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:** **2621100007**	**Enquiry Date:** **18.01.2011**	**Due date for submission of quotation:** **18.02.2011**

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 Multi Plane Pipe Cold Bending Machine** as per the technical specification & commercial conditions applicable (to be downloaded from web site www.bhel.com or http://tenders.gov.in)	**2 Nos**.

Important points to be taken care during submission of offer:

1. **Delivery required 8 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 "2621100007".

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 / Capital Equipment / MM

PART A

QUALIFYING CRITERIA FOR THE SUPPLY OF CNC PIPE BENDING MACHINE

SECTION – I

The BIDDER / VENDOR has to necessarily provide the following details, for making an assessment of the firm's capability and competency:

[The BIDDER is expected to give complete details against each clause in the table given below and wherever necessary an additional sheet may be attached (giving clear reference number) to cover the required details]

S. No.	PARTICULARS	VENDOR's RESPONSE
1	Number of Years of Experience of the BIDDER/ VENDOR in the field of design, manufacture and supply of **'CNC PIPE BENDING MACHINES'**	
2	Number of similar size and type of CNC Pipe Bending Machines supplied, installed and commissioned till date.	
3	Number of CNC Pipe Bending supplied, installed and commissioned till date for the following category of CUSTOMERS: a) Power Utility Boiler manufacturers b) Ship Building industries c) Process industry equipment suppliers.	
4	Details of Designing background of the PRINCIPAL Equipment manufacturer.	
5	Details of the International code followed for designing CNC Pipe Bending machine shall be furnished. Copies of the relevant portions of the International code shall be annexed with the offer.	
6	Details of Quality Assurance System followed	
7	Details on SERVICE-after-SALES Set-Up in India including the addresses of Agents/Service Centres in India and Asia	
8	Any Additional Data to supplement the manufacturing capability of the BIDDER	
9	Offers for machine made at Taiwan / Korea / China will not be considered.	

SECTION – II

The BIDDER / VENDOR has to compulsorily meet the following requirements to get qualified for submitting an offer for the CNC Pipe Bending Machine.

S. No.	REQUIREMENTS	VENDOR's COMMENTS
10	The BIDDER / VENDOR shall have a minimum of TEN Years of Continuous Experience in the Design, Manufacture & Supply of CNC Pipe Bending machine. Indicate the actual experience.	
11	Reference List of Customers and Performance Certificate from CUSTOMERS (minimum 2 Customers) with full contact details of CONTACT PERSON.	
12	Reference list of Customers who are Power Utility Boiler manufacturers. The contact details may be furnished.	

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
13	The BIDDER / VENDOR shall submit the offer in TWO PARTS - Technical **[with PART A & PART B]** & Commercial and Price Bid. The Technical Offer shall be in line with the BHEL Technical Specifications and the Guidelines or Annexures mentioned, wherever applicable.	
14	The Offer shall contain a comparative statement of Technical Specifications given by BHEL and the Offer Details submitted by the Bidder, against each clause. A just 'CONFIRMED' or 'COMPLIES' or 'YES' or 'NO-DEVIATION' or similar words in the technical comparative statement may lead to disqualification of the Technical Offer.	
15	The BIDDER / VENDOR shall assure a continuous support for SPARES and SERVICE for TEN Years, from the date of commissioning of the equipment at BHEL Works.	
16	The Technical Offer shall be supported by Product Catalogue and Data Sheets in ORIGINAL and complete technical details of 'Bought-Out-Items' with copies of Product Catalogue and Selection Criteria	
17	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 Scope of Supply.	
18	The reference List of Customers shall be accompanied with the details (Phone Number / E-Mail ID) of the CONTACT PERSON for cross reference by BHEL	

PART B

TECHNICAL SPECIFICATIONS for CNC PIPE 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 pipes in multi-plane axes to form high pressure components for Power Boilers and Pipe-Lines for Process Industries. The bending system shall be Draw-Bending type by Electro-Hydraulic means and with CNC mode of operation.	

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

Sl.No	OUTER-DIAMETER	WALL THICKNESS RANGE (Tolerance : Max. +12½ %)
1	88.9 mm	4 / 5.49 / 7.62 / 11.13 / 12.5 / 14.2
2	108.0 mm	8 / 10 / 12.5 / 16 / 20
3	114.3 mm	13.49 / 17.1 / 20
4	127.0 mm	11.5 / 12.5 / 20
5	133.0 mm	10 / 16
6	141.3 mm	16
7	159.0 mm	6.3 / 10 / 12.5 / 16 / 18 / 22.2 / 30
8	168.3 mm	10 / 11 / 21.9 / 27.5
9	219.1 mm	8.18 / 10 / 12.5 / 14.2 / 16 / 20 / 22.2 / 24

3. MATERIALS:

a CARBON STEEL : SA 106 Gr.B/Gr.C (ASTM Standards)
b ALLOY STEEL : SA 335 Gr.P11, P12, P22, P91(ASTM)
c STAINLESS STEEL : SA 312 TP 304, SA 312 TP 316

4. RADII OF BENDS:

Sl.No	PIPE DIAMETER	RADIUS OF BENDS
1	88.9 mm	R 240, 300 mm
2	108.0 mm	R 300, 400, 500 mm
3	114.3 mm	R 400 mm
4	127.0 mm	R 500 mm
5	133.0 mm	R 600 mm
6	141.3 mm	R 400 mm
7	159.0 mm	R 450, 600 mm
8	168.3 mm	R 450, 600 mm
9	219.1 mm	R 600, 800 mm

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)/ Original OD} x100	To be Less than 10%	
5.3	PERCENTAGE THINNING	% Thinning = {(t1 - t2)/ t1 } x 100 where , t1 – actual wall thickness before bending t2 – actual wall thickness after bending	Maximum allowed Thinning is 8%	
5.4	FLATNESS	Cold bending operation	No flatness allowed	
5.5	BEND PLANE	Out of plane for single "U" Bends and others.	± 5 mm (Refer Annexure-1)	
5.6.1	BEND TO BEND OFFSET	a) For Single Offset and Single Plane Bends where a = Offset Height	± 5 mm (Refer Annexure-1)	
5.6.2		b) For Compound Offset / Multi Plane Bends	± 10 mm (Refer Annexure-1)	

S. No.	PARTICULARS	BHEL SPECIFICATIONS		BIDDER's OFFER [with Complete Technical Details]
5.7.1	SRAIGHT PORTION	Tolerance on straight portion encompassing bends	± 10 mm	
5.7.2		Tolerance on straight portion for end limbs of multiple bends	+15/-5 mm	
5.7.3		Intermediate tolerance of "U" shaped bends with bends for different plane	± 10 mm	
5.7.4		Twist gap permissible using straight edge and plumb	1mm/ metre (subject to 10 mm maximum)	
5.7.5		Arm Length (ends) for simple bends	+ 5.0 / - 2.0 mm	
5.7.5		Acceptance limit for Wrinkles (Refer Annexure-1)	1) The depth of valley / OD (d/D) shall be ≤3% 2) Pitch of valley / Depth (A/d) shall be ≥12	
5.8	BENDING ANGLE		± 0.5 °	
5.9.1	BEND RADIUS	a) For Radius < 250 mm	± 3 mm	
5.9.2		b) For Radius 300 to 600 mm	± 6 mm	
5.9.3		c) For Radius 600 to 1000 mm	± 1% of Radius	

S. No.	PARTICULARS	BHEL SPECIFICATIONS	BIDDER's OFFER [with Complete Technical Details]
6	**OPERATING PARAMETERS:**		
6.1	Pipe Diameter	Minimum: 88.9 mm Maximum: 219.1mm	
6.2	Pipe Wall Thickness	As given in the table	
6.3	Reference Pipe Size for establishing the machine capacity	**(Diameter x Thickness)** 219.1 x 24.0 mm; 159 x 30 mm; 168.3 x 6.3 mm; 88.9 x 4 mm	
6.4	Pipe Clamping Length required	200mm for OD 88.9 to 133mm 300mm for OD141.3 to 219.1mm	
6.5	Minimum End Limb Length	200mm for OD 88.9 to 133mm 450mm for OD141.3 to 219.1mm	
6.6	Pipe length handled	Minimum : 950mm Maximum: 8000mm	
6.7	Bending Radius	Minimum : 240 mm Maximum : 800 mm	
6.8	Bending Angle in Job	0° to 180°	
6.9	Multi Plane Turning Angle	360°	
6.10	Bending Direction	Clockwise	
6.11	Most frequently used Pipe sizes	OD 127 x 12.5 / R 500 / SA106 Gr C OD 159 x 18 / R 450, R 600 / SA106 Gr C	

