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

TWO PART BID Tender to be submitted in two Parts	**Enquiry Number:** **2620900157**	**Enquiry Date:** **27.08.2009**	**Due date for submission of quotation:** **12.10.2009**

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

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	**CNC Tube 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**.

Important points to be taken care during submission of offer:

1. **Delivery required 10 months from the date of purchase order.**
2. **Grace period of 2 months beyond the above delivery period will be considered.**
3. **Check-list to be filled and enclosed along with the offer failing which, the offer will not be considered for evaluation.**

BHEL's General guidelines / instructions 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 "2620900157".

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 Equipment / MM

PART A

QUALIFYING CRITERIA FOR THE SUPPLY OF CNC / PC based PLC - TUBE BENDING MACHINE

SECTION – I

The BIDDER is expected to give complete details against each clause in the table given below, with additional sheets those may be attached (giving clear reference number) to furnish and cover the requisite details / documents.

S. No.	PARTICULARS	VENDOR's RESPONSE
1	VENDOR to provide the Profile of their Company	
2	The BIDDER / VENDOR shall have a minimum of TEN Years of Continuous Experience in the Design, Manufacture & Supply of CNC / PC based PLC - TUBE BENDING MACHINES.	
3	List of customers to whom CNC Tube Bending Machines were supplied, installed and commissioned till date, highlighting the customers who are in the field of Power Utility Boilers manufacturing (of High Pressure Ratings). The sizes of machines supplied may be furnished.	
4	Details on SERVICE-AFTER-SALES Set-Up in India including the Addresses of Agents / Service Centres in India.	
5	Any Additional Data to supplement the manufacturing capability of the BIDDER for the subject equipment.	

SECTION – II

The BIDDER / VENDOR has to compulsorily meet the following requirements to get qualified for submitting an offer for the CNC TUBE BENDING MACHINE.

S. No.	REQUIREMENTS	VENDOR's RESPONSE
1.0	Only those vendors (**OEMs**), who have supplied and commissioned at least **ONE CNC / PC based PLC Tube Bending machine that can bend tubes upto OD 76.1mm,** 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:	
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 the Performance certificate from the customer for the satisfactory performance of the equipment supplied as per clause 1.0 above. (For obtaining the Performance certificate, a suggestive format is provided in **SECTION – IV**)	
1.7	Offers of only those vendors who meet the above Qualifying Criteria will be considered for further evaluation.	
1.8	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 period shall not exceed 10 months from the date of Purchase Order. A grace period of 2 months in addition is provided. The additional grace period will attract loading, which is explained in the commercial terms of the enquiry. The delivery period is reckoned from the date of purchase order to date of despatch from the vendor works.	

SECTION – III

The BIDDER / VENDOR has to comply with the following, for accepting the Technical Offer for scrutiny by the Purchaser:

S. No.	REQUIREMENTS	VENDOR's COMPLIANCE
1	The BIDDER / VENDOR shall submit the offer in TWO PARTS-Technical **[with PART A & PART B]** & Commercial and Price Bid.	
2	The offer shall contain a comparative statement of Technical Specifications given by BHEL and the offered details submitted by the Bidder, against each clause. Merely stating 'CONFIRMED' or 'COMPLIES' or 'YES' or 'NO-DEVIATION' or similar words wherever 'Vendor to Specify' details in the technical comparative statement may lead to disqualification of the Technical Offer.	
3	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.	
4	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 of the inclusion of all the accessories, toolings, attachments, auxiliary parts, spares, consumables, etc. with the main and basic equipment, to meet the technical specification requirements.	
5	BIDDER has to indicate the Country of Origin for the supply of equipment.	

SECTION – IV

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 for which machine is used :

5. Sizes of Jobs Performed in the machine
   a. Tube diameter :
   b. Tube thickness (maximum) :
   c. Tube material :

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

7. After Sales Service : Satisfactory / Good / Average / Not Satisfactory

8. Any other remarks :

Date:

Signature & Seal of the Authority
Issuing the Performance Certificate

PART B

TECHNICAL SPECIFICATIONS for CNC/PC based PLC - TUBE BENDING MACHINE

<table>
<tr><th>S. No.</th><th>PARTICULARS</th><th>BHEL SPECIFICATIONS</th><th>Bidder's OFFER [With Complete Technical Details]</th></tr>
<tr><td>1.0</td><td>APPLICATION</td><td>A) The machine is meant for cold bending of seamless steel tubes/ Tubes in multi-plane axes to form tubular coils for Power Boilers, Industrial Boilers and Process Industries.
B) The bending system shall be of CLOCKWISE direction Draw-Bending type with PC based PLC or CNC mode of operation with booster.</td><td></td></tr>
<tr><td>2.0</td><td colspan="3">TUBE SPECIFICATIONS and RADII OF BENDS:</td></tr>
<tr><td>2.1</td><td colspan="2">TUBE OUTER DIAMETER AND THICKNESS:
All are OD (Outer Diameter) Controlled tubes with thickness tolerance of Max.+12 %</td><td></td></tr>
<tr><td></td><td colspan="2">
<table>
<tr><th>S.No</th><th>Tube OD, mm</th><th>Minimum Thick,mm</th><th>Maximum Thick,mm</th></tr>
<tr><td>1</td><td>31.8</td><td>3.2</td><td>5.0</td></tr>
<tr><td>2</td><td>38.1</td><td>3.2</td><td>6.3</td></tr>
<tr><td>3</td><td>44.5</td><td>4.0</td><td>10.0</td></tr>
<tr><td>4</td><td>47.63</td><td>5.0</td><td>10.0</td></tr>
<tr><td>5</td><td>51.0</td><td>3.6</td><td>12.0</td></tr>
<tr><td>6</td><td>54.0</td><td>3.6</td><td>12.0</td></tr>
<tr><td>7</td><td>63.5</td><td>4.8</td><td>12.5</td></tr>
<tr><td>8</td><td>76.1</td><td>7.1</td><td>12.5</td></tr>
</table>
</td><td></td></tr>
</table>

<table>
<tr><th>S. No.</th><th>BHEL SPECIFICATIONS</th><th>Bidder's OFFER [With Complete Technical Details]</th></tr>
<tr><td>2.2</td><td>MATERIALS:</td><td></td></tr>
<tr><td></td><td>a. Carbon Steel:
SA192, SA210A1, SA210C
b. Alloy Steel:
SA209T1, SA213T11,
SA213T22, SA213T91, T-23, T-93
c. Stainless Steel
SA 213 TP304H, SA 213 TP321H, SA 213 TP347H</td><td></td></tr>
<tr><td>2.3</td><td>RADII OF BENDS:</td><td></td></tr>
<tr><td></td><td>
<table>
<tr><th>S. No</th><th>TUBE OD, mm</th><th>Minimum Bend Radius, mm</th><th>Maximum Bend Radius, mm</th><th>Other bend radii</th></tr>
<tr><td>1</td><td>31.8</td><td>R 40</td><td>R 48</td><td></td></tr>
<tr><td>2</td><td>38.1</td><td>R 48</td><td>R 65</td><td>R 51</td></tr>
<tr><td>3</td><td>44.5</td><td>R 48</td><td>R 143</td><td></td></tr>
<tr><td>4</td><td>47.63</td><td>R 51</td><td>R 152</td><td>R 114</td></tr>
<tr><td>5</td><td>51.0</td><td>R 76.5</td><td>R 151</td><td></td></tr>
<tr><td>6</td><td>54.0</td><td>R 76.5</td><td>R 165</td><td></td></tr>
<tr><td>7</td><td>63.5</td><td>R 76.5</td><td>R 320</td><td>R 100, 160, 320</td></tr>
<tr><td>8</td><td>76.1</td><td>R 160</td><td>R 225</td><td></td></tr>
</table>
</td><td></td></tr>
<tr><td>2.3.1</td><td>Tube Dia. 38.1mm, Thickness: 5.3, Material: SA 210 Gr. A1 (Carbon Steel)
Bend Radius R38mm. Is it possible? Vendor to give details.</td><td></td></tr>
<tr><td>2.4</td><td>JOB DETAILS: For Typical configuration of Job, Refer Annexure 1</td><td></td></tr>
</table>

S. No.	BHEL SPECIFICATIONS		Bidder's OFFER [With Complete Technical Details]
3.0	**TOLERANCES FOR BENDS**		
3.1	**VISUAL DEFECTS**		
3.1.1	It shall be free from harmful surface visual defects, such as scoring marks, wrinkles, tool marks and depressions, etc		
3.2	**PERCENTAGE OVALITY**		
3.2.1	% Ovality ={(Max.OD - Min.OD)/ Nominal OD} x100	Maximum allowed ovality is 10%	
3.3	**MINIMUM OD**		
3.3.1	Minimum OD in any section of the bend should comply with this formula	Min.OD shall not be less than 0.895xNominal OD + 0.233 x Min. Wall thickness after bending	
3.4	**PERCENTAGE THINNING**		
3.4.1	% Thinning = {(t1–t2) / t1}x100, where, t1–nominal wall thickness before bending t2–minimum wall thickness after bending	Maximum allowed Thinning is i) 10% max. for R/d ≥ 1.5 ii) 12.5% max. for R/d < 1.5	
3.5	**FLATNESS**		
3.5.1	Cold Bending operation	No flatness allowed	
3.6	**Bending Angle**	± 0.5°	
3.7	**Bend Radius**	± 3 mm	

