Bharat Heavy Electricals Limited

(High Pressure Boiler Plant**)**
Tiruchirappalli – 620014, TAMIL NADU, INDIA
An ISO 9001 Company
CAPITAL PURCHASE / MATERIALS MANAGEMENT / MANUFACTURING

ENQUIRY	Phone: +91 431 257 79 38 Fax : +91 431 252 07 19 Email : tvenkat@bheltry.co.in Web : www.bhel.com

	Enquiry Number:	**Enquiry Date:**	**Due date for submission of quotation:**
	2620700082	**18.08.2007**	**03.10.2007**
You are requested to quote the Enquiry number date and due date in all your correspondences. This is only a request for quotation and not an order			

Item	**Description**	**Quantity**	**Delivery (Item required at BHEL on)**
10	Panel Bending Machine for Spiral Wall Forming {Tubular Panel (Boiler Membrane wall) Bending machine} as per the technical specification & commercial conditions applicable (to be downloaded from web site www.bhel.com or http://tenders.gov.in)	1 No.	30.12.2008

BHEL commercial terms & conditions with Price Bid and Bank Guarantee formats along with technical specifications 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 "2620700082".

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 Manager / Capital Purchase / MM / Manufacturing

PART A.

QUALIFYING CRITERIA FOR THE SUPPLY OF TUBULAR PANEL BENDING MACHINE

SECTION – I : COMPANY PROFILE

The BIDDER has to provide the details pertaining to each clause in the table given below to understand the profile of the BIDDER's COMPANY.

S.No.	PARTICULARS	VENDOR's RESPONSE
1.0	Number of Years of Experience of the BIDDER / VENDOR in the field of Design, Manufacture & Supply of Roller Type Bending Machines or Section Rolling Machines or SPMs (Special Purpose Machines) for metal forming works.	
2.0	Details on the Codes/Standards adopted for the Machine Design and Manufacture	
3.0	Details on Manufacturing Facilities available with the VENDOR for : a. Sourcing/Building Large Machine Castings or Fabricated Components b. Heat Treatment Facilities c. Heavy Machining & Grinding Facilities d. Machine Assembly & Testing Rigs	
4.0	Details of Quality System (with Stages of Internal Inspection) followed for the Machine Building and Testing of Capacity	

SECTION – II : QUALIFYING CRITERIA

The BIDDER / VENDOR has to meet the following requirements to get qualified for submitting an offer for the Panel Bending Machine :
[Additional Sheets shall be attached with the OFFER, to provide requisite details]

S.No.	REQUIREMENTS	VENDOR's RESPONSE
5.0	The BIDDER / VENDOR shall have a minimum of THREE Years of Experience of in the Field of Design, Manufacture & Supply of Machines described under **Clause No. 1.0**, used in Heavy Fabrication Industries	

S.No.	REQUIREMENTS	VENDOR's RESPONSE
6.0	Performance Certificate in the enclosed FORMAT for a period, not less than one year, from CUSTOMERS **or** Reference List of Customers with full contact details (E-mail id, Fax Number, Name of Contact Person), who are the End Users of the Machines (mentioned under **Clause No. 5.0)**	
7.0	Details on SERVICE-AFTER-SALES Set-Up in India including the Addresses of Agents / Service Centres in India, to be furnished .	

SECTION – III : BID / OFFER FORMATS

The BIDDER / VENDOR has to note the following :

S.No.	REQUIREMENTS	VENDOR's COMPLIANCE
8.0	The BIDDER shall submit the offer in TWO PARTS - Technical **[**with **PART A & PART B]** & Commercial and Price Bid.	
9.0	The OFFER shall contain a comparative statement of Technical Specifications given by BHEL and the Offer Details submitted by the Bidder, against each Clause.	
10.0	The Technical Offer shall be supported by Product Catalogue (of similar machines supplied earlier) in ORIGINAL .	
11.0	The Commercial Offer shall contain the Scope of Supply and the Un-Priced Part of the Price-Bid, for confirmation of the inclusion of all the accessories, tooling, auxiliary parts, spares, consumables, etc. with the main and basic equipment, to meet the technical specification requirements.	