S. No.	PARTICULARS	BHEL SPECIFICATIONS	BIDDER's OFFER [with Complete Technical Details]
6.12	Use of the machine	Single production (Each pipe in a lot will have a different bend configuration but with same Radius)	
6.13	Output required	Minimum 100 bends / shift in OD 127 x 12.5mm pipe for single production jobs with Radius 500mm	
6.14	'S' bend configuration (zero distance between bends) -	OD 127 x R 500 Angles as given in Annexure-2 Drg No. CABS-1-15-07	
6.15	Maximum Bending Speed	Vendor to specify	
6.16	Minimum Reverse Speed	Vendor to specify	
6.17	Clamp & Pressure Slide Stroke	Vendor to specify	
6.18	Follower Slide Stroke	Vendor to specify	
6.19	Reaction Slide Stroke	Vendor to specify	
6.20	Traveling Speed of Carriage	Vendor to specify	
6.21	Mandrels (Plug / Ball type mandrels to be quoted with unit cost)	Vendor to specify for all Pipe diameters with thickness less than 8mm. Tolerance on Pipe thickness: Max. +12½ %. Details to be provided in the offer.	
6.22	Mandrel Retraction Stroke	Minimum - 1200 mm	
6.23	Pipe Working Height	Maximum - 1200mm from ground level	
6.24	Maximum Bending Torque	Vendor to specify	
6.25	Maximum Operating Pressure	Vendor to specify	

S. No.	PARTICULARS	BHEL SPECIFICATIONS	BIDDER's OFFER [with Complete Technical Details]
6.26	Main Pump Motor Power in kW	Vendor to specify	
6.27	Total Power Requirement in kVA	Vendor to specify	
6.28	Hydraulic Tank Capacity	Vendor to specify	
7	**CNC AXES SPECIFICATIONS:**		
7.1	**SPEEDS :**		
7.1.1	Y-axis : Pipe Feed/Transport Speed	Vendor to specify	
7.1.2	B-axis : Pipe Rotation Speed (range)	Vendor to specify	
7.1.3	C-axis : Bending Speed (range)	Vendor to specify	
7.2	**RESOLUTION :**		
7.2.1	Y-axis : Pipe Feed/Transport Speed	0.01 mm	
7.2.2	B-axis : Pipe Rotation Speed	0.005 degrees	
7.2.3	C-axis : Bending Speed	0.01 degrees	
7.3	**REPEATABILITY :**		
7.3.1	Y-axis : Pipe Feed/Transport Speed	0.10 mm	
7.3.2	B-axis : Pipe Rotation Speed	0.10 degrees	
7.3.3	C-axis : Bending Speed	0.10 degrees	

S. No.	PARTICULARS & BHEL SPECIFICATIONS	BIDDER's OFFER [with Complete Technical Details]
8	**GENERAL DESIGN & CONSTRUCTIONAL FEATURES :**	
8.1	**Foundation:**	
8.1.1	Foundation of the machine shall be designed suitably. Vendor to provide details of the type of foundation.	
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.	
8.2.3	Machine shall be operated in three modes viz., Automatic, semi-Automatic and Manual.	
8.2.4	Boosting facility shall be available to control thinning. The extent of boosting shall be set through CNC program by operator	
8.2.5	CNC System operator panel shall be Self Standing - PC Based Touch Screen type control panel.	
8.2.6	The bending angle encoder shall be suitably placed for easier accessibility.	
8.2.7	All feedback systems & elements shall have easy accessibility for maintenance	
8.2.8	All control logics used in the machine to be detailed out in the manual.	
8.2.9	Carriage movement sensor shall be of non-contact type. Separate Precision position switch to be provided for referencing the machine.	
8.3	**Carriage Construction:**	
8.3.1	Carriage to be provided with a Pipe Gripping Device - Collet Type, for feeding Pipes into the machine.	

S. No.	PARTICULARS & BHEL SPECIFICATIONS	BIDDER's OFFER [with Complete Technical Details]
8.3.2	Collet shall be suitably designed to permit the 'weld reinforcement' on Pipes at Pipe to Pipe joints, through the collet. A weld reinforcement of 2mm per side (4mm on diameter) can be considered for designing collet. Also a tolerance of +1% on Outside diameter may be considered.	
8.3.3	Vendor to give details of the different collet arrangements and their ranges that will be used for various diameters as per our specification.	
8.3.4	Carriage shall be of rigid construction with capability of handling the entire range of pipes mentioned and with anti-slip gripping of pipes during bending operations.	
8.4	**Lubrication**	
8.4.1	Centralised Automatic Lubricating System to be provided with metallic tubings.	
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	
8.5.2	Independent Bend dies for all sizes mentioned in the specification shall be quoted in the offer	
8.6	**Mandrel**	
8.6.1	Mandrel rod parallelity with the axis of pipe to be ensured for smooth insertion of pipe over the madrel and removal of pipe after bending	
8.6.2	Suitable retractable supports to be given for the mandrel rod	
8.7	**Follower jaw construction**	
8.7.1	Follower jaw shall be provided in segments and to be mountable independently.	

S. No.	PARTICULARS & BHEL SPECIFICATIONS	BIDDER's OFFER [with Complete Technical Details]
8.7.2	The follower jaw shall be as follows: Follower jaw shall be provided in three segments, each with sufficient length for bending upto 600. For angle less than 600 shall be mounted. If angle required is more than 600 and upto 1200 the second segment will be mounted and for bending angles more than 1200 all the three segments shall be mounted.	
8.7.3	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.	
8.7.4	Follower jaws shall be easily removable and mountable with least effort by the operator.	
8.8	**Clamping and Clamp Jaw construction**	
8.8.1	The bending machine shall have swing arm type of pipe bending arrangement. Note: NO overhead clamping type.	
8.8.2	Clamp jaw shall be easily removable and mountable with least effort by the operator.	
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 options of clamping by (a) standard Straight movement of clamp jaw for clamping and (b) Clamp-jaw engagement for bending and retraction into the bending arm after the bending is completed. (Retraction into the bending arm after bending, below the level of bending former and come up to clamping position before bending for engaging the clamp jaw.)	
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	

S. No.	PARTICULARS & BHEL SPECIFICATIONS	BIDDER's OFFER [with Complete Technical Details]
8.10	**Pipe Loading Facility**	
8.10.1	A pipe loading stand / rack with automatic loading of Pipe into the collet shall be provided. The feeding of pipe shall be from the rear of the collet.	
8.10.2	The type and arrangement of the system to be explained in detail in the offer.	
8.10.3	The machine shall have suitable sensors to sense the pipe end and load the pipe to the programmed length.	
8.10.4	Pipe loading when the mandrel is engaged to be explained in detail by the vendor.	
8.11	**Mandrel**	
8.11.1	Mandrel Lubrication Unit to be provided	
8.11.2	Suitable Mandrel support rollers to be provided	
8.11.3	Hydraulic Mandrel Withdrawing Unit	
8.11.4	Mandrel adjustment facility whether motorized or manual?	
8.12	**Bend correction**	
8.12.1	Bend correction to a maximum of 5 deg. by reversing the bend die, with pipe loaded, by manual control, shall be possible to rectify any errors in bending or in case the bending arm overshoots the programmed bend angle due to some error. (Note: The nature of job is single production and NOT batch production)	
8.13	**Hydraulics**	
8.13.1	All Hydraulic valves to be of modular construction. All hydraulic operating components to be mounted on the manifold in a centralised place in convenient location for easy approach for Maintenance. Preferably outside the frame, behind and on side of the machine.	

S. No.	PARTICULARS & BHEL SPECIFICATIONS	BIDDER's OFFER [with Complete Technical Details]
8.13.2	Hydraulic power pack and Oil tank shall be separate from the Machine and positioned behind the machine conveniently to attend to any maintenance problems.	
8.13.3	Hydraulic hose end fittings shall be of suitable material female swivel nut with 24^0 cone.	
8.13.4	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. MINIMEβ Pressure Gauge - 1 No with Connecting Hose to be provided.	
8.13.5	The hydraulic oil cooling unit shall be tropicalized. An Oil-Chiller is preferable to maintain oil temp. less than 50 deg C. The machine shall be suitable for an ambient temperature of +50 deg C and relative humidity of 85% respectively, but both do not occur simultaneously. Vendor to provide details of Oil chiller such as capacity and type.	
8.13.6	All hydraulic pipelines to be neatly laid out.	
8.14	**CNC SYSTEM FEATURES :**	
8.14.1	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.	
8.14.2	System Software to be stored in EPROM along with Flash Memory	
8.14.3	Software back-up shall be given by the supplier.	