S. No.	BHEL SPECIFICATIONS		Bidder's OFFER [With Complete Technical Details]
4.0	**OPERATING PARAMETERS:**		
4.1	Tube Diameter	Minimum: 31.8 mm Maximum: 76.1mm	
4.2	Tube Wall Thickness	As given in the table (Sl.No. 2.1)	
4.3	Bend Radius	Minimum: 40mm Maximum: 320mm	
4.4	R/d Ratio (Bend Radius / Tube Diameter)	**1.2** for all sizes	
		1.0 for tube OD ≥ 51 and with minimum 10% wall thickness	
4.5	Tube length handled – Automatic tube feeding from tube rack	Minimum: 3000mm Maximum: 22000mm	
4.6	Tube length handled – Tube feeding manually done	Minimum: 950mm Maximum: 3000mm	
4.7	Tube Clamping Length required	50mm for tubes upto OD 51mm 1xD for tubes above OD 51mm	
4.8	End Limb Length	100mm for ≤ 90 deg bends 200mm for 180 deg bends	
4.9	Bending Angle in Job	0° to 180°	
4.10	Multi Plane Turning Angle	360°	
4.11	Bending Direction	**CLOCKWISE**	
4.12	Tube batch quantity	Each lot will have max. of 40 to 50 tubes	
4.13	'S' bend configuration (zero distance between bends)	Machine to be capable of making 'S' bends	

S. No.	BHEL SPECIFICATIONS		Bidder's OFFER [With Complete Technical Details]
5.0	**PRODUCTIVITY**		
5.1	No.of bends per shift on Tubes with OD 51mm and Radius 76.5mm - Angle 180 degrees.	300 bends in one 8 hour shift	
6.0	**MACHINE PARAMETERS**		
6.1	Maximum Bending arm Bending Speed in rpm	Vendor to specify	
6.2	Maximum Bending arm Reverse Speed in rpm	Vendor to specify	
6.3	Clamp Jaw Stroke length in mm	Vendor to specify	
6.4	Pressure die Stroke length in mm	Vendor to specify	
6.5	Carriage travel feed stroke : 13000mm	Vendor to confirm	
6.6	Carriage bed length	Vendor to specify	
6.7	Creep speed to be provided for Bending arm during start and end of bending	Vendor to specify and confirm	
6.8	Creep speed to be provided for Clamp Jaw movement, Pressure Die forward / reverse stroke, Carriage movement.	Vendor to specify and confirm	
6.9	Traveling Speed of Carriage in m / min	Not less than 30 m / min. Speed shall be variable. Creep speed to be provided during start and end of the stroke. Vendor to specify range of speed	
6.10	Transfer mechanism of tube from tube rack to in feed roller stand to feed through carriage	Fast enough to feed tubes such that the required productivity is achieved as per 4.12.1	

S. No.	BHEL SPECIFICATIONS		Bidder's OFFER [With Complete Technical Details]
6.11	Mandrels	Mandrels not required	
6.12	Tube Working Height.	Maximum – 1000 - 1200mm from ground level	
6.13	Maximum Bending Torque	Vendor to specify	
6.14	Maximum Tube rotation torque	Vendor to specify	
6.15	Maximum Section Modulus of tube that can be bent in the machine	Vendor to specify	
6.16	Maximum Operating Pressure	Vendor to specify	
6.17	Main Pump Motor capacity in kW	Vendor to specify	
6.18	Total Power Requirement in kVA	Vendor to specify	
6.19	Carriage drive motor power rating, kW	Vendor to Specify	
6.20	Tube rotation drive motor rating, kW	Vendor to Specify	
6.21	Hydraulic Tank Capacity	Vendor to specify	
7.0	**MACHINE OPERATING SYSTEM SPECIFICATIONS:**		
7.1	**SPEEDS :**		
7.1.1	Tube Rotation Speed - Steplessly variable	Vendor to specify range in rpm	
7.1.2	Bending Speed - Steplessly Variable	Vendor to specify range in rpm	
7.2	**RESOLUTION:**		
7.2.1	Tube Feed/Transport	Vendor to specify	
7.2.2	Tube Rotation	Vendor to specify	
7.2.3	Bending	Vendor to specify	

S. No.	BHEL SPECIFICATIONS		Bidder's OFFER [With Complete Technical Details]
7.3	**REPEATABILITY:**		
7.3.1	Tube Feed/Transport	Vendor to specify	
7.3.2	Tube Rotation	Vendor to specify	
7.3.3	Bending	Vendor to specify	
8.0	**GENERAL DESIGN & CONSTRUCTIONAL FEATURES**		
8.1	**Foundation:**		
8.1.1	Foundation of the machine shall be designed suitably, if any. Vendor to specify the details of the foundation. The shop floor at BHEL works has 200mm thick concrete floor with M15 concrete mix. If there is no foundation, the machine shall be placed on anti-vibratory pads.		
8.2	**Controls:**		
8.2.1	The three axis controls viz, bending angle, rotation angle and distance between bends of 3-Axes shall be PC based programmable type. Collet axis centering, in line with CLR of bend die shall also be through programming.		
8.2.2	Machine shall be operated in three modes viz., Manual, semi-Automatic and Automatic		
8.2.3	Boosting facility shall be available to control thinning. The extent of boosting shall be set through program by the operator.		
8.2.4	Operator Control panel shall be Self Standing - PC Based touch screen type control panel with 10m long cable having protective sheathing and plug-in connectors through closed cable ducts.		
8.2.5	The bending process auto and feed back field start and stop initiating field sensors, such as encoders, limit switch, feed back devices shall be suitably placed for easier accessibility rigidly.		

S. No.	BHEL SPECIFICATIONS	Bidder's OFFER [With Complete Technical Details]
8.3	**Carriage Construction:**	
8.3.1	Carriage movement sensor shall be of non-contact type	
8.3.2	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.	
8.3.3	Collet shall be suitably designed to allow the weld butt joints between tubes, through the collet freely. A weld reinforcement of maximum 4mm per side (8mm on diameter) can be considered for designing collet.	
8.3.4	Vendor to give details of the different collet arrangements and their ranges that will be needed for various diameters as per our specification.	
8.3.5	The carriage size shall be such that the carriage does not foul / interfere with long end limb of 180 degree bends of close radius.	
8.3.6	Carriage shall be of rigid construction with capability of handling the entire range of tubes/ Tubes mentioned. The carriage shall receive the tube from the loading stand located at the rear side of the machine bed and position the tube through carriage collet to the bender. The collet shall open once the tube is clamped to the bending former. As the bend is under progress, the carriage shall reverse back and position automatically to the programmed length / hitching length for the following bend. This shall be repeated for all the bends.	
8.3.7	The sliding carriage guide way and the gripping arrangement of carriage over the slide way shall be rigid enough so that the carriage does not lift. The design details to be briefly explained by the vendor.	
8.3.8	Supports to prevent sagging of tube during tube feeding. Vendor to Specify with details of how this is achieved in their machine.	

S. No.	BHEL SPECIFICATIONS	Bidder's OFFER [With Complete Technical Details]
8.4	**Tube Loading Facility**	
8.4.1	Loading stand / Tube storage rack shall be provided and positioned behind the machine parallel to the machine bed. The stand shall be suitable to load a bundle of tubes weighing 4 tons The slope of the storage rack shall hold 40 tubes of dia 38.1mm and the straight portion of the storage rack shall have a width of ONE metre.	
8.4.2	The following shall be provided in the machine: a) Tube bending machine shall have automatic loading of tube. b) Tube kick off from the tubes storage rack on to the tube feed rollers for tubes of maximum 22 metre long and a minimum of 3 metres long. c) Tube kick off to be pneumatically operated. d) Automatic tube feeding with feed rollers along the bed. e) Tube feeding through the collet from the rear of the carriage. f) Automatic Tube end sensing and positioning of tube to the programmed length for the first bend g) To reduce noise, Teflon beading to be provided on the loading tube storage supports.	
8.5	**Bend die construction**	
8.5.1	Bend die mounting plate shall be designed such that there is no interference with multi-plane bends while bending multi-plane bend configurations.	
8.5.2	Split die actuation to be provided in the machine. Lift has to be more than 10mm and not more than 20mm.	
8.5.3	Split die actuation to be achieved only from the bottom of the machine and NOT overhead.	
8.5.4	Bend die mounting shall be of quick type with only hand tightening.	