PERFORMANCE CERTIFICATE – [SAMPLE FORMAT]

(On Customer's Letter Head)

1. Supplier of the Equipment/Machine :

2. Make & Model of the Equipment :

3. Month & Year of Commissioning :

4. Application for which Machine is used :

5. a. Equipment Serial Number :
   b. Total Connected Load in Horse Power/kW :
   c. Brief Machine Specifications :

6. Performance of the Machine (with reasons for recommendation) : Best in the market / Satisfactory / Good / Average / Not Satisfactory

7. Any other Remarks :

Date:

Signature & Seal of the Authority
Issuing the Performance Certificate

PART B

TECHNICAL SPECIFICATIONS for TUBULAR PANEL (BOILER MEMBRANE WALL) BENDING MACHINE

AA. APPLICATION

The proposed machine is intended for bending welded tube walls (panels formed by welding tubes side by side and with the introduction of a flat strip in between the tubes) as well as bending single tubes, coming in high pressure and high temperature boiler applications. The details of bending are given in **Annexure – 1, 2, 3 & 4.**

BB. JOB DETAILS

Tube Outside Diameter	:	25.4mm to 76.1mm
Tube Wall Thickness	:	2.3mm to 10mm
Tube Material [as per ASTM std.]	:	
a) Carbon Steel	:	SA192, SA210A1, SA210C
b) Alloy Steel	:	SA209T1, SA213T11, SA213T22 SA213T91
Fin Material (welded to tubes)	:	Carbon Steel & Alloy Steel
Fin Width	:	10 mm to 110 mm
Fin Thickness	:	5 mm to 12 mm
Weld Process used (in building tubular panels)	:	SAW (sub-merged arc welding) or MIG / MAG – Flux Cored Arc Welding
Panel Length (Welded Portion)	:	4000.mm (min.) / 25000.mm (max.)
Panel Width	:	2500.mm (max)
Maximum tensile strength of bending material	:	70 kg/sq. mm.

CC. MACHINE WORKING DATA

Maximum bending radius	:	450 mm
Minimum bending radius over plain roller	:	200 mm
Maximum bending angle	:	135 °
Through width (for panel feed in)	:	3000 mm
Through width in case of diagonal bending (maximum 15 ° over plain roller)	:	2500 mm
Maximum bending speed	:	0.3 RPM
Maximum Operating Pressure	:	200 bar

Bidder to specify the following parameters (for the offered bending machine) :

1. Operating Height (desired height is around 1200 mm above floor)
2. Panel Insert Gap between Rollers
3. Maximum Bending Force Developed

DD. MACHINE CONSTRUCTION

The machine shall be of advanced design and shall incorporate latest developments in machine building. The machine design shall facilitate easy changing of bending tools and easy removal of bent panels or tubes from the machine, after the bending operation. The following specification clauses describe the various features of the machine and the working environment, to which the Bidder / Vendor has to comply with .

EE. BASIC DESIGN & CONSTRUCTIONAL FEATURES

S.No.	DESCRIPTION / PARTICULARS	VENDOR's OFFER [with Technical Details]
1.0	The machine body shall be of fully welded construction and amply ribbed , and built in closed construction	
2.0	The drive to the bending rollers shall be by hydraulic power, through a suitable power transmission system	
3.0	Pressing of the bending roller as well as clamping of the membrane walls shall be carried out hydraulically through pressure cylinders	
4.0	Clamping as well as unclamping (pressing and releasing) of the pressing rollers shall be carried out in 'inching' mode	
5.0	It shall be possible to adjust the pressing force (the pressure exerted by pressing rollers against the tube walls) to avoid the formation of wrinkles and folds or deformation of tube profile.	
6.0	During bend angle measuring operation, the tube wall must remain clamped, but the pressing rollers moved away. (This provision is to hold the panel in position and to re-bend, if required)	
7.0	Machine is to be equipped with pre-bending roller, to facilitate production of true radius	
8.0	A suitable indicator (electronic digital display activated by an encoder fitted to the driving axis is preferred) shall be provided to read-out the actual mechanical bending angle, displayed in 0.1 ° steps	

