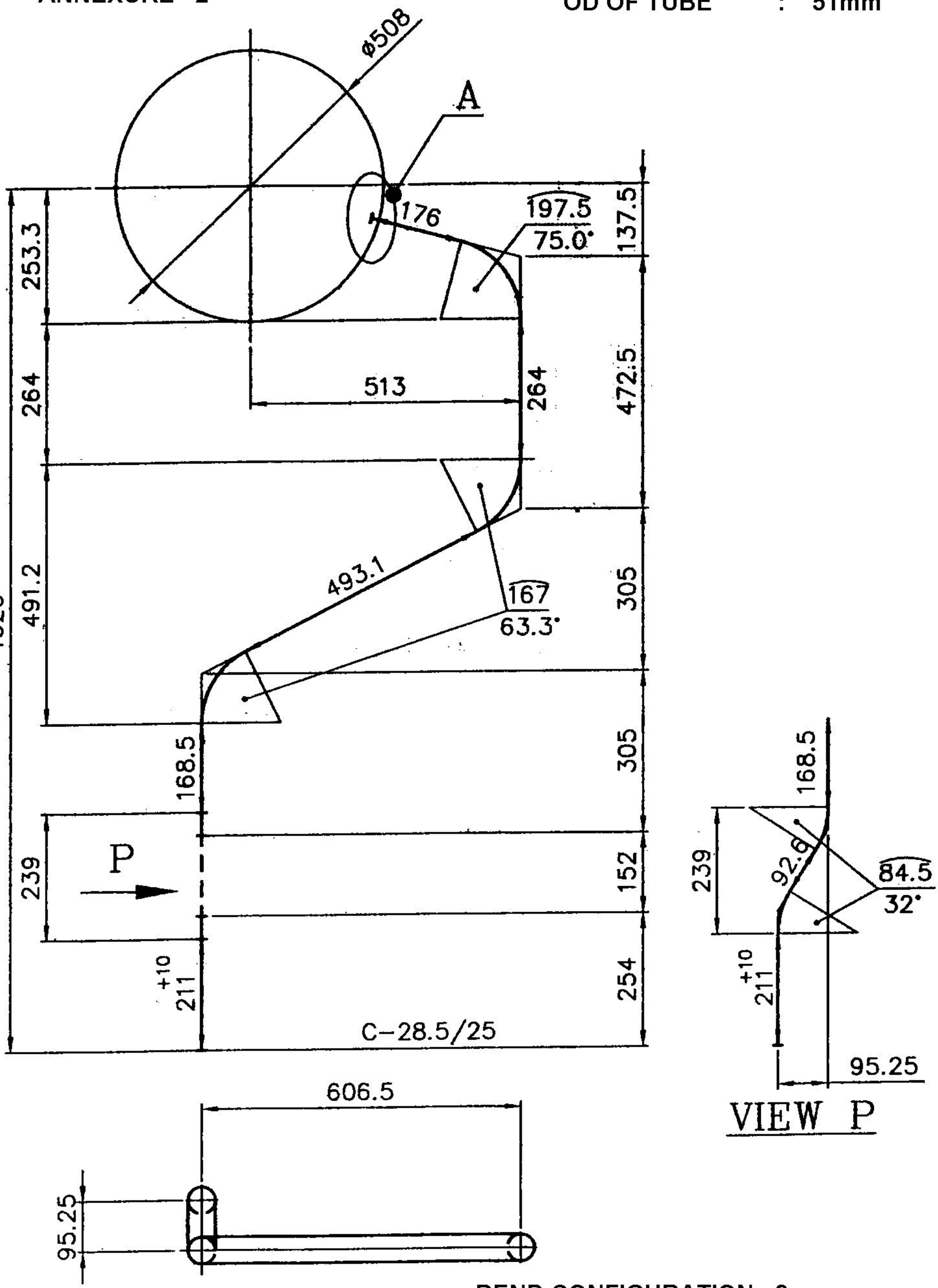


BEND CONFIGURATION - 1
DRG No. CABS-1-23A-01

BHEL, TIRUCHIRAPPALLI

ANNEXURE - 2

RADIUS OF BEND : 151mm
OD OF TUBE : 51mm

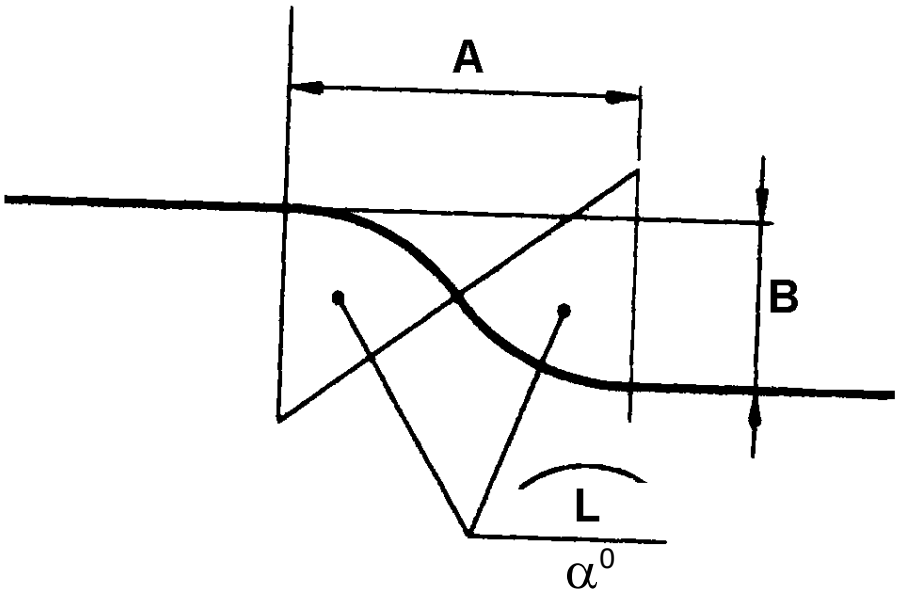