S. No.	BHEL SPECIFICATIONS		Bidder's OFFER [With Complete Technical Details]
8.5.5	Provision for bend to bend ('S' bends) clamping to be confirmed.		
8.5.6	Design of the DIE-BOSS (Bending Table) on which the BENDING FORMER is mounted has to suit the FORMER mounting details given in Annexure - 2. (This is required to enable use of bending formers available with BHEL.)		
8.6	**Follower jaw construction**		
8.6.1	The length of the Follower jaw shall be in single piece suitable for making 180 degree bends in a single stroke.		
8.6.2	Independent Follower jaws for each diameter shall be quoted, for all diameters as given in Clause 9.0 under Toolings. There shall NOT be any pads to change over diameters.		
8.6.3	Follower jaws shall be easily removable and mountable. Provision for handling by crane to be provided like eye hooks.		
8.7	**Booster Unit**		
8.7.1	Type of Boosting	Back boosting / Clamp boosting / Pressure die assist boosting. Vendor to specify	
8.7.2	Maximum Booster force	Vendor to specify	
8.7.3	Boosting shall be programmable It should be possible to set the required boosting power in the program.	Vendor to Confirm - Details to be furnished	
8.8	**Clamping and Clamp Jaw construction**		
8.8.1	The bending machine shall have swing arm type of Tube bending arrangement. NO overhead clamping type.		
8.8.2	Clamp jaw shall be easily removable and mountable with least effort by the operator with quick clamping mechanism.		

S. No.	BHEL SPECIFICATIONS	Bidder's OFFER [With Complete Technical Details]
8.8.3	Independent clamp 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.	
8.8.4	The clamping by standard straight movement of clamp jaw for clamping	
8.8.5	Height adjustment for adjusting the clamp jaw height to be provided	
8.9	**Sliding surfaces**	
8.9.1	Sliding surfaces shall have metal to metal contact. NO pads or Hylam strips in between shall be used	
8.10	**MACHINE OPERATING CONTROL SYSTEM FEATURES:**	
8.10.1	To provide latest System - Details to be specified in the offer clearly. (with PC Based PLC Control).	
8.10.2	Control system shall be preferably PC with PLC.	
8.10.3	Real time bending to be displayed with details such as bending angle, distance of carriage movement, rotation angle etc.	
8.10.4	Recognition of collision point of the Tube rotation device with counter pressure rail, Carriage with Tube kick-off system etc.	
8.10.5	Auto-Display of machine positions on the screen during manual operation.	
8.10.6	Display in flat color monitor. Vendor to specify their standard Monitor size and furnish details such as make and model.	
8.10.7	Auto calculation of co-ordinate conversion from Cartesian co-ordinates into bending machine co-ordinates and vice-versa.	
8.10.8	Spring back and Stretch automatic calculation facility.	
8.10.9	Spring back and Stretch automatic compensation facility.	
8.10.10	Pre-programming and storage of number of different bending tool-data.	

S. No.	BHEL SPECIFICATIONS	Bidder's OFFER [With Complete Technical Details]
8.10.11	Automatic diagnostic alarm feature with error code and message display.	
8.10.12	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.	
8.10.13	System shall have the facility to display Memory details.	
8.10.14	System Software to be stored in EPROM along with Flash Memory.	
8.10.15	The supplier shall give software back up.	
8.10.16	A standard RS 232 C (V 24) interface to connect IBM compatible computer.	
8.10.17	Remote access to the machine through network - internet for remote tele-diagnosis.	
8.10.18	USB Ports for connectivity to be provided	
8.10.19	Additional external standard 104key Keyboard and Optical Mouse.	
8.10.20	The computer shall have CD read and write drive.	
8.10.21	One additional hard disk fully loaded with complete software and clearly written Instructions to take back-up and reloading of a new hard disk to be provided	
8.11	**Hydraulics**	
8.11.1	All Hydraulic valves to be of modular construction. All hydraulic operating components to be mounted on the manifold in a centralized place at convenient location for minimum piping and easy approach for Maintenance. Hydraulic system layout to be provided.	
8.11.2	Hydraulic circuits shall be designed with minimum number of control valves and to suit oil of ISO VG 46 or 68 only. Also minimum number of check-points to be provided wherever pressure is required to be read for setting and trouble shooting. Minimess Pressure Gauge - 1 No with Connecting Hose to be provided.	

S. No.	BHEL SPECIFICATIONS	Bidder's OFFER [With Complete Technical Details]
8.11.3	Vendor to provide a Refrigerant type of Oil chiller suitable to handle the quantity of hydraulic oil in the machine, to maintain oil temperature not exceeding 40 deg C.	
8.11.4	The hydraulic oil cooling unit shall be tropicalized.	
8.11.5	All hydraulic Tube lines to be neatly laid out.	
8.11.6	The hydraulic circuit shall have the facility to unload the pump during idle running..	
8.11.7	Safety interlocks like auto shutoff during low oil level , sudden hose failure etc,. shall be incorporated. Vendor to specify and give details	
8.11.8	Lubricator, Regulator, Filter and hand wheel valve shall be fitted at the centralized location for any pneumatic circuits.	
8.12	**Lubrication**	
8.12.1	Centralized Automatic Lubrication system with a provision for adjusting the timer shall be provided for the machine.	
8.13	**Electrical Points:**	
8.13.1	Wiring: All electrical motors, limit switches etc, on the machine shall be Wired using PVC sheathed cable running in conduits to cable ducts to common terminal block. External wiring from / to control panel, control desk, external motors etc shall be by means of screened multi-core cables. All machine cables shall be of copper.	
8.13.2	Control circuit voltage should be 24 V DC.	
8.13.3	Control panel shall have built in 230V, 5 amps, 3 pin plug.	
8.13.4	Machine panel shall be adequately illuminated for maintenance purpose.	
8.13.5	Control Panels and Operating Panel shall be air-conditioned.	
8.13.6	Type of drives used for motors to be indicated.	
8.13.7	The machine shall be suitable for 415V ± 10%, 50±3% Hz, 3 Phase, 3 wire system	
8.13.8	Electrics shall be tropicalised & shall have IP 54 protection	

S. No.	BHEL SPECIFICATIONS	Bidder's OFFER [With Complete Technical Details]
8.14	**Components used:**	
8.14.1	All motors shall be from makers like SIEMENS, ABB, Allen Bradley or any other internationally reputed makes conforming to IEC Standards, acceptable to BHEL	
8.14.2	All hydraulic elements shall be of VICKERS / REXROTH or any international reputed make acceptable to BHEL.	
8.14.3	All hydraulic hoses shall be preferably of GATES / Parker Hannifin make or reputed makes acceptable to BHEL.	
8.14.4	All electrical items shall be of from SEW / ROCKWELL Allen Bradley/ Telemechanique / Delta or reputed makes acceptable to BHEL.	
8.14.5	All components/devices/terminals are to be incorporated with numbered ferrules.	
9.0	**GENERAL POINTS**	
9.1	Make and Model of the machine to be mentioned. Detailed catalogs of the machine to be sent with the offer.	
9.2	Complete description of all systems & sub-systems shall form part of the technical bid.	
9.3	Is the machine suitable for CAD/CAM interface / compatibility?	
9.4	A schematic diagram showing the layout of the machine & associated systems with salient dimensions shall be submitted along with the offer. Hydraulic system layout to be provided.	
9.5	The operating sequence of the machine with broad outline of various operations involved should be furnished with the offer.	
9.6	Standards for Design, Manufacture and testing of the machine shall be in accordance with internationally accepted standards.	

S. No.	BHEL SPECIFICATIONS	Bidder's OFFER [With Complete Technical Details]
10.0	**TOOLINGS**	
10.1	List of tooling (Standard Clamp jaws, Bending formers, Follower jaw/ Pressure die etc) for the sizes mentioned below to be quoted out item wise separately. A) Tube dia. 44.5mm / Bend Radius 48mm. - 1 Complete set B) Tube dia. 51mm / Bend Radius 76.5mm - 1 Complete set C) Tube dia. 54mm / Bend Radius 165mm - 1 Complete set Note: Detailed Manufacturing drawings for toolings are to be provided for the ordered tools, in case of an order.	
11.0	**AMBIENT CONDITIONS**	
11.1	The tube-bending machine with all Sub-Systems shall be suitable for operation in an ambient temperature varying from 25 to 50°C and with a Relative Humidity varying from 45% to 90% at the Factory Location.	
11.2	The entire equipment shall be Tropicalized in Design and Construction	
12.0	**SAFETY**	
12.1	Laser mechanism to be provided for safety, preferably of SICK make,	
12.2	All other safety features provided in the machine shall be specified by the vendor.	
13.0	**PAINTING:**	
13.1	Machine and its accessories to be coated with Polyurethane Paint. Colour shade : RAL 6011	

S. No.	BHEL SPECIFICATIONS	Bidder's OFFER [With Complete Technical Details]
14.0	**SPARES (to be recommended by the vendor)**	
14.1	Spares for mechanical, hydraulic, electrical and electronic systems used in the machine required for running the machine on three shift continuous running for 2 years of trouble free operation should be offered by vendor, with item wise break up. **(Unit Price of each item of spare should be offered)**	
14.2	**Mechanical & Hydraulic Spares:** All types of Pumps, Valves, Pressure Switches, Transducers, Flow Switches, Filters, Seals, O-rings, Hydraulic Hoses etc. Essential Spares for vendor has to quote compulsorily: Mechanical & Hydraulic spares: a) For Mechanical wearing components due to linear movements & rotation - 4 Sets b) For Hydraulic Power Pack, Complete Seal kit for the hydraulic cylinders and other components etc.,-4 Sets	
14.3	**b) Electrical / Electronic / Control System Spares:** 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, Drive and Power Module & Control Cards for Main Drive as well as Feed Drives etc. Essential Spares for vendor has to quote compulsorily a) CNC and PLC PCBs (I/O card, digital to analogue card, CPU card, power supply board etc.) display unit, HMI etc., - 4 Nos each b) Field sensors, such as encoders, optical sensors, proximity switch, limit switches, push buttons, indicating lamps etc. - 4 Nos. each.	