S.No.	DESCRIPTION / PARTICULARS	VENDOR's OFFER [with Technical Details]
9.0	The membrane clamping plate shall be equipped with two side limits, which facilitate the positioning of membrane walls, so that bending takes place in the right angle to tube axis.	
10.0	By setting the above side limits in diagonal position, it shall be possible to bend the membrane walls diagonally under the use of a plain roller	
11.0	The complete hydraulic system with pump, motor and control units shall be accommodated in a separate console away from the machine. The connection between the hydraulic cylinders and hydraulic units shall be made through suitable hoses (not less than 5 mtrs. In length) with quick-fix leak-proof couplings.	
12.0	A portable control panel shall be provided with 5 mtr. long cable and duplicated for all machine operating functions.	
13.0	Remote control pressure relief valve (which can be set for various operating pressures) shall be provided and shall be easily accessible with trip mechanism when pressure reaches maximum set value.	
14.0	Oil level indicator, temperature switch indicator etc. are to be provided for easy viewing.	
15.0	Low oil level, high oil temperature alarms shall be provided.	
16.0	Thermal sensor for oil temperature monitoring to be provided. Indicator to be provided with tripping facility.	
17.0	Safety interlocks for electrical and hydraulic shall be provided	
18.0	All gears are to be hardened and ground	
19.0	Vendor to furnish details of material, hardness & constructional details including explanatory drawings of various components/assemblies like Machine Frame, Rollers, Power Transmission System, Electric Motors, PLC, etc. employed in the machine.	
20.0	Video images on CD / Hard copy of literature with photographs & drawings explaining the technical features shall be enclosed with the offer	

FF. MACHINE LIGHTING SYSTEM

S.No.	DESCRIPTION / PARTICULARS	VENDOR's OFFER [with Technical Details]
1.0	A fluorescent machine lamp with drip proof protective cover to be provided for the working area visibility.	
2.0	A spot light with sufficiently long cable should also be provided 24V AC.	
3.0	Flashing / Rotary type machine lamp to denote Machine Working, End of Bending , Alarm / Tripping Condition, etc. as per Industry Standards, to be provided.	

GG. IMPORTANT POINTS

S.No.	DESCRIPTION / PARTICULARS	VENDOR's OFFER [with Technical Details]
1.0	415V + 10% / -10%, 50HZ +/-1.5 HZ, 3 Phase AC (3 wire system with out neutral) Power Supply Source 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 point to different parts of the machine/control cabinets, shall be the responsibility of vendor.	
2.0	All electrical equipment shall be Tropicalized and shall have IP 54 degree of protection	
3.0	All electrical control cabinets & panels should be dust and vermin proof	
4.0	All electrical components in the cabinets should be mounted on DIN Rail	
5.0	All electrical panels should be provided with CFL lamps for sufficient illumination and electric power receptacles of 220 Volts, 5/15 Amp. AC. All adapters/receptacles should have compatibility with Indian equivalents.	
6.0	Motors shall be from M/s Siemens / ABB or other reputed make conforming to IEC Standards and acceptable to BHEL	
7.0	All electrics shall be of reputed make like Siemens, L&T, BCH, Tele-mechanique.	
8.0	Electrical drives shall be of Siemens / ABB / L&T / Eurotherm and PLC of SEW / Allen Bradley / Siemens / Messung / Fanuc	
9.0	All components / devices / terminals are to be incorporated with ferrules.	
10.0	Vendor should ensure the proper earthing for the machine and its accessories.	

S.No.	DESCRIPTION / PARTICULARS	VENDOR's OFFER [with Technical Details]
11.0	Wiring: All electrical motors, limit switches etc, on the machine shall be wired using PVC sheathed cable running in conduits to common terminal block	
12.0	External wiring from / to control panel, control desk, external motors etc shall be by means of armoured multi-core cables	
13.0	All cables/ hoses moving with traversing axes should be installed in cable drag chain. Additionally, all the cable trays required for laying of cables should be included in the offer.	
14.0	**AIR CONDITIONERS** : Air Conditioners with Dehumidifiers of suitable / sufficient capacity to be provided for all Electrical / Electronic Panels / Cabinets including Operator's Panel considering specified ambient conditions. Detailed specifications of the same are to be submitted.	
15.0	Independent Centralized Automatic Lubricating System for all sliding area in the gantry and bed to be provided with metallic tubings.	
16.0	Pneumatics on machine, and associated equipment shall be connected by nylon and/or steel tube to common point on machine. Fitted at the common point would be a lubricator, regulator, filter and hand wheel valve	
17.0	BHEL supplied compressed air will be at a pressure of 60 PSI to 70 PSI . All pneumatic systems on the machine shall be designed to operate efficiently at this air pressure	
18.0	All hydraulic elements used shall be of Vickers/Rexroth or any other reputed make acceptable to BHEL.	
19.0	All hydraulic operating components to be mounted on the manifold in a centralised place on the hydraulic power pack .	
20.0	Hydraulic circuits shall be designed with minimum number of control valves and to suit oil of ISO VG 46 or 68 only. Also MINIMESS checkpoints to be provided wherever pressure is required to be read for setting and troubleshooting.	
21.0	All Hydraulic hoses shall be preferably from GATES, MARKWELL, Parker Hannifin only,	
22.0	Seals, to be used shall be of imported type (preferred brand : MERKAL, HUNGER, JAMES- WALKER)and shall be such that they withstand 125% of operating pressure.	
23.0	The control voltage for all solenoid operated valves should be less than 110 V	