S. No.	PARTICULARS & BHEL SPECIFICATIONS	BIDDER's OFFER [with Complete Technical Details]
8.14.4	A standard RS 232 C (V 24) interface to connect IBM compatible computer.	
8.14.5	USB Ports for connectivity to be provided	
8.14.6	Remote access through network - internet, for remote diagnosis shall be provided.	
8.14.7	Additional external standard 104key Keyboard and Optical Mouse.	
8.14.8	Pendrive of 512MB capacity of reputed make shall be provided with the machine for storing programs	
8.14.9	The computer shall have CD drive	
8.14.10	Real time bending data to be displayed on the screen with details such as bending angle, distance of carriage movement, rotation angle etc.	
8.14.11	Input shall be through either manual data feed or through an external computer.	
8.14.12	Recognition of collision point of the pipe rotation device and counter pressure rail	
8.14.13	Auto-Display of machine positions on the screen during manual operation	
8.14.14	Display in 2-letter sizes	
8.14.15	Auto calculation of co-ordinate conversion from Cartesian co-ordinates into bending machine co-ordinates and vice-versa	
8.14.16	Spring back and Stretch automatic calculation facility.	
8.14.17	Spring back and Stretch automatic compensation facility	
8.14.18	Vendor to provide details of how the stretch compensation is done and the intermediate distance between bends is controlled.	
8.14.19	Pre-programming and storage of number of different bending tool-data	

S. No.	PARTICULARS & BHEL SPECIFICATIONS	BIDDER's OFFER [with Complete Technical Details]
8.14.20	No.of bends produced counter - data logging of no.of bends per shift produced	
8.14.21	Automatic diagnostic alarm feature with error display	
8.14.22	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.	
8.14.23	System shall have the facility to display Memory details.	
8.14.24	Remote Operator Control Unit (with 10 metre long cable having protective sheathing and plug-in connectors)	
8.15	**PAINTING:**	
8.15.1	The painting scheme shall be as per BHEL requirement.	
9	**OPTIONAL ACCESSORIES :**	
9.1	Automatic clamping jaw changing device - interchanging between Straight clamp jaw and Curved clamp jaw for making 'S' bends	
9.2	Bending Tool Changing Device	
9.3	AUTOCAD integration - Facility to download autocad drawings of pipe bends and convert to operating programs.	
9.4	CAD / CAM interface / Compatibility	
9.5	Real time monitoring facility of logic circuits for CNC programme deployed in the machine	
9.6	Any Other Optional Accessories: Additional Optional Accessories which enhance the productivity of the machine to be described by the supplier with the offer	

S. No.	PARTICULARS & BHEL SPECIFICATIONS	BIDDER's OFFER [with Complete Technical Details]
10	**GENERAL POINTS**	
10 a	Make and Model of the machine to be mentioned. Detailed catalogs of the machine to be sent with the offer	
10 b	List of tooling (Standard Clamp jaws, Bending formers, Follower jaw, 'S' Bend clamp jaw s, Mandrels etc) for the sizes mentioned in specification and any optional tooling shall be listed and quoted out item wise separately.	
10.1	**Components used:**	
10.1.1	All motors shall be from reputed makers like SIEMENS, ABB, Allen Bradely conforming to IEC Standards.	
10.1.2	All hydraulic elements shall be of VICKERS / REXROTH make	
10.1.3	All hydraulic hoses shall be preferably of GATES make	
10.1.4	All electrics shall be of reputed make like SEW / ROCKWELL Allen Bradley/ Telemechanique/ Delta.	
10.1.5	All components/devices/terminals are to be incorporated with ferrules.	
10.2	**Electrical Points:**	
10.2.1	Control Voltage for all Solenoid Valves shall be 24V	
10.2.2	Control panel shall have built in 230V, 5 amps, 3 pin plug.	
10.2.3	Machine panel shall be adequately illuminated for maintenance purpose.	
10.2.4	Control Panels and Operating Panel shall be air-conditioned	
10.2.5	Type of drives used for motors to be indicated	
10.2.6	The machine shall be suitable for 415V ± 10% , 50±3% Hz, 3 Phase, 3 wire system	
10.2.7	Electrics shall be tropicalised & shall have IP 54 protection	

S. No.	PARTICULARS & BHEL SPECIFICATIONS	BIDDER's OFFER [with Complete Technical Details]
10.3	**Ambient Conditions at the Factory location:**	
10.3.1	The machine shall be suitable for an ambient temperature of +50 ° C and relative humidity of 85 % respectively, but both do not occur simultaneously.	
10.3.2	The offered equipment, CNC System and Hydraulic system has to work in a normal fabrication shop environment in ambient conditions.	
10.4	**Manuals in English:**	
10.4.1	Operation & Maintenance (Operation manual shall include all operations of the machines and its accessories with full details and safety instructions. All the features of the machine and how to operate them shall be explained in detail. All CNC functions shall be elaborated in the manual in a user friendly manner.) (Maintenance manual shall include all machine construction drawing, Component drawings, assembly drawings, explanation and details about the sequence of operations of Electrical, Electronic & Hydraulic circuits) Hard copy Original: 3 Nos, CD Media: 1 No	
10.4.2	Detailed spare parts specification for the electrical, electronics, mechanical, hydraulics (and pneumatic if any) to be furnished for items made by the supplier and for the items bought out and assembled by the supplier. Hard copy Original: 3 Nos.	
10.4.3	Electronic and electrical interconnecting drawings (i.e. between machine, control panel and drives) Hard copy Original: 3 Nos.	
10.4.4	Machine data / Commissioning data to be provided	

S. No.	PARTICULARS & BHEL SPECIFICATIONS	BIDDER's OFFER [with Complete Technical Details]
11	**Spares:**	
11.1	Spares for two years of trouble free operation including Hydraulic, Electrical and Electonic components shall be quoted separately with price list item-wise.	
12	**Inspection:**	
12.1	The Machine shall be offered for inspection and performance trials to test the design capabilities of the machine, by BHEL Engineers before Dispatch.	
13	**Acceptance criteria:**	
13.1	All the features of the machines shall be operated and shown and to work as given the specification at supplier's works during inspection and during commissioning at BHEL works.	
13.2	The prove-out trials shall be for the pipe sizes, bend pattern given by BHEL during the technical discussions / 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.	
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. 6.13)	
13.4	Bending on all thin walled pipes (as per our specification) shall be proved out during commissioning.	
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.	

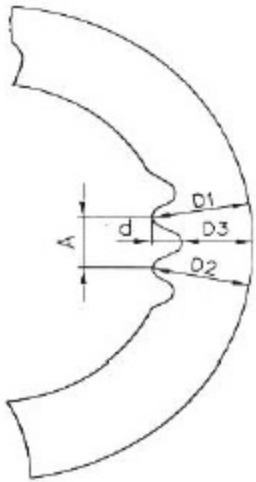
S. No.	PARTICULARS & BHEL SPECIFICATIONS	BIDDER's OFFER [with Complete Technical Details]
15	**Training:**	
15.1	The supplier shall train Four BHEL's Engineers in Operation and Maintenance (Mechanical, Electrical/ Electronics and CNC System) of the Machine at supplier's works for a period not less than 10 working days.	
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 15 working days.	
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 g) Electrical / Mechanical / Electronics systems	
15.4	Co-ordination for a visit of BHEL Personnel to an industry having similar/identical machine & system, in case of order realisation, for system acquaintance & performance feedback	
16	**Guarantee:**	
16.1	Equipment has to be guaranteed for its performance, for a minimum of 24 months from the date of commissioning.	

Enclosures:

a) **Annexure-1 Bend Quality Requirements**
b) **Annexure-2 with drawings of 7 different bend configurations.**

NOTE 2 (1) WRINKLES : Acceptance limits for wrinkles are as given below: (Refer Figure 1).

1) The depth of valley / OD (d/D) shall be <or= 3%
2) Pitch of valley / Depth (A/d) shall be >or= 12
3) Wrinkles beyond acceptable limits shall be corrected. Alloy steel pipes shall be checked by LPI/MPI after correction.