S. No.	BHEL SPECIFICATIONS	Bidder's OFFER [With Complete Technical Details]
14.4	All types of spares for total machine and accessories should be available for at least seven 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	
15.0	**DOCUMENTATION:**	
15.1	The following documents in English language should be supplied along with the machine: **Hard Copies - 3 Sets** **In CD form - 1 Set** **Vendor to confirm** 1. Operating manuals of Machine & its Control System 2. Programming manuals of Machine & its Control System 3. Maintenance manuals with drawings of machine assemblies / sub-assemblies with parts list 4. Electrical circuit diagrams with bill of materials 5. Hydraulic circuit diagrams with bill of materials 6. Pneumatic circuit diagrams with bill of materials 7. Maintenance & Interface manuals for Machine Control System 8. Manufacturing drawings for all toolings ordered with machine under clause 10.0 9. Catalogues, O&M manuals for all bought out items used in the machine. 10. Detailed specification of all rubber items / hydraulic / lubrication fittings 11. PLC program print-outs with comments in English 12. PLC program and data on CD 13. Complete list of Alarm log, Error code, error messages & remedies and on line fault diagnostics to be provided by the vendor.	
15.2	GA drawings, Machine detailed constructional drawings with dimensions, Civil Foundation layout drawings, Hydraulic / Pneumatic / Electrical / Electronic circuits with BOM, are to be submitted within 45 days from the date of ordering (in case of an order) for approval by BHEL.	

S. No.	BHEL SPECIFICATIONS	Bidder's OFFER [With Complete Technical Details]
16.0	**PRE-DISPATCH INSPECTION AT SUPPLIER'S WORKS:**	
16.1	The Machine shall be offered for inspection and performance trials to test the design capabilities of the machine, by BHEL Engineers before Dispatch at Supplier's works. Acceptance Criteria during pre-dispatch inspection: a) All the features of the machine construction shall be operated and shown in good working condition as per the Technical Specification and Drawings approved by BHEL. b) Prove-out trials shall be done on tubes that are supplied by BHEL. c) Quality tests are to be conducted by the supplier, on the bends made during prove-out trials and the results should be within the tolerance limits as per Clause 3.0.	
17.0	**ERECTION AND COMMISSIONING:**	
17.1	The supplier shall depute his engineer(s) for supervising the erection and commissioning of the machine at BHEL.	
18.0	**PROVE-OUT AND ACCEPTANCE AT BHEL WORKS:**	
18.1	After the machine has been erected and energized, a few idle runs have to be done to demonstrate the good working condition of the machine. Acceptance Criteria during commissioning: a) Prove out trials to be conducted on the tubes given by BHEL with the toolings supplied along with the machine. b) Quality tests will be conducted by BHEL, on the bends made during prove-out trials at BHEL and the results should be within the tolerance limits as per Clause 3.0. c) Actual jobs shall be loaded to see the performance of the machine during continuous running for two 8 hr shifts. d) Productivity should be proven as per clause 5.1on actual jobs or test pieces.	

S. No.	BHEL SPECIFICATIONS	Bidder's OFFER [With Complete Technical Details]
19.0	**TRAINING**	
19.1	The supplier shall train TWO BHEL Engineers in Operation and Maintenance (Mechanical, Electrical/ Electronics and Programming) of the Machine for FIVE working days at supplier's works after the pre-dispatch inspection.	
19.2	The supplier shall impart training to BHEL Machine Operators and Maintenance crew in Operation and Maintenance (Mechanical, Electrical/ Electronics and Programming) during Commissioning of the Machine at BHEL works for 5 working days.	
19.3	The training shall be in the following disciplines: a. Safety, b. Operation of the machine, c. Machine Operation programming, d. Trouble-Shooting, e. Software Application, f. All special features of the machine to be explained g. Electrical / Mechanical / Electronics systems	
20.0	**GUARANTEE**	
20.1	Performance Guarantee to be given for 12 months from the date of commissioning OR 18 months from the date of dispatch whichever is earlier.	

Enclosures:

a) **Annexure-1 Bend Configurations**
b) **Annexure-2 Typical Bending formers in BHEL**

Sumesh Anand, DM / BPN / TP

I Kamalakannan, DGM / M&S

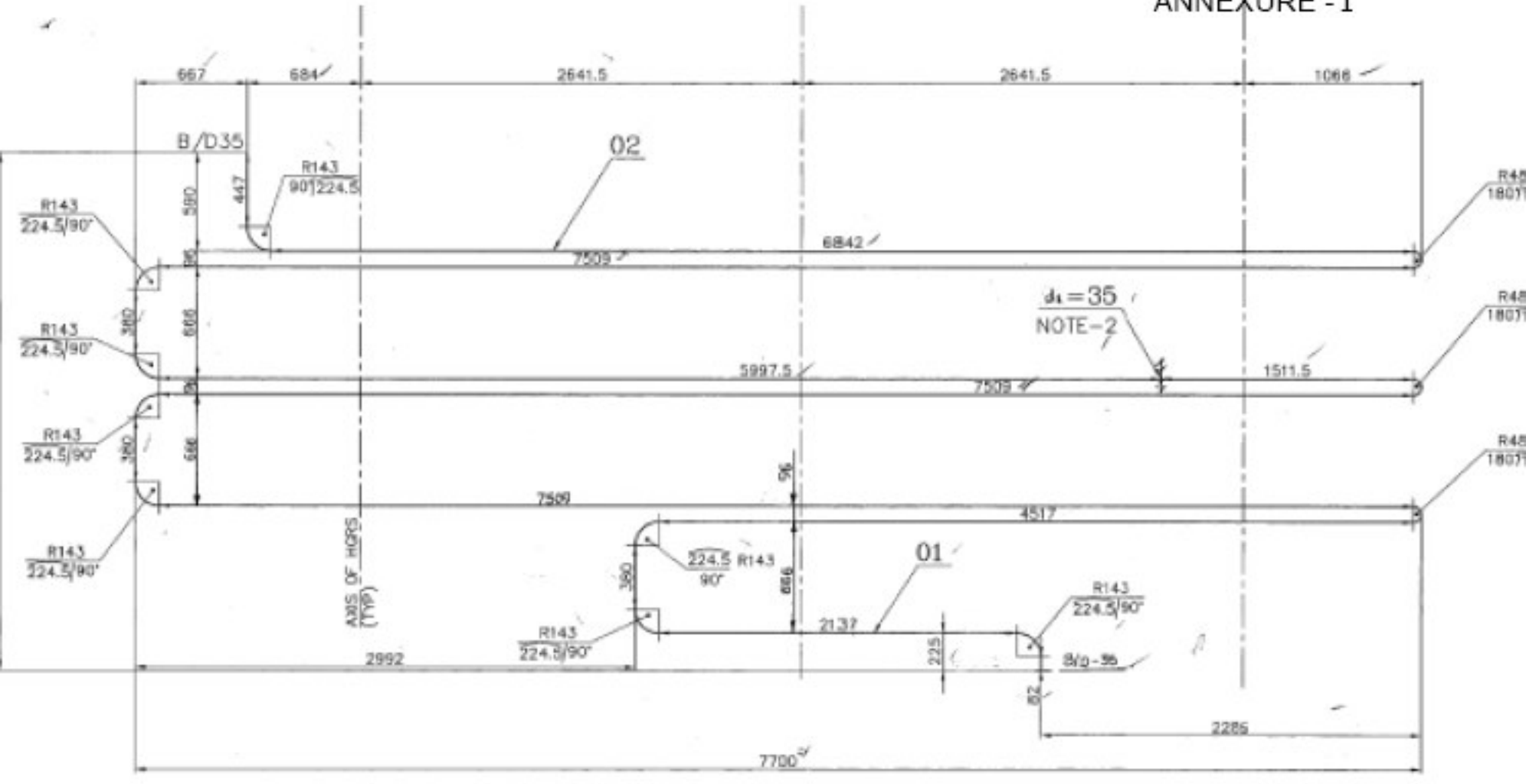
S.Kumarappan, SM / OP&C / TP

G. Subramanian, Mgr./ TE

A.Venkateshwarlu, DGM / Modn.