S.No.	DESCRIPTION / PARTICULARS	VENDOR's OFFER [with Technical Details]
24.0	Hydraulic Pump Capacity (flow / pressure) to be specified	
25.0	Filtration System, Failure indication Automatic shut off provision Details should be submitted.	
26.0	Each pump should have an independent motor. Tandem pumps should not be used	
27.0	Refrigerant type Cooling system of sufficient capacity to maintain complete Hydraulic System, including lubrication oil, hydrostatic oil and gearbox oil, etc. at a temperature not exceeding 50 deg C irrespective of the ambient conditions. Complete details should be submitted	
28.0	**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.	
29.0	All non-working surfaces and control panels shall be given a primer coat & two coats of paint as specified in Painting scheme. All unpainted surfaces shall be protected from rust during transit	
30.0	Painting Scheme a) HIMMEL BLUE (RAL 5015) - for machine base and stationary parts b) GREY COLOR (RAL 7035) - for sliding covers and control panels in machine	
31.0	**GUARANTEE :** The equipment has to be guaranteed for its performance and also of the sub-assemblies / bought-out items, for a minimum period of 24 months from the date of commissioning at BHEL Works.	
32.0	A schematic diagram showing the layout of the machine & associated systems with salient dimensions shall be submitted along with the offer.	
33.0	The operating sequence of the machine with broad outline of various operations involved should be furnished with the offer	

HH. ENVIRONMENTAL PERFORMANCE OF THE MACHINE

S.No.	DESCRIPTION / PARTICULARS	VENDOR's COMPLIANCE]
1.0	Maximum noise level shall be 85 dB (A) at normal load condition, 1 M away from the machine with correction factor for back ground noise, if necessary. This will be measured as per international standards like DIN 45635-16. Vendor to demonstrate compliance to noise level, if so required.	

S.No.	DESCRIPTION / PARTICULARS	VENDOR's COMPLIANCE]
2.0	The machine shall be suitable for an ambient temperature of +45 ° C and relative humidity of 95 % respectively, but both do not occur simultaneously.	
3.0	If any safety / environmental protection enclosure is required it shall be built in the machine by the vendor.	
4.0	Paint of the machine should be oil / coolant resistant and should not peel off and mix up with coolant.	
5.0	The total machine, including attachments and accessories, shall be suitable for 24 hrs. continuous operation to its full capacity for 24 hour a day and 7 days a week throughout.	

II. SAFETY ARRANGEMENTS

[the following safety features, in addition to other standard safety features, shall be provided]

S.No.	DESCRIPTION / PARTICULARS	VENDOR's OFFER [with Technical Details]
1.0	Machine shall have adequate and reliable safety interlocks / devices to avoid damage to the machine, work piece and the operator due to mistakes or the malfunctioning. Machine functions shall be monitored continuously and alarm / warning indications through lights/ alarm number with messages (on display panels) shall be made available, if possible.	
2.0	A detailed list of all alarms / indications provided on machine should be submitted by the Vendor.	
3.0	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.	
4.0	All the rotating parts used on machine should be statically & dynamically balanced to avoid undue vibrations and suitably guarded.	
5.0	Emergency Switches at suitable locations as per International Norms should be provided.	
6.0	All lubricated parts shall have provision for collecting the used Lubrication oil from machine parts and preventing them from spilling over on to the ground.	
7.0	Enclosures or protective covers shall be provided for the moving parts (either linear or rotary), as a safety measure, as per industry standards.	

JJ. TOOLING FOR JOB PROVE-OUT

JJ.1 The following Table gives the various sizes of tubes, material, radii of bending and angle of bending , envisaged in the proposed panel bending machine.

a. Tube Sizes : [OD controlled tubes with +18% tolerance in wall thickness]