BEND CONFIGURATION - 2
DRG No. CABS-1-23A-02

BHEL, TIRUCHIRAPPALLI

ANNEXURE - 2

‘S’ BEND CONFIGURATION

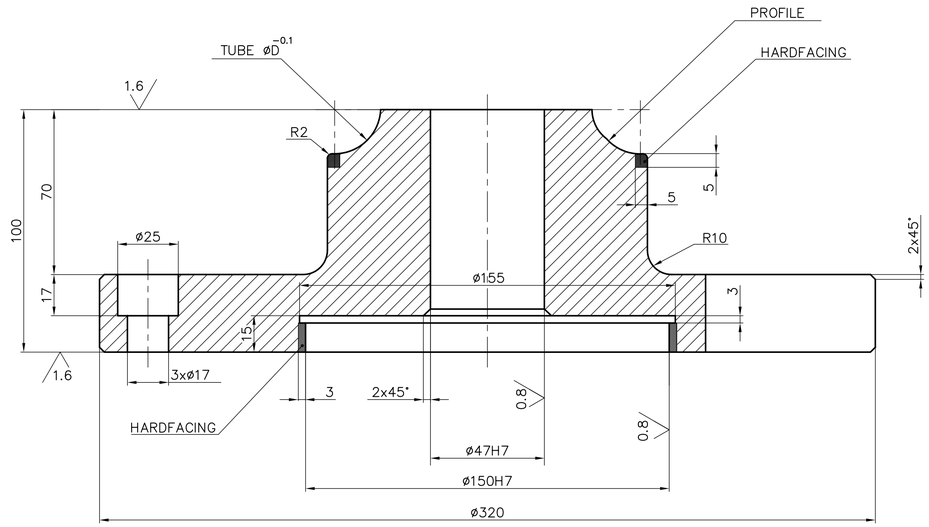


VARIANTS All dimensions are in ‘mm’