P Soundararajan, AGM / BPN

ANNEXURE - 1

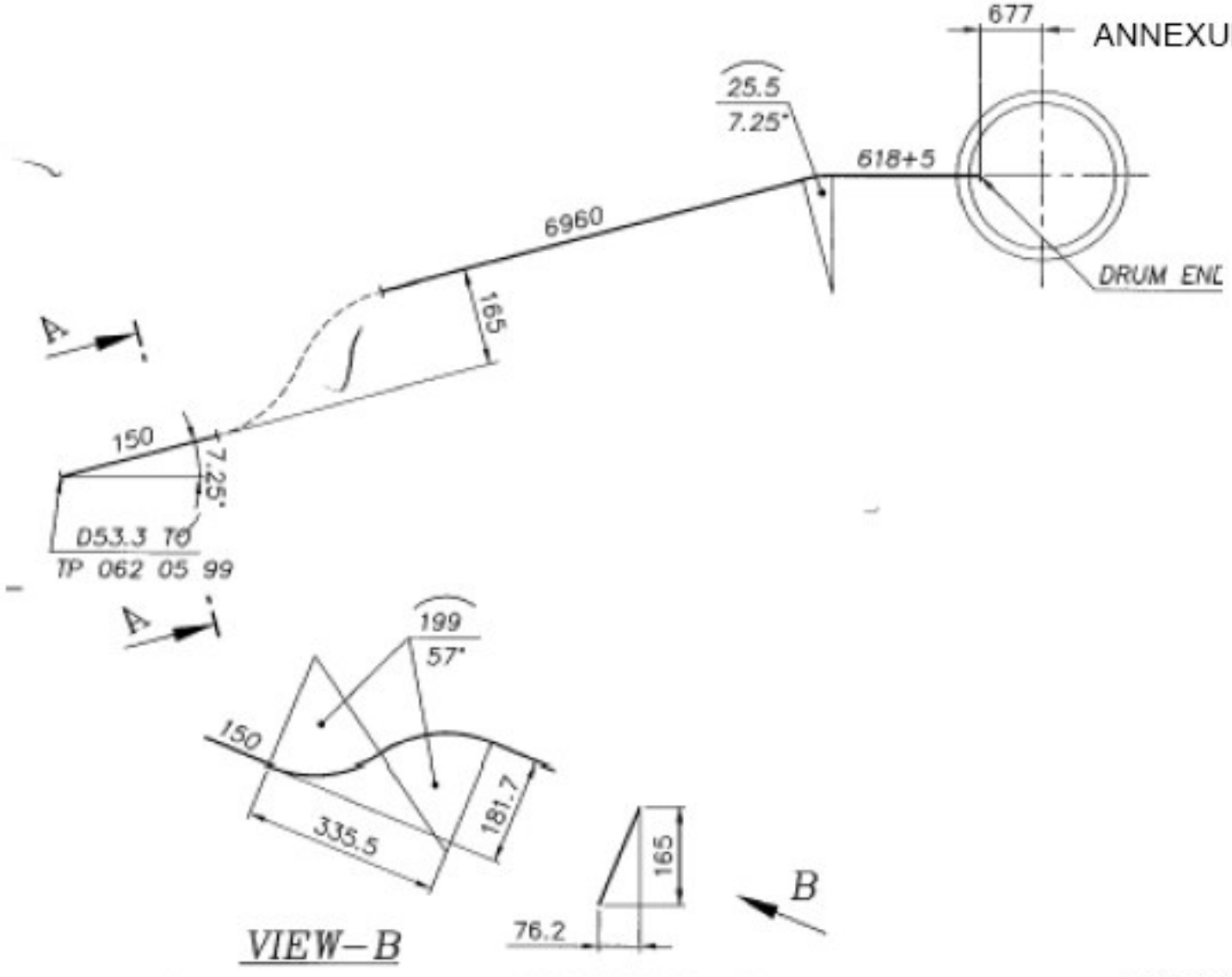


LTSH bend

BEND CONFIGURATION - 1
Drg No : CABS-1-05-01

BHEL, Tiruchirappalli

ANNEXURE - 1



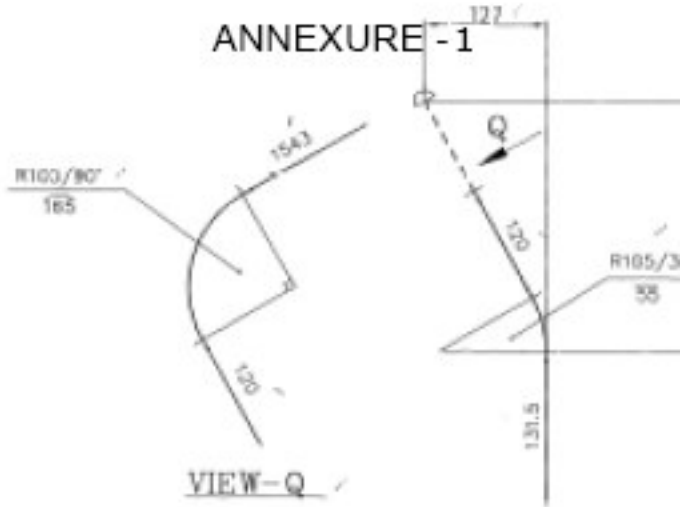
Roof tube bend

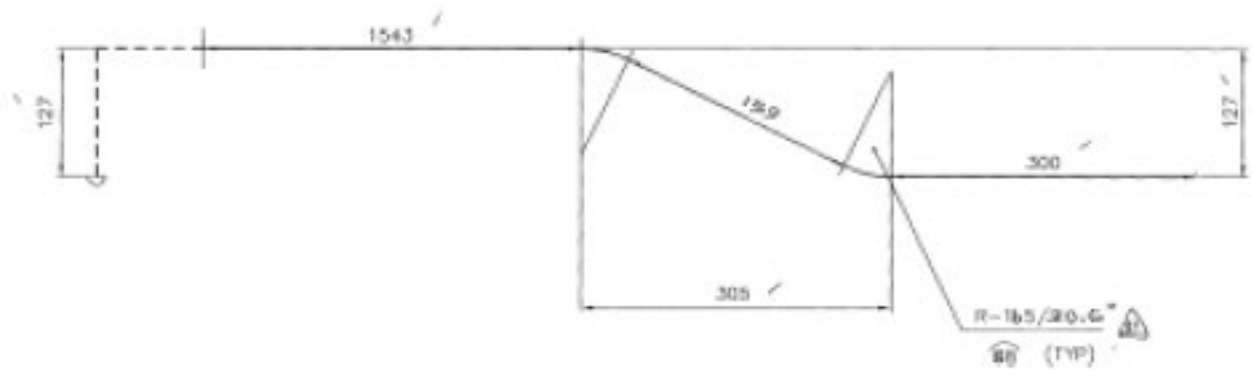
BEND CONFIGURATION - 2

Drg No : CABS-1-05-02

BHEL, Tiruchirappalli

ANNEXURE - 1





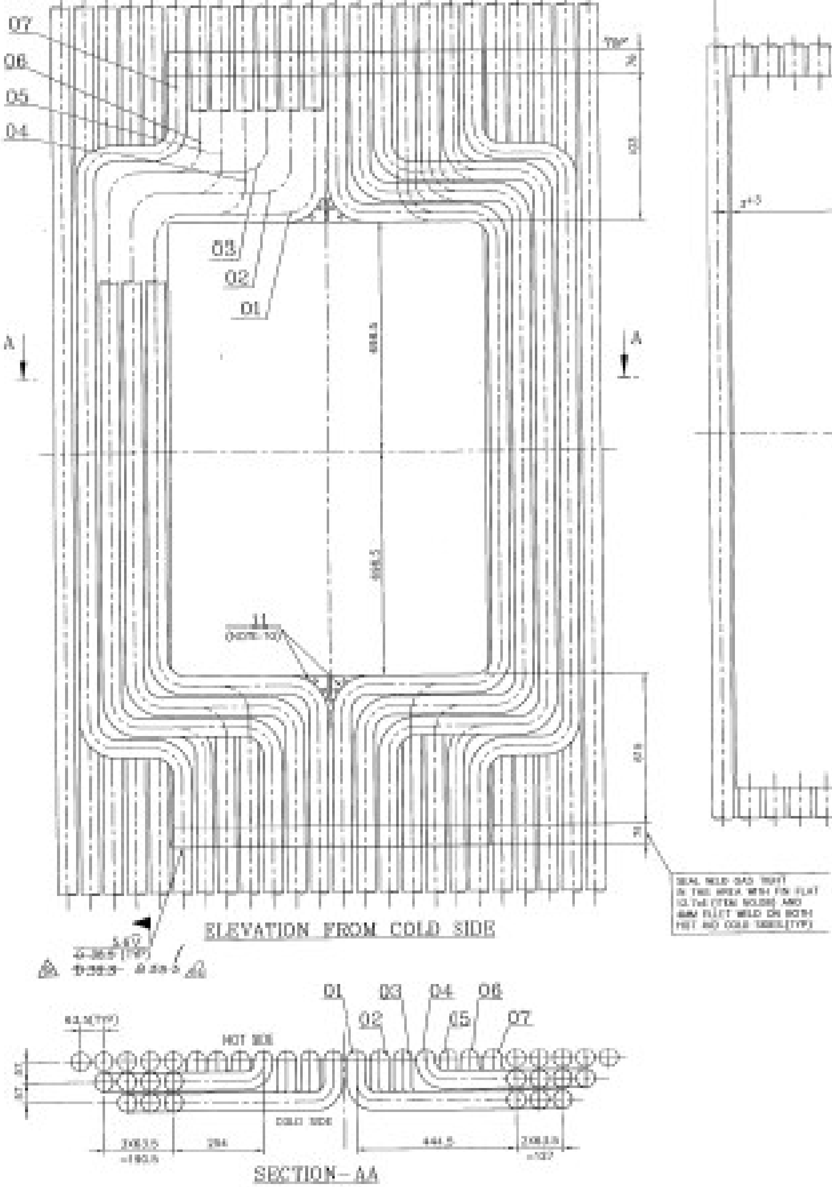
RH cross over tube bend

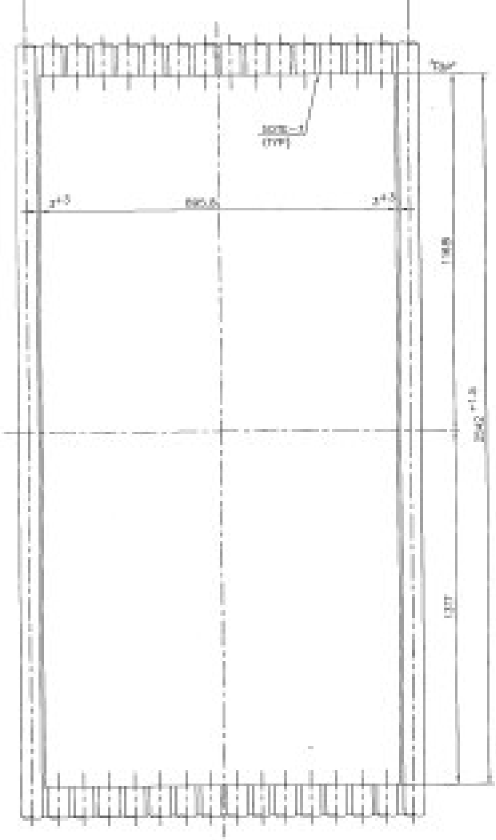
BEND CONFIGURATION - 3

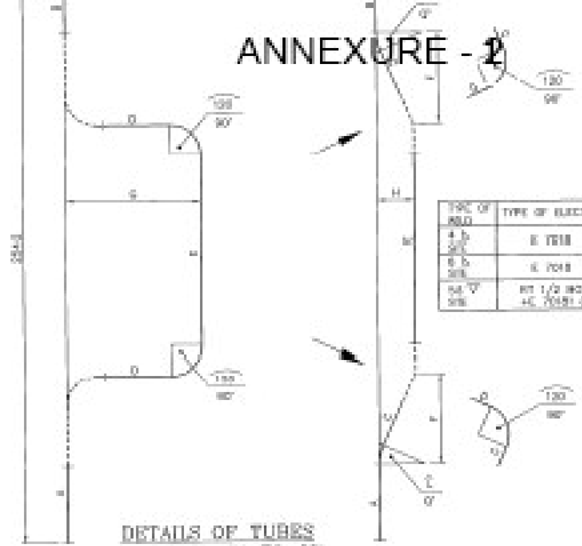
Drg No : CABS-1-05-03

BHEL, Tiruchirappalli

ANNEXURE - 2