S.No	**OD,** in **mm**	**THICKNESS,** in **mm**
1	31.8	3.2 / 3.6 / 4.0 / 5.0
2	38.1	3.2 / 4.0 / 5.0 / 6.3
3	44.5	4.0 / 4.5 / 5 / 6.3 / 8 / 9 / 10
4	47.63	5 / 6.3 / 8 / 10
5	51.0	3.6 / 4 / 4.5 / 5 / 6.3 / 8 / 10
6	54.0	3.6 / 4 / 4.5 / 5 / 6.3 / 8 / 10
7	57.0	4 / 5 / 6.3 / 8 / 10
8	60.3	4 / 5 / 6.3 / 8 / 10
9	63.5	4.8 / 5.6 / 6.3 / 10
10	76.1	7.1 / 10

b. Tube Material : Carbon Steel – SA 192, SA210A1, SA 210C
[as per ASTM Standards]

c. Popular Radii of Panel Bends : R 248 and R 406 [in millimetres]

d. Angle of Bending : 35 / 40 / 84 / 87 / 90 / 135 Degrees

JJ.2 The Bidder/Vendor is expected to quote for the toolings on UNIT RATE basis (i.e., cost of complete set of toolings for a given size of tube, given radius of bending and for a given angel of bending), so that the exact pattern of job for the machine prove-out at he Vendor's Works (at the time of pre-despatch inspection) and at BHEL Works (during commissioning) can be finalised at the time of release of purchase order for the machine.

KK. MACHINE SPARES

S.No.	**DESCRIPTION / PARTICULARS**	**VENDOR's OFFER** [with Technical Details]
1.0	Itemised break-up of mechanical, hydraulic, electrical spares used on the machine in sufficient quantity as per recommendation of Vendor for 2 years of trouble free operation on three shifts continuous running basis should be offered by vendor. The list to include following, in addition to other recommended spares: (Unit Price of each item of spare shall be offered)	

S.No.	DESCRIPTION / PARTICULARS	VENDOR's OFFER [with Technical Details]
2.0	Mechanical & Hydraulic Spares: Bearings, clutches, gears and all types of pumps, Valves, pressure switches / transducers, filters, seals, O rings, Hydraulic Hoses, etc.	
3.0	Electrical: All types of Relays, Contactors, Proximity Switches, Push Buttons, Indicating Lamps, Semiconductor Fuses, Special Fuses, Circuit Breakers, Main Power Switch.	
4.0	All types of spares for total machine and accessories shall 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 & Vendors to enable BHEL to procure these in advance, if required.	
5.0	Vendor to confirm that complete list of spares for machine and accessories, along with specification / type / model, and name & address of the spare Vendor shall be furnished along with documentation to be supplied with the machine.	

LL. DOCUMENTATION

S.No.	DESCRIPTION / PARTICULARS	VENDOR's COMPLIANCE
1.0	THREE sets of following documents (Hard Copies) in English language shall be supplied along with machine	
2.0	Operating Manuals of Machine & Control Panel	
3.0	Programming Manuals of Machine (if applicable)	
4.0	Detailed Maintenance Manual of machine with all drawings of machine assemblies/sub-assemblies/parts including Electrical / Pneumatic/ Hydraulic circuit diagrams. All Assembly/ Sub Assembly Drawings shall be supplied with the part list also	
5.0	Complete Printed Circuit Board Schematics indicating check points (Test Points) for Electronic Controls	
6.0	Maintenance, Interface & Commissioning Manuals for PLC system, if used.	
7.0	Manufacturing drawings for all supplied tooling devices, bending dies or formers, adapters, sleeves, etc.	
8.0	Component drawings for all wearing parts to be provided.	
9.0	Catalogues, O&M Manuals of all bought-out-items including drawings, wherever applicable.	
10.0	Detailed specification of all rubber items and hydraulic/lube fittings	

S.No.	DESCRIPTION / PARTICULARS	VENDOR's OFFER [with Technical Details]
11.0	Hydraulic, Lubrication and Electrical circuits with Bill Of Materials	
12.0	Operating Manuals, Maintenance Manuals and Catalogues shall be supplied for Air-Conditioners, Air-Compressor (if any) and all other Accessories supplied.	
13.0	PLC (if any) program print-outs with comments in English.	
14.0	PLC (if any) program/ladder diagram on CD, NC data & PLC data on floppy.	
15.0	Complete Master List of parts used in the machine shall be submitted by the vendor.	
16.0	One additional set of all the above documentation on CD ROM, wherever possible.	