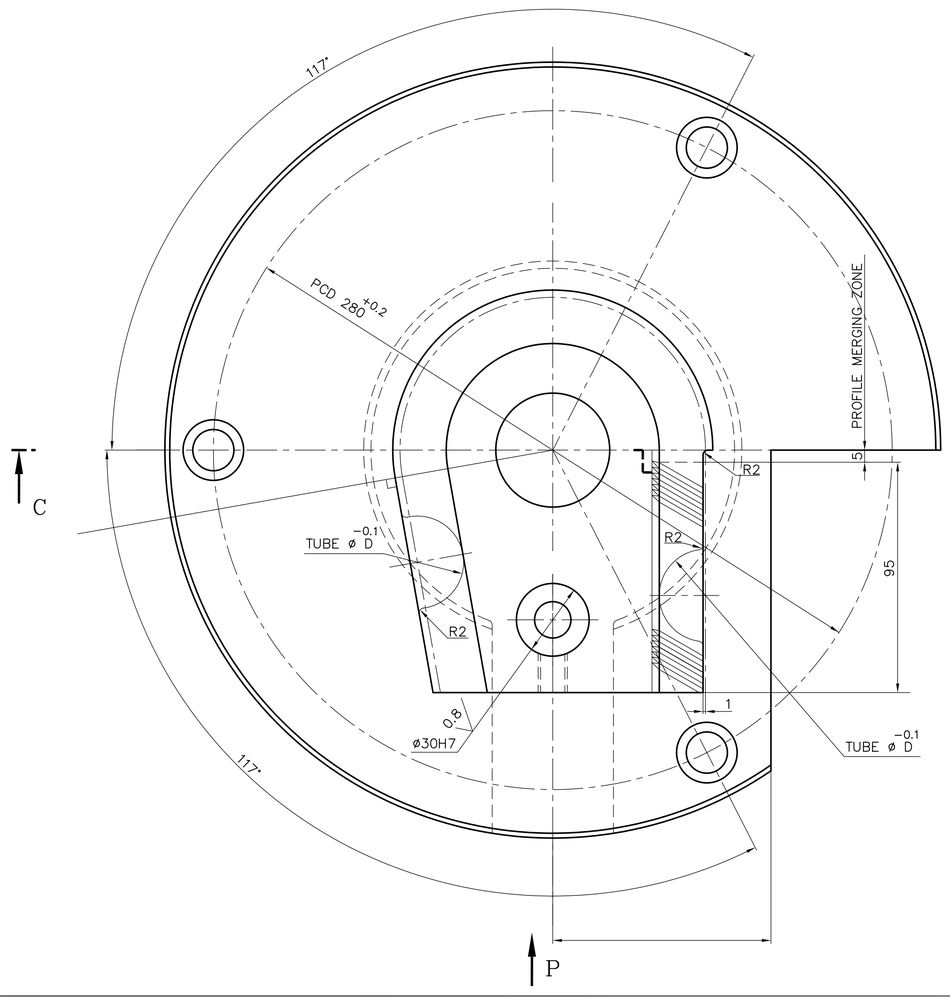
S.No	Tube OD	Radius of bend	A	B	Arc Length L	Angle α
1	76.1	160	--	233	207	74^0 12’
2	63.5	200	317	156	183	52^0 30’
3	51	151	--	102	128	48^0 30’

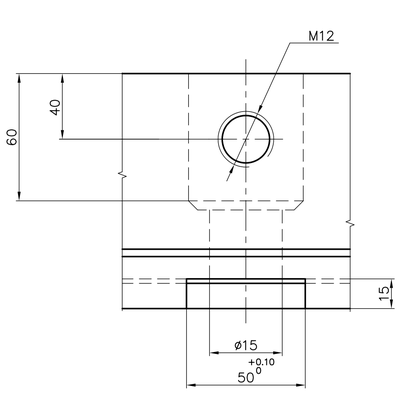
DRG NO. CABS-1-23A-03

BHEL, TIRUCHIRAPPALLI



SECTION –CC





VIEW–P

DETAIL OF HELICAL SERRATIONS
SCALE 2:1

MOUNTING DETAILS OF CLOCKWISE TUBE BENDING MACHINE

NO. OF PIECES	DESCRIPTION	SEM. PRO/SEQ. NO.	INT. MAT/SEQ. NO.	FINAL MATERIAL	SCRAP QUAN.	NET WT.(KG)	GROSS WT.(KG)	DRAWING NO.	ITEM NO.
	ø320 x 100								

FIRST ANGLE.

ALL DIMENSIONS IN MILLIMETRES.

BOTTOM FORMER

BOTTOM FORMER