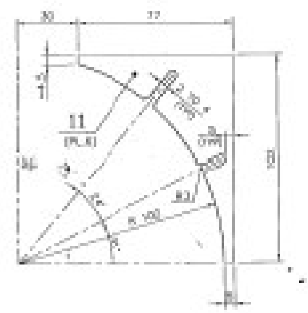




TYPE OF WELD	TYPE OF ELECTRODE	LENGTH (M)
4 b	E 7018	≈ 9.5
6 b	E 7018	≈ 10
54 ▽	RT 1/2 IRG (X) +C 7018 (X)	28 Nos.

DETAILS OF TUBES
ITEM NOS: 01 TO 07

ITEM NO.	A	B	C	D	E	F	G	H	I	Q°	DEV.LENGTH
01	487	275	76	291.5	1299	168	444.5	114	52.5	38°30'	3377
02	432	218	76	291.5	1409	168	444.5	114	52.5	38°30'	3377
03	373	161	76	291.5	1523	168	444.5	114	52.5	38°30'	3377
04	483	271	76.5	101	1295	170	254	57	26.5	30°	3937
05	426	214	76.5	101	1409	170	254	57	26.5	30°	3937
06	369	157	76.5	101	1523	170	254	57	26.5	30°	3937
07	312	100	76.5	101	1637	170	254	57	26.5	30°	3937