MM. TRAINING OF BHEL PERSONNEL

S.No.	DESCRIPTION / PARTICULARS	VENDOR's COMPLIANCE
1.0	Air-fare, boarding & lodging for the trainees shall be borne by BHEL.	
2.0	Competent, English speaking experts shall be arranged by the vendor during training for satisfactory & effective training of BHEL personnel.	
3.0	BHEL Personnel shall be trained at Supplier's Works for mutually agreed period (10 Days) in the area of a. Electrical, Electronic & CNC Maintenance for Machine & other supplied equipments b. Mechanical & Hydraulic Maintenance of the Machine & other supplied equipments c. Operation of the Machine & other supplied equipments.	
4.0	Bidder to quote for training on man / week basis	

NN. INSPECTION & MACHINE ACCEPTANCE

S.No.	DESCRIPTION / PARTICULARS	VENDOR's COMPLIANCE
1.0	**MACHINE ACCEPTANCE:** (Tests/Activities to be performed by Vendor at Vendor's works, on the machine, before dispatch:)	
1.1	Physical Inspection and Verification of Certificates or Records for Materials of Construction, Bought-out Items, Adherence to Machine Building Procedures given by the Vendor, etc.	

S.No.	DESCRIPTION / PARTICULARS	VENDOR's COMPLIANCE
1.2	Idle running of mechanical, electrical components / parts of machine for 48 hrs. continuously and other tests as per applicable standard test chart recommended by the Vendor	
1.3	Full load test to demonstrate the maximum power & operating parameters of the machine.	
1.4	Demonstration of all features of the machine, control system & accessories	
1.5	Sample bending operations with tubes and panel segments mobilized by the vendor or by BHEL, for performance rating of the machine.	
2.0	**Tests / Activities to be carried out at BHEL works while commissioning the machine:**	
2.1	Demonstration of all features of the machine, control system & accessories to the satisfaction of BHEL for efficient and effective use of the machine	
2.2	Demonstration by actual use of all supplied attachments and accessories to their full capacity.	
2.3	The details of prove-out trials shall be based on the mutually agreed job pattern (bending of tubes and panels) arrived at, during the technical discussions, to be held at BHEL Works after the tender opening.	
2.4	Supervision by vendors of independent operation of machine by BHEL after job prove out during the training period of 5 working days	

PP. MACHINE FOUNDATION

S.No.	DESCRIPTION / PARTICULARS	VENDOR's COMPLIANCE
1.0	Vendor shall submit the preliminary layout drawing for getting BHEL's approval within one month from the date of Letter of Intent (LOI). Vendor shall submit complete foundation details including static and dynamic loads within three months after getting BHEL's approval. The layout should consist of all requirements pertaining to complete machine including space requirement for main machine, control panels, hydraulic power-packs and any other accessories. BHEL shall construct complete foundation for the machine as per the Vendor's recommendation.	
2.0	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	

QQ. MACHINE ERECTION & COMMISSIONING

S.No.	DESCRIPTION / PARTICULARS	VENDOR's COMPLIANCE
1.0	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 bending 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.	
2.0	Successful proving of BHEL components by the Vendor shall be considered as part of commissioning. All tests, as mentioned in **Clause NN.2.0** shall form part of the commissioning activity.	
3.0	Tools, Tackles, Testing Instruments and other necessary equipment required to carry out all above activities shall be brought by the Vendor.	
4.0	Commissioning spares, required for commissioning of the machine within stipulated time, shall be brought by the Vendor on returnable basis.	
5.0	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.	
6.0	Schedule of Erection and Commissioning shall be submitted with the offer.	
7.0	Charges, duration, terms & conditions for Erection & Commissioning should be furnished in detail separately by Vendor along with the Technical Offer.	
8.0	**LEVELLING & ANCHORING SYSTEM :** Complete anchoring system including foundation bolts, anchoring materials, fixtures, levelling shoes etc shall be supplied along with the Machine.	
9.0	**TOOLS for ERECTION, OPERATION & MAINTENANCE :** 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 & Maintenance of the machine should be supplied. List of such tools shall be submitted with offer.	

RR. MACHINE PACKING

S.No.	DESCRIPTION / PARTICULARS	VENDOR's COMPLIANCE
1.0	Sea worthy & rigid packing for all items of complete machine, control panels , 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	

SS. MACHINE DATA [GENERAL] – *DESIRED TO BE INDICATED WITH THE OFFER*

S.No.	DESCRIPTION / PARTICULARS	VENDOR's RESPONSE
1.0	Machine Model Number	
2.0	Total Connected Electrical Load in kVA	
3.0	Floor area required (Length, Width, Height) for Complete Machine & Accessories	
4.0	Machine lubrication	
5.0	Painting of Machine / Electrical Panels	
6.0	Total weight of the Machine	
7.0	Weight of heaviest part of Machine	
8.0	Weight of the heaviest assembly / sub-assembly of the Machine	
9.0	Dimensions of largest part/ sub-assembly/ assembly of the Machine	