D – NOMINAL OD OF PIPE

FIGURE –1

ANNEXURE - 1

NOTE 5 TOLERANCES FOR BENDS

ANNEXURE - 1

a. Bend to Bend offset : Ref. Fig. 3 & 4

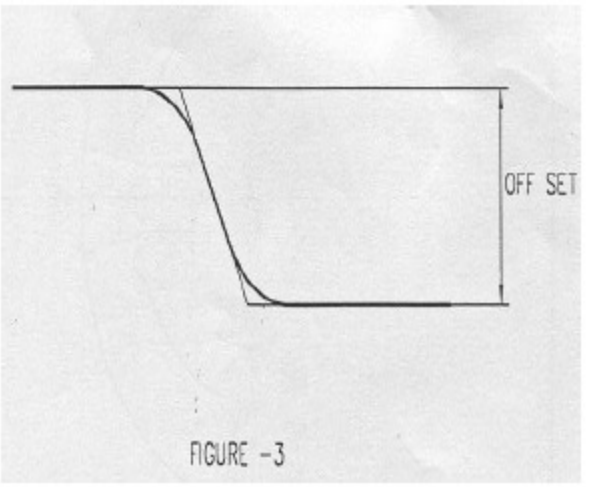


FIGURE -3

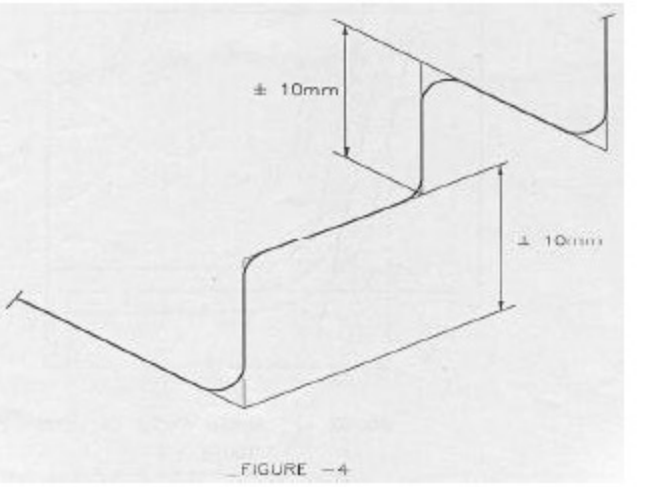


FIGURE -4

For single offset & single plane bends : ± 5mm
For Compound Offset / Multi plane bends : ± 10mm

b. Bend angle : ± 0.5 °

c. Bend radius: ± 5.0 mm

d. Arm length (ends): +5.0/-2.0 mm

e. Linear tolerance in between the bends can be adjusted in the same plane or parallel plane length.

Tolerance on straight portion encompassing bends : ± 10mm
Tolerance on straight portion for end limbs of multiplane bends : + 15/-5mm

f. Intermediate tolerance of `U'shape bends with bends for different planes: ±10mm (Ref. Fig 5).

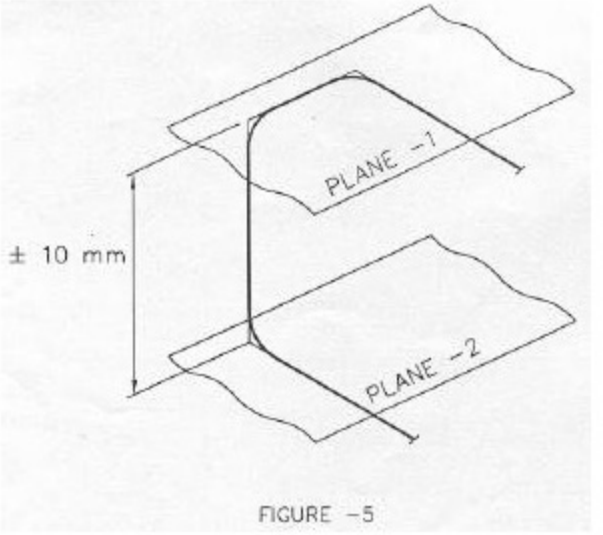


FIGURE -5

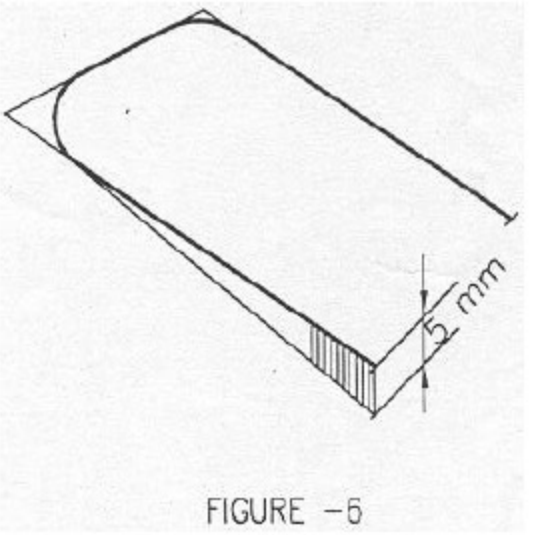


FIGURE -6

g. Out of plane for single`U' bends and others : ± 5mm (Ref Fig.6).

h. Twist (gap observed using straight edge plumb) : 1mm/mtr. 10mm Max.

i. Ovality shall be within the limits specified below:

ANNEXURE - 1

1) IBR : <or= 20 D/R

2) ANSI: 8% max. for bends of R/D > 5

Where R = Radius of bend & D = Diameter of the pipe

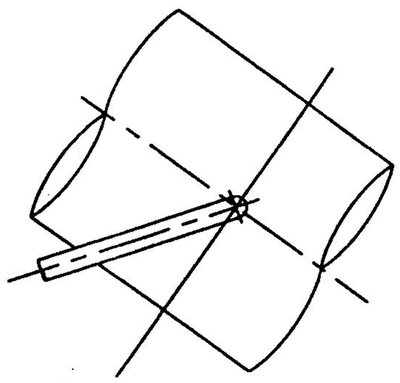
$$\% \text{ Ovality} = \frac{(D_{max} - D_{min})}{D \text{ nominal}} \times 100$$

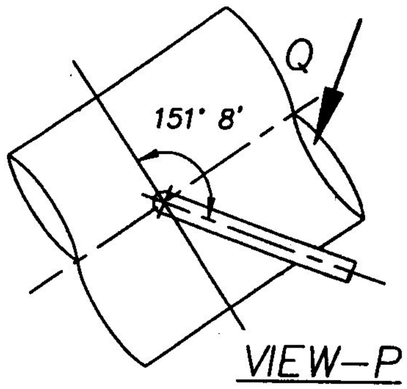
j. Thinning :

a) Cold bends

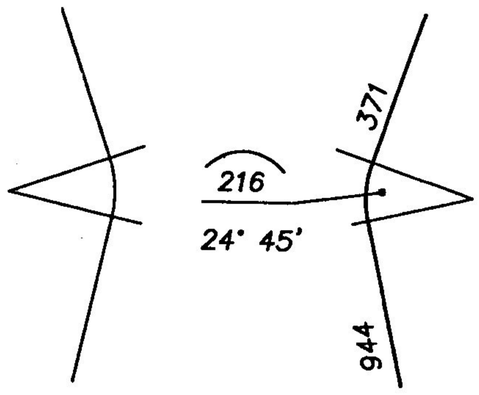
For ID controlled Pipes : 10%
For OD controlled pipes : 21.5% (since a negative tolerance of 12.5 % on thickness is considered in design)