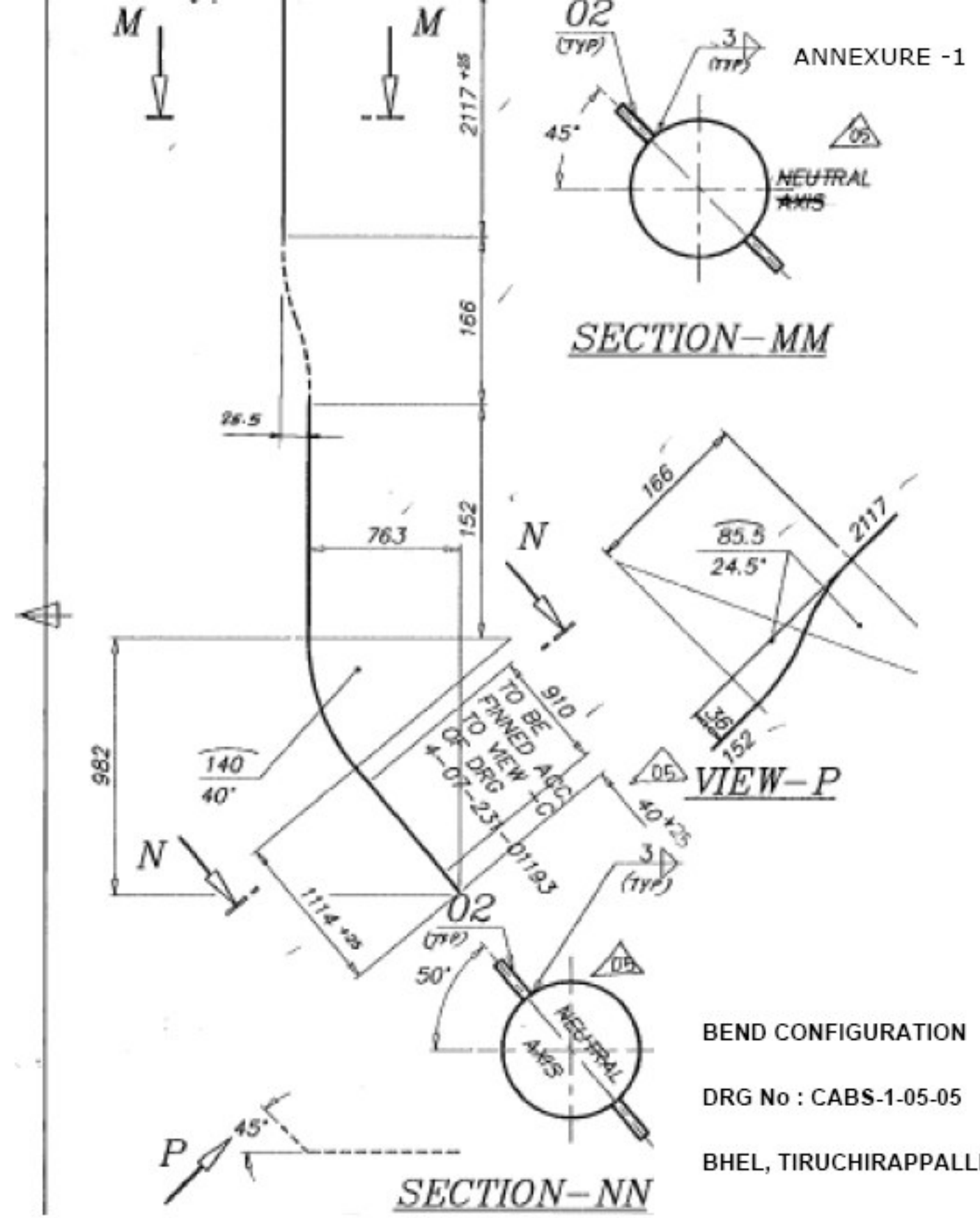
BEND CONFIGURATION - 4

Drg No : CABS-1-05-04

BHEL, Tiruchirappalli

Scaffoled door opening bends

ANNEXURE -1



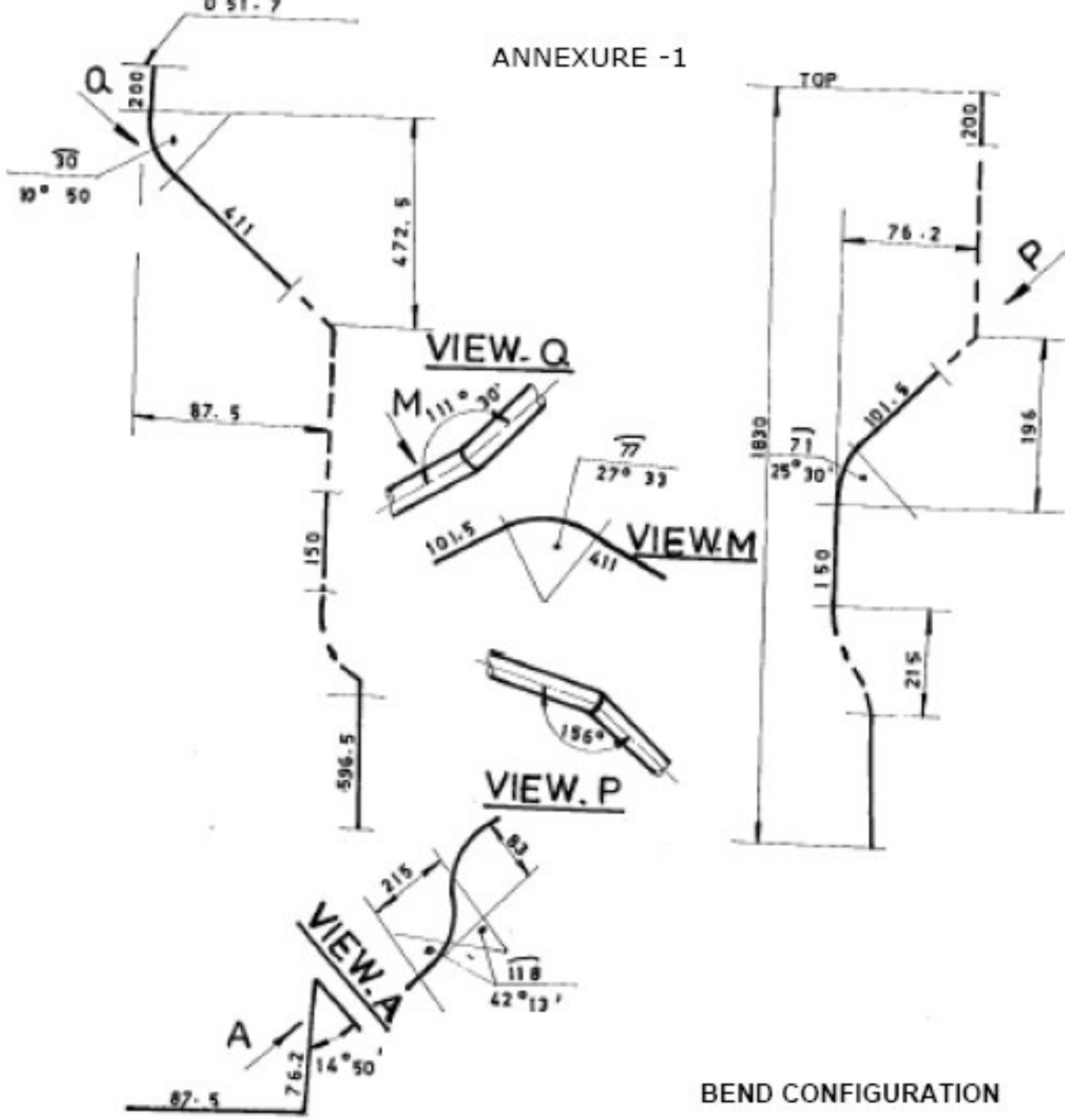
BEND CONFIGURATION

DRG No : CABS-1-05-05

BHEL, TIRUCHIRAPPALLI

Lower corner transition bend

ANNEXURE -1



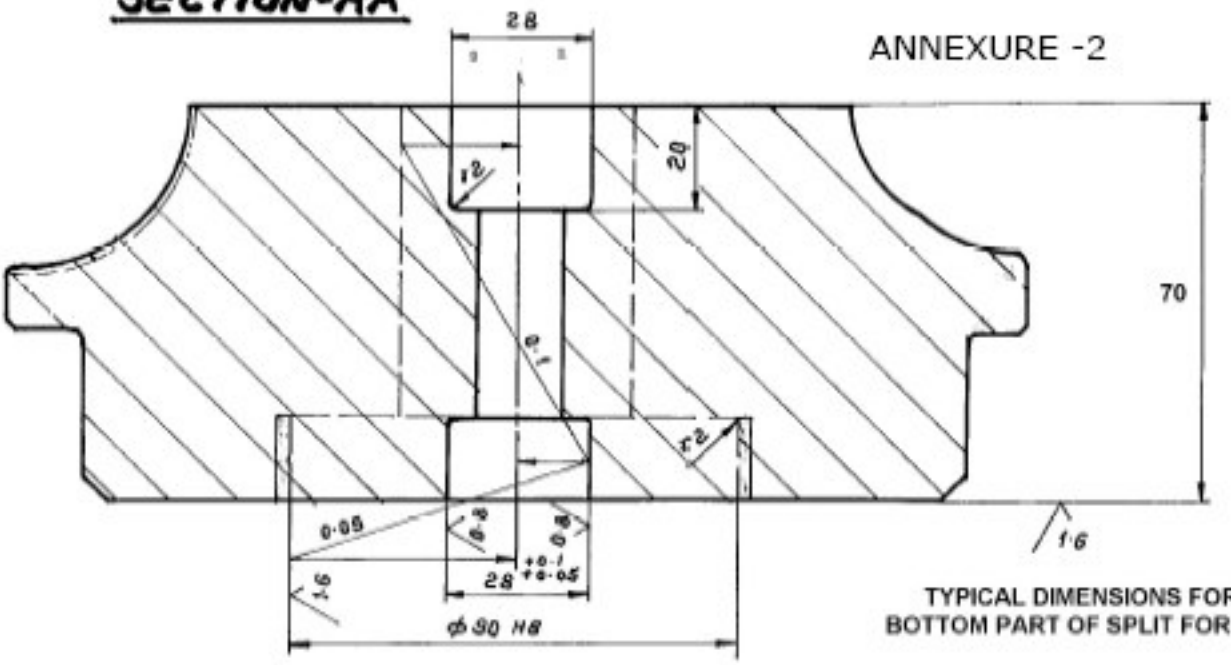
BEND CONFIGURATION

DRG No : CABS-1-05-06

BHEL, TIRUCHIRAPPALLI