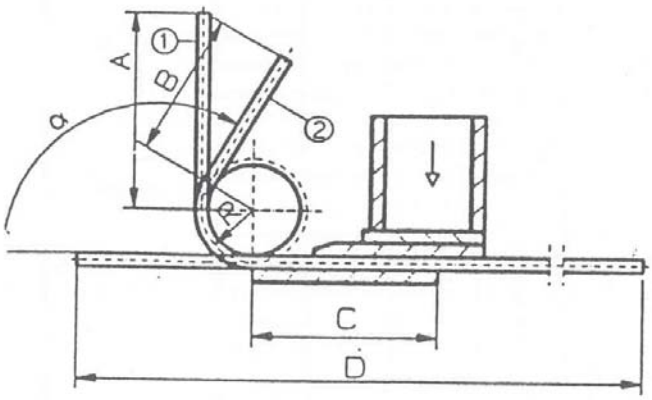
Enclosures :

Annexure – 1, 2, 3 & 4 : Typical Bending Patterns

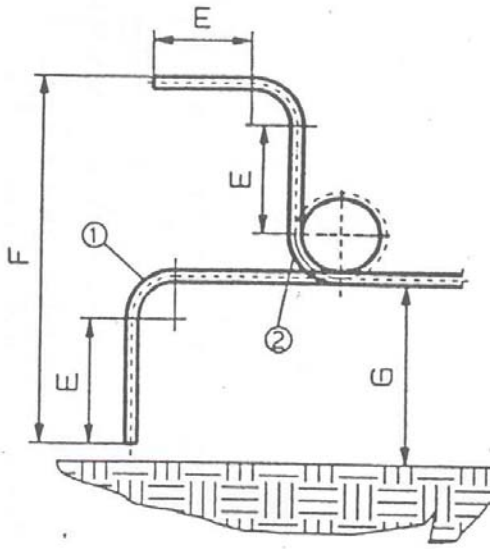
ANNEXURE – 01

A. BENDING OF STRAIGHT TUBES

EXAMPLE - 1



EXAMPLE - 2



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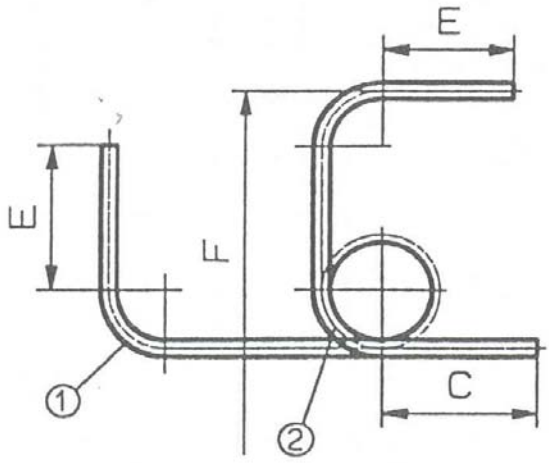


TABLE-1. BEND DIMENSIONS

DIMENSION	MINIMUM/mm	MAXIMUM/mm
A	450	6750
B	450	6350
C	700	--
D	--	25000
E	450	1100
F	--	8000
G	--	1400
U	1400	--
V	--	6500
α	--	135 °

① ② = Bending Sequence

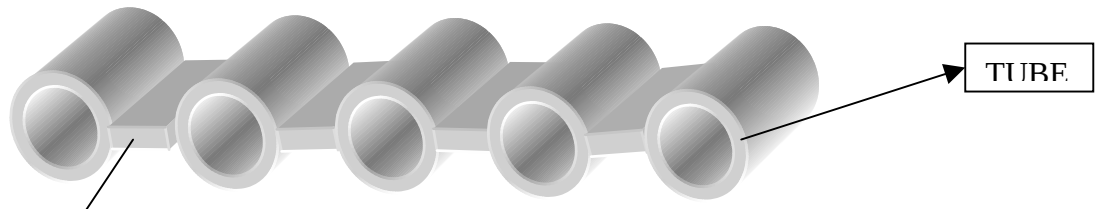
R = Bend Radius

ANNEXURE – 02

B. BEND RADIUS FOR VARIOUS TUBE SIZES (TABLE – 2)

(All Dimensions in mm)