RADIUS OF BEND : 500mm
OD of PIPE : 127mm

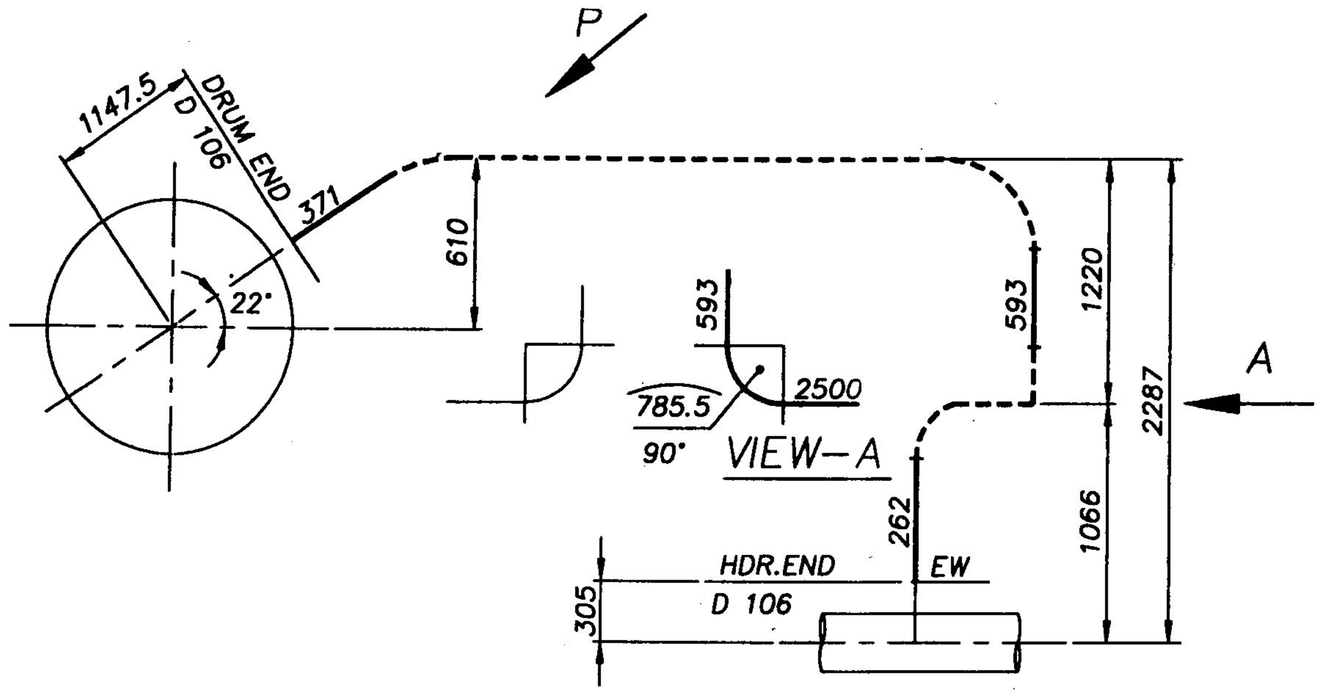


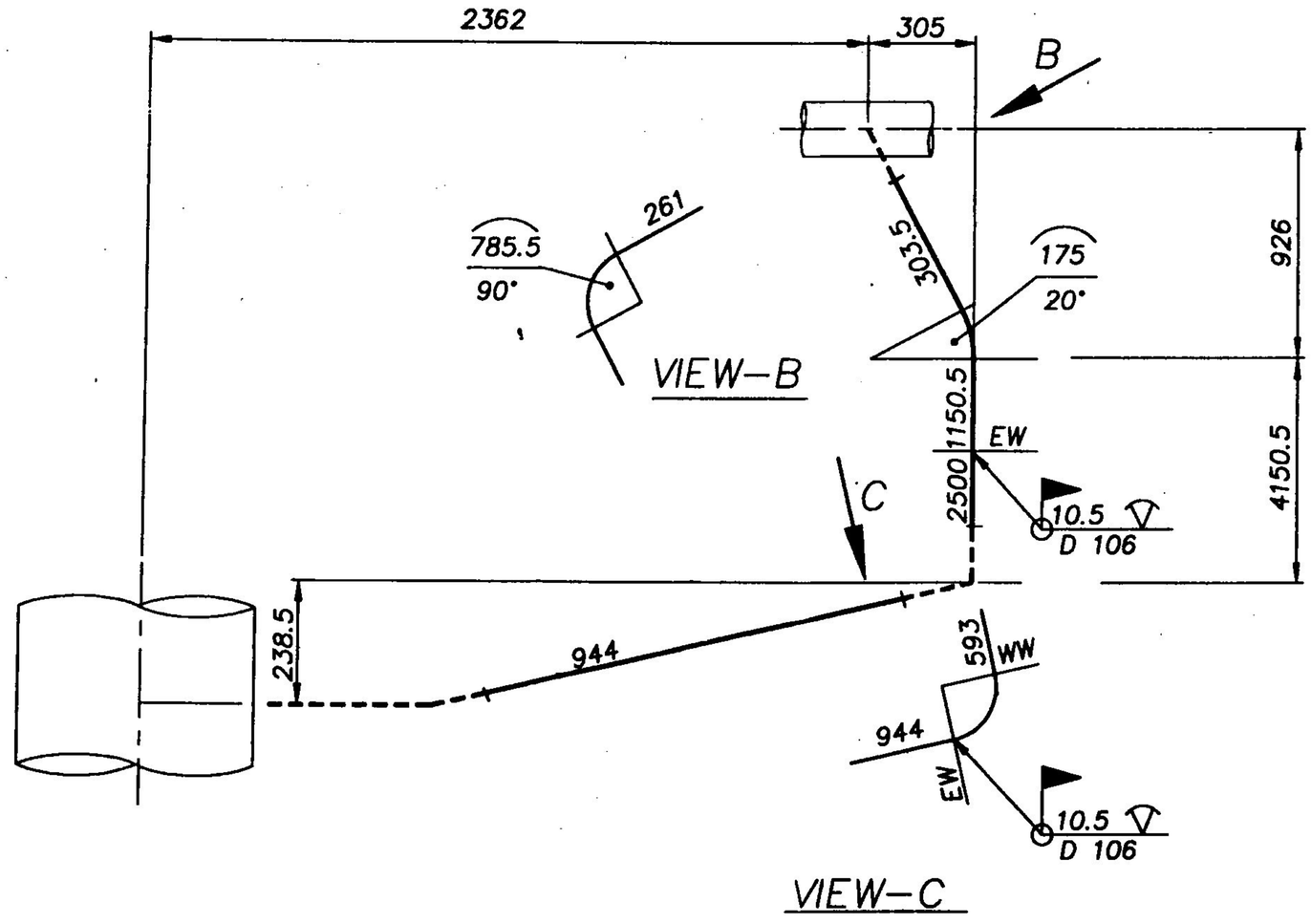


VIEW–P



VIEW–Q



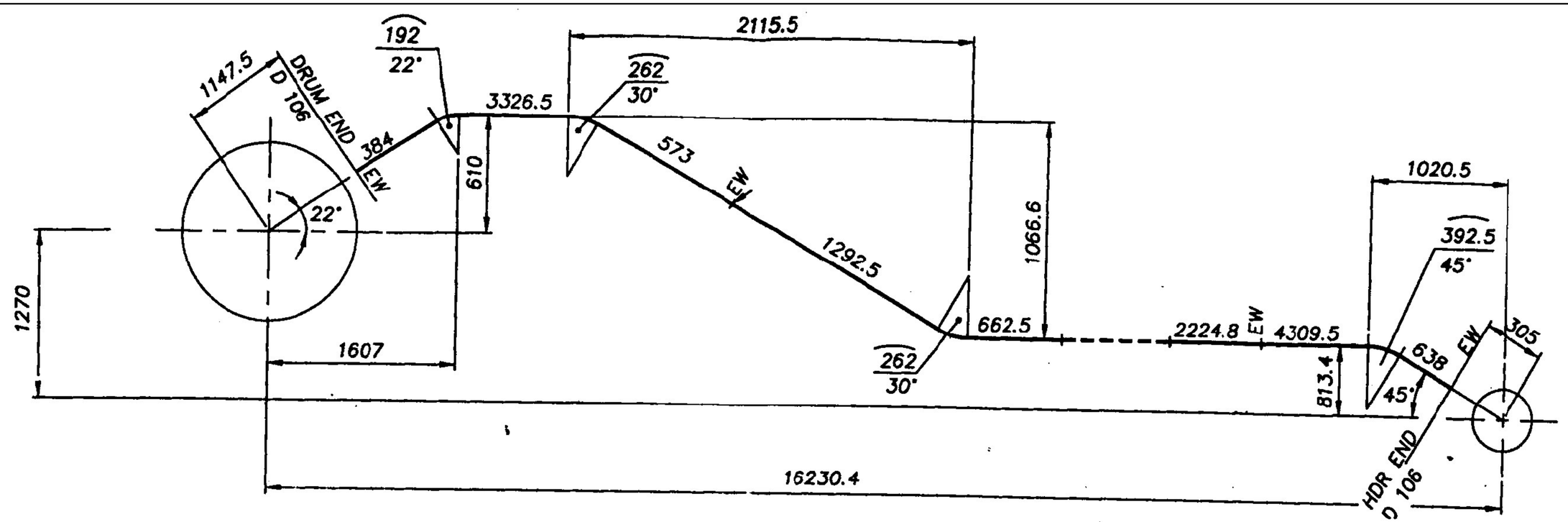


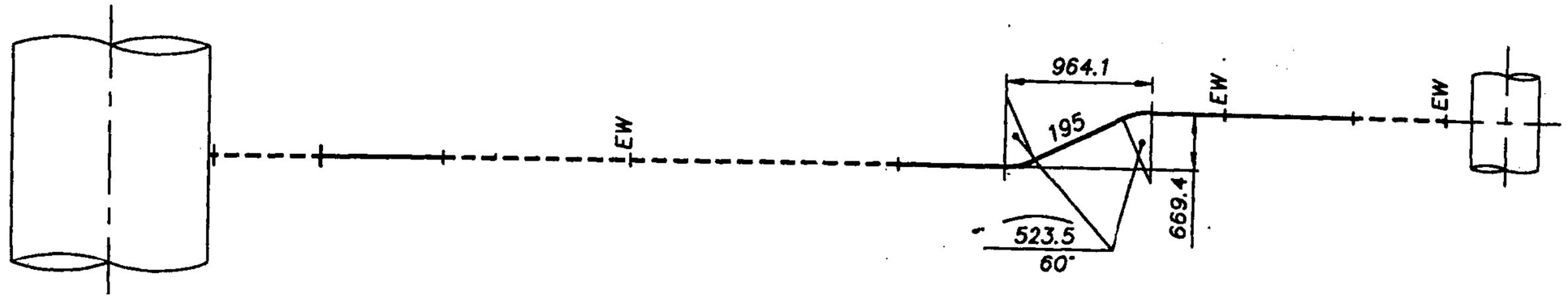