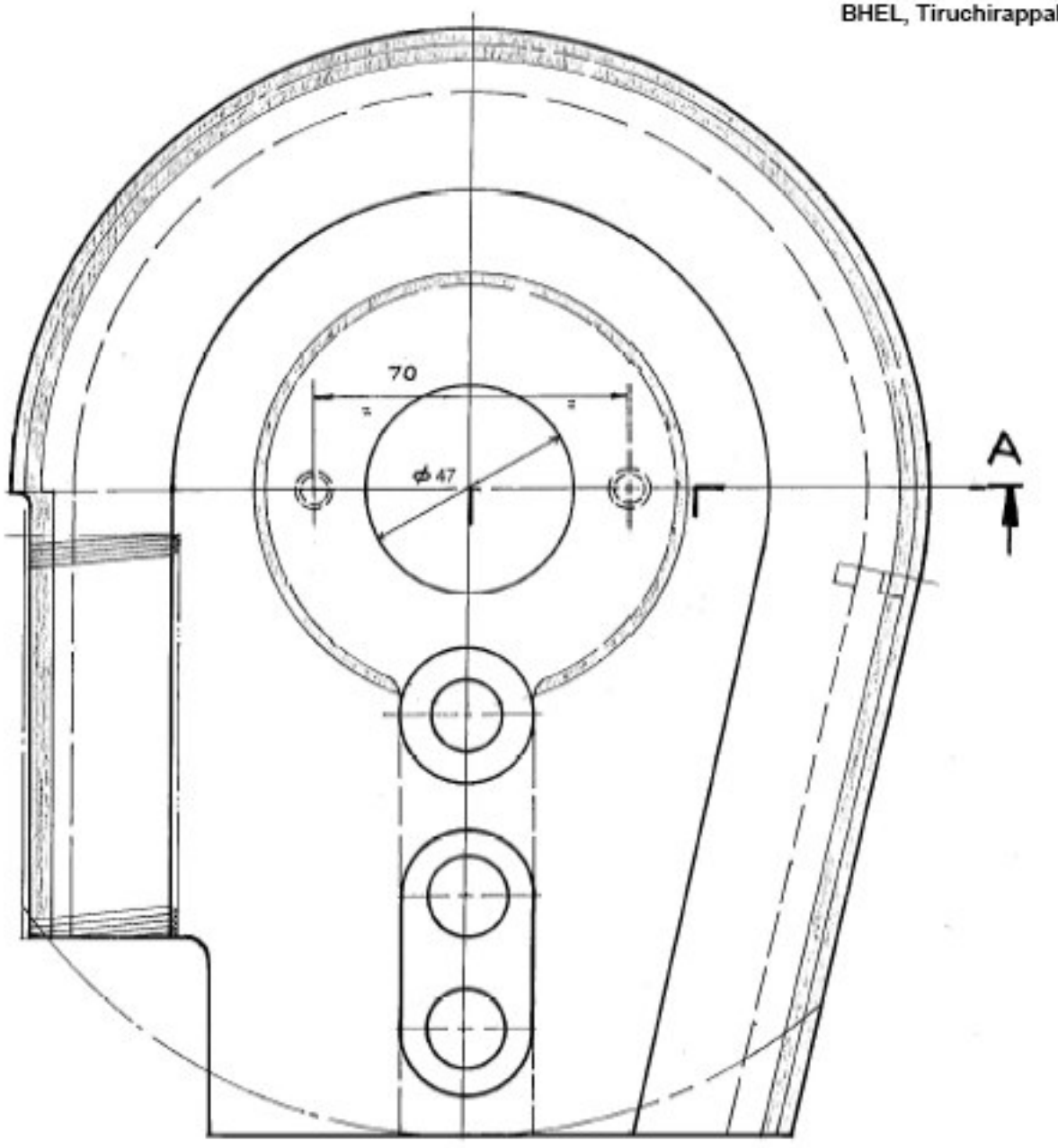
Burner panel bend

ANNEXURE -2



TYPICAL DIMENSIONS FOR
BOTTOM PART OF SPLIT FORMER

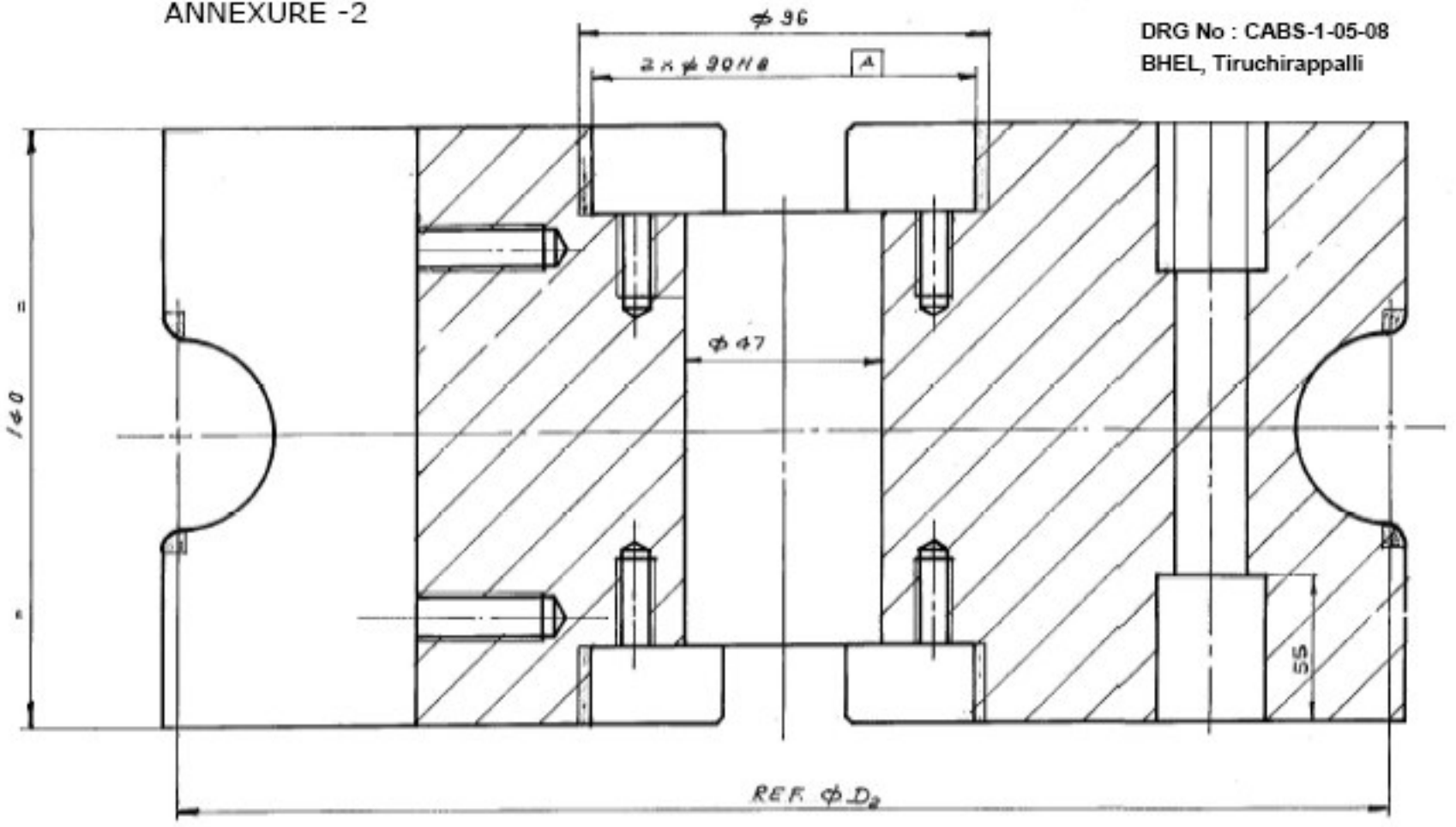
DRG No : CABS-1-05-07
BHEL, Tiruchirappalli



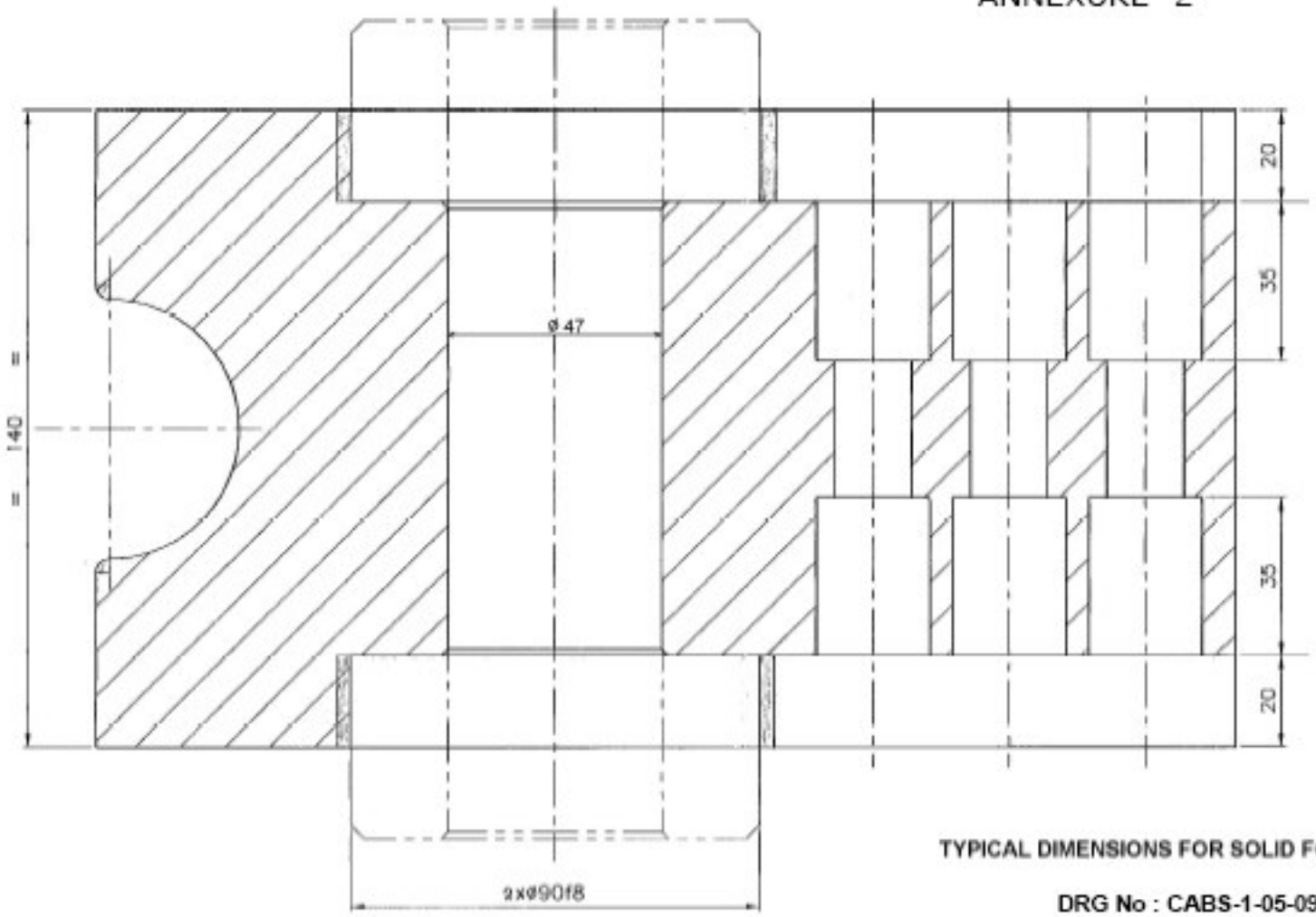
TYPICAL DIMENSIONS FOR SOLID FORMER

ANNEXURE -2

DRG No : CABS-1-05-08
BHEL, Tiruchirappalli



ANNEXURE -2



TYPICAL DIMENSIONS FOR SOLID FORMER

DRG No : CABS-1-05-09
BHEL, Tiruchirappalli