TUBE DIMENSION		BEND RADIUS R							PARTITION
DIA.	THICKNESS	150	200	240	250	280	300	400	
25.0	4.0	X	X		X				36.0
	4.5	X	X		X				
	5.0	X	X		X				
	5.6	X	X		X				
	6.3	X	X		X				
31.8	4.0	X			X				41.0
	4.5	X			X				
	5.0	X			X				
	5.6	X			X				
	6.3	X			X				
33.7	4.0	X	X						49.0
	4.5	X	X						
	5.0	X	X						
	5.6	X	X						
	6.3	X	X						
38.1	4.0	X	X		X				49.0
	4.5	X	X		X				
	5.0	X	X		X				
	5.6	X	X		X				
	6.3	X	X		X				
44.5	4.0		X		X				53.5
	4.5		X		X				
	5.0		X		X				
	5.6		X		X				
	6.3		X		X				
48.3 And 51.0	4.0		X		X				62.0
	4.5		X		X				
	5.0		X		X				
	5.6		X		X				
	6.3		X		X				
57.0	4.0				X	X			68.0
	4.5		X		X	X			
	5.0		X		X	X			
	5.6		X		X	X			
	6.3		X		X	X			
60.3 And 63.5	4.0								75.0
	4.5				X				
	5.0		X		X				
	5.6		X		X				
	6.3		X		X				
76.1	4.0						X		95.0
	4.5						X		
	5.0						X		
	5.6						X		
	6.3						X		



SAMPLE SECTIONAL VIEW OF TUBULAR PANEL

C. ALL SIDE INCLINED TUBES MEMBRANE TUBE WALL

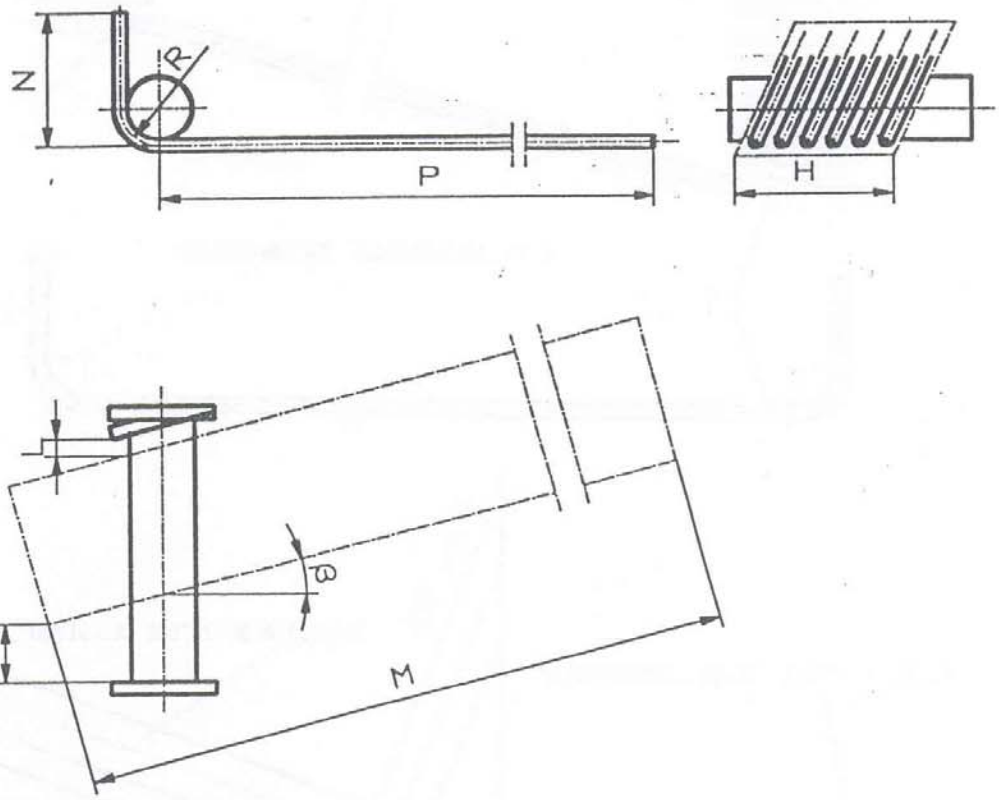


TABLE – 3. BEND DIMENSIONS (values are in mm)

β	K	H_{max}	L	M_{max}	N
10 °	45	2500	ca. 20	25000	350
15 °	105	2300			
20 °	185	2000			
25 °	255	1750			
30 °	285	1600			

D. OVERVIEW OF TWO SIDE INCLINED TUBE ASSEMBLY