VIEW–C

BEND CONFIGURATION - 1

Drg.No : CABS-I-15-01

BHEL, Tiruchirappalli



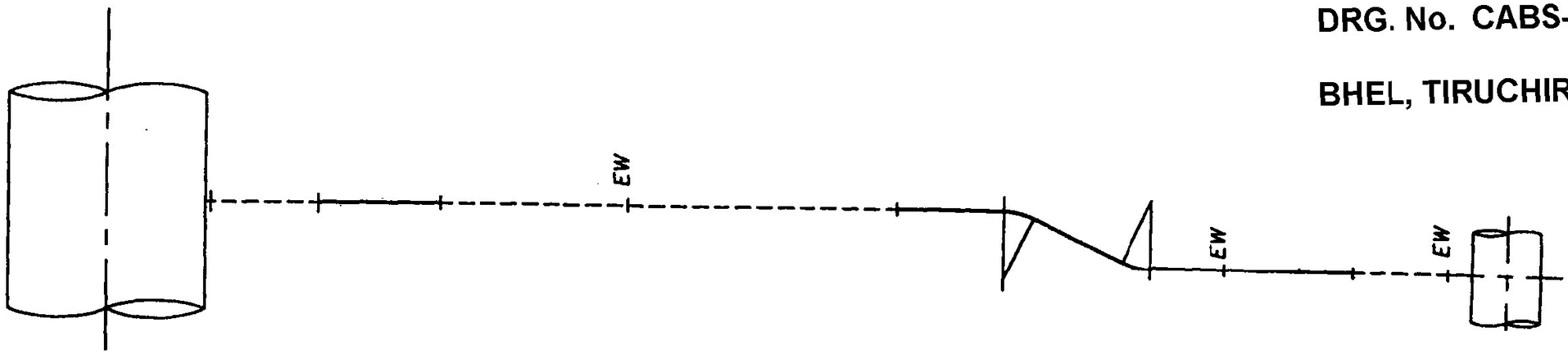


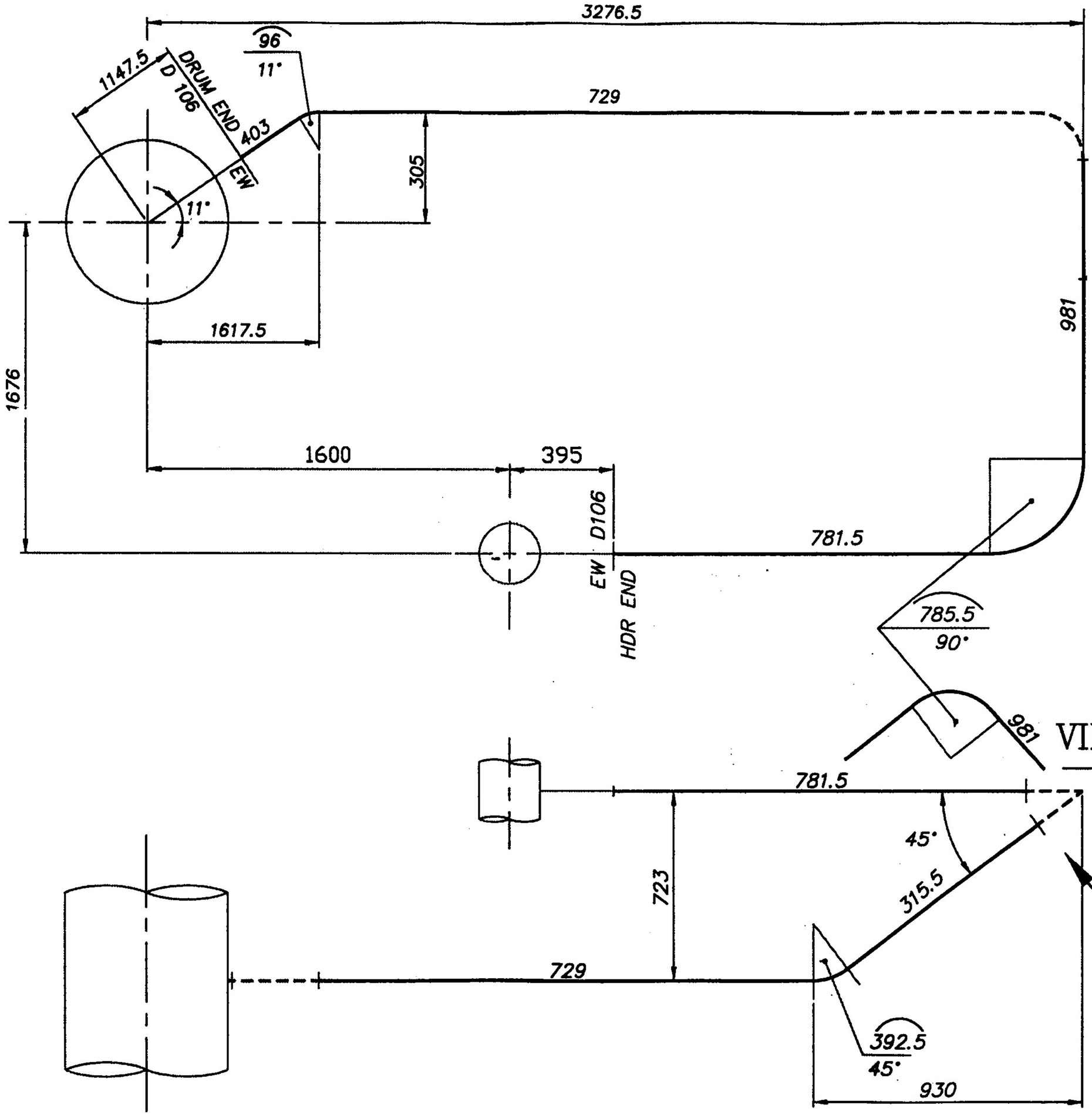
EW : Erection Site Weld

RADIUS OF BEND : 500mm
OD of PIPE : 127mm

BEND CONFIGURATION - 2
DRG. No. CABS-1-15-02

BHEL, TIRUCHIRAPPALLI

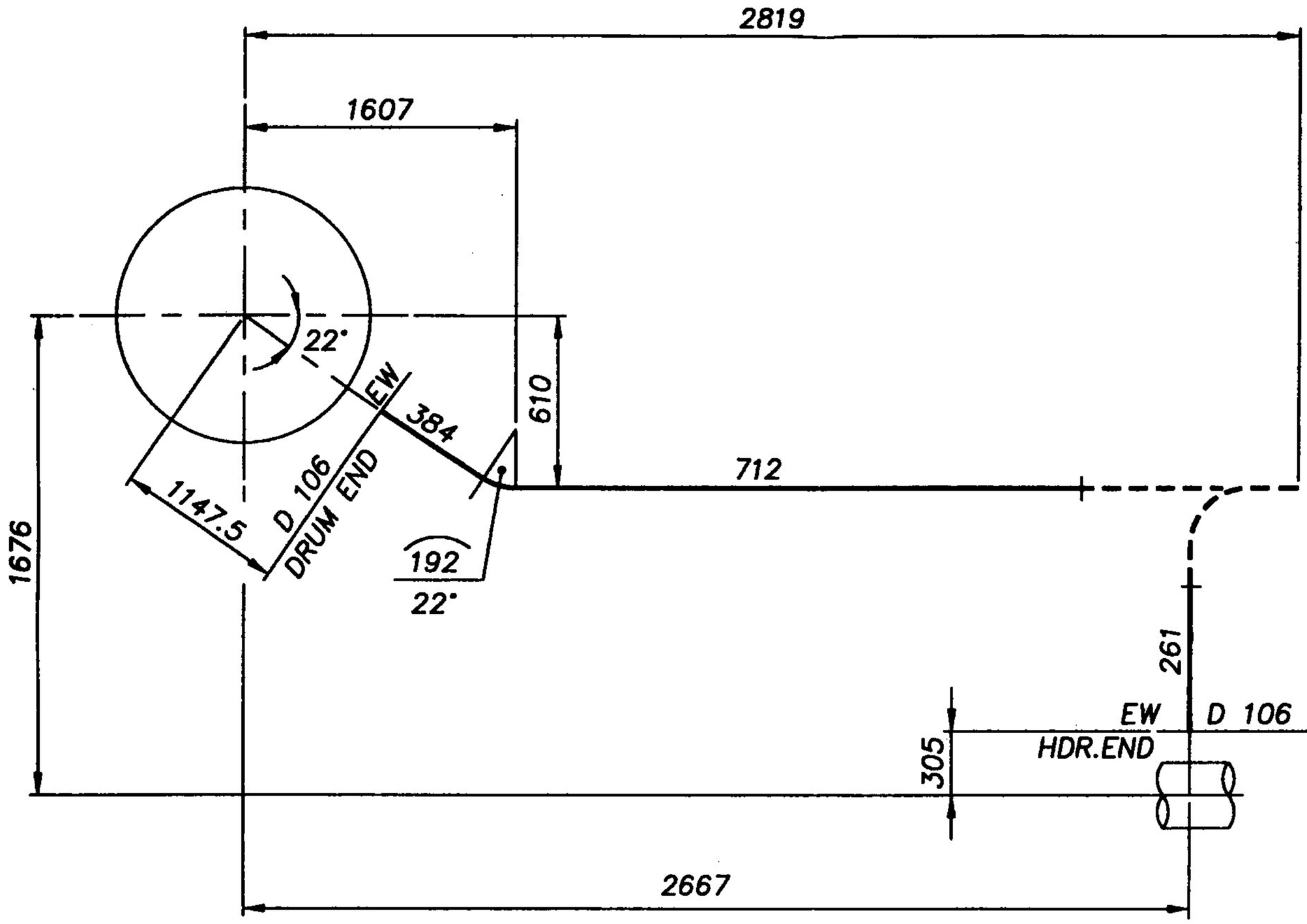


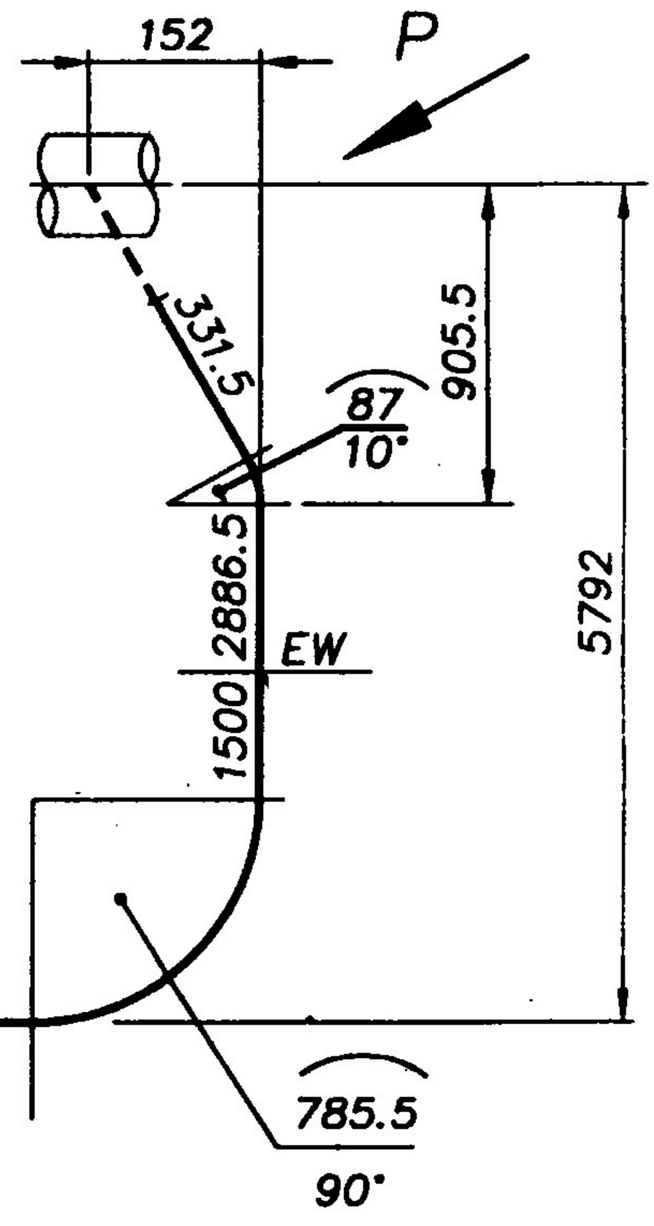


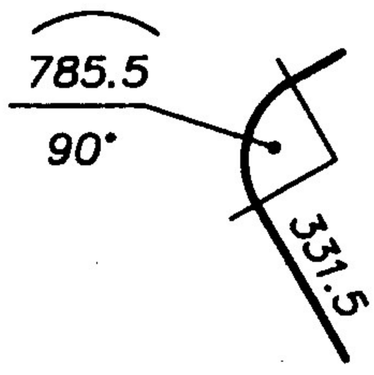
RADIUS OF BEND : 500mm
OD of PIPE : 127mm

BEND CONFIGURATION - 3
DRG No. CABS-1-15-03

BHEL, TIRUCHIRAPPALLI

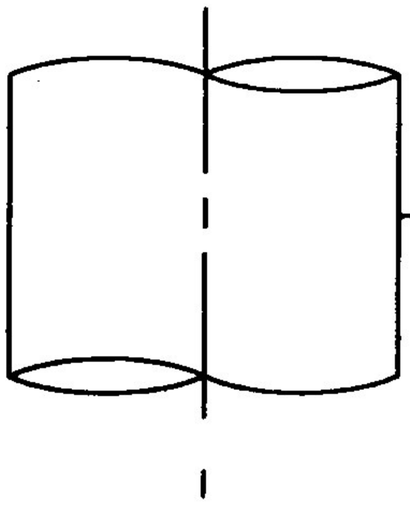






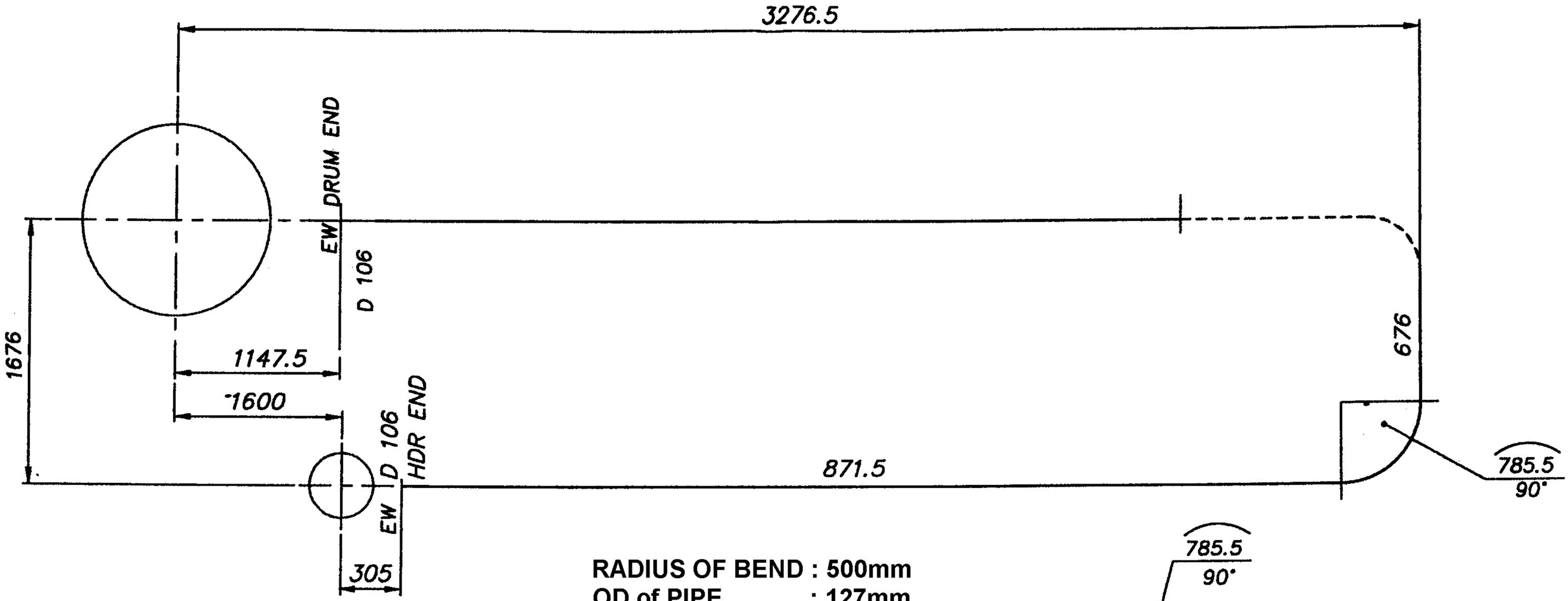
VIEW–P

RADIUS OF BEND : 500mm
OD of PIPE : 127mm

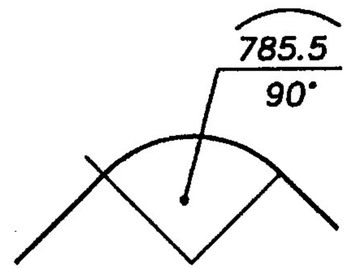


BEND CONFIGURATION - 4
DRG No. CABS-1-15-04

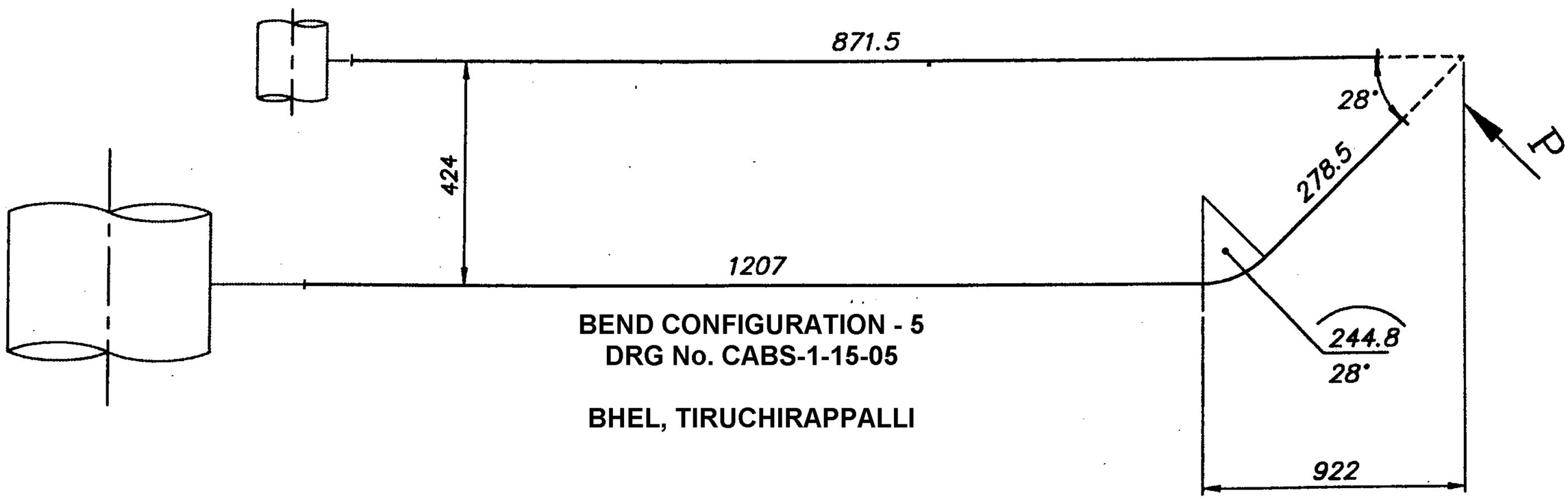
BHEL, TIRUCHIRAPPALLI



RADIUS OF BEND : 500mm
OD of PIPE : 127mm

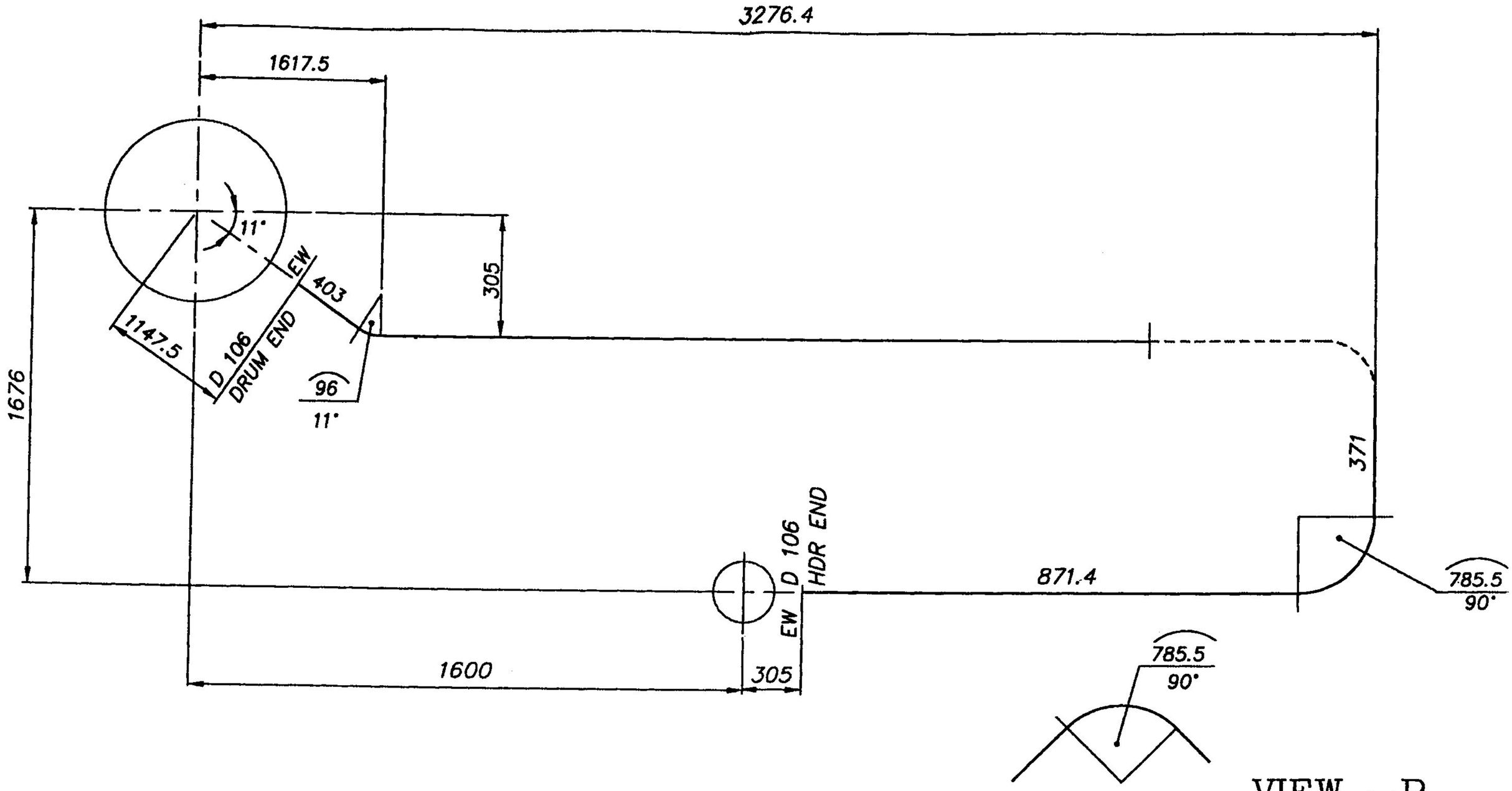


VIEW – P



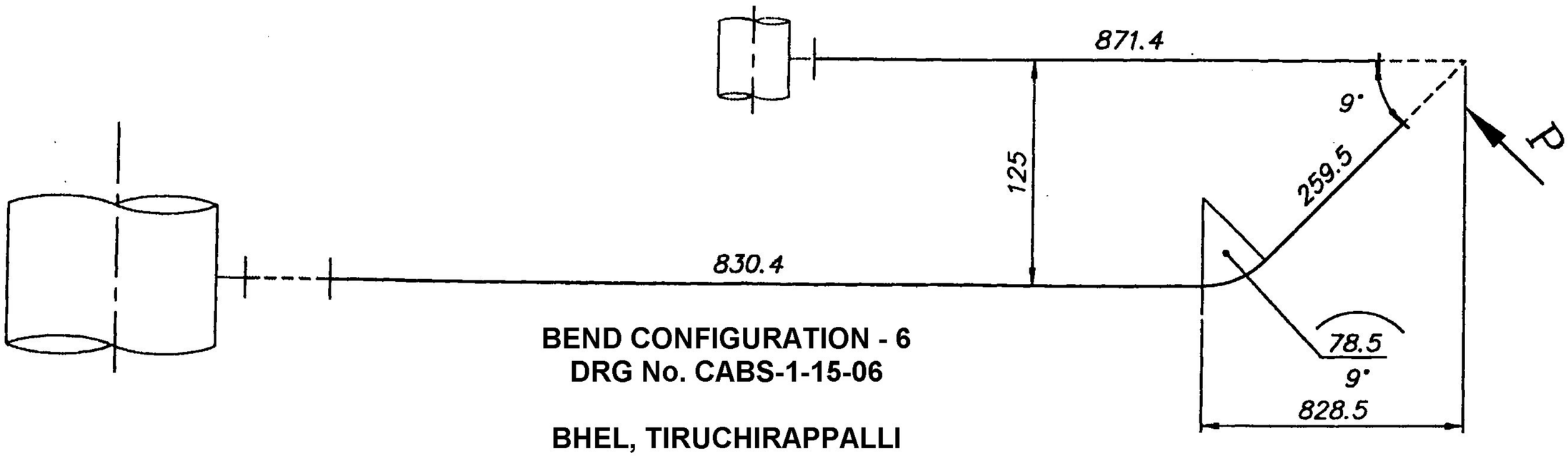
BEND CONFIGURATION - 5
DRG No. CABS-1-15-05

BHEL, TIRUCHIRAPPALLI



VIEW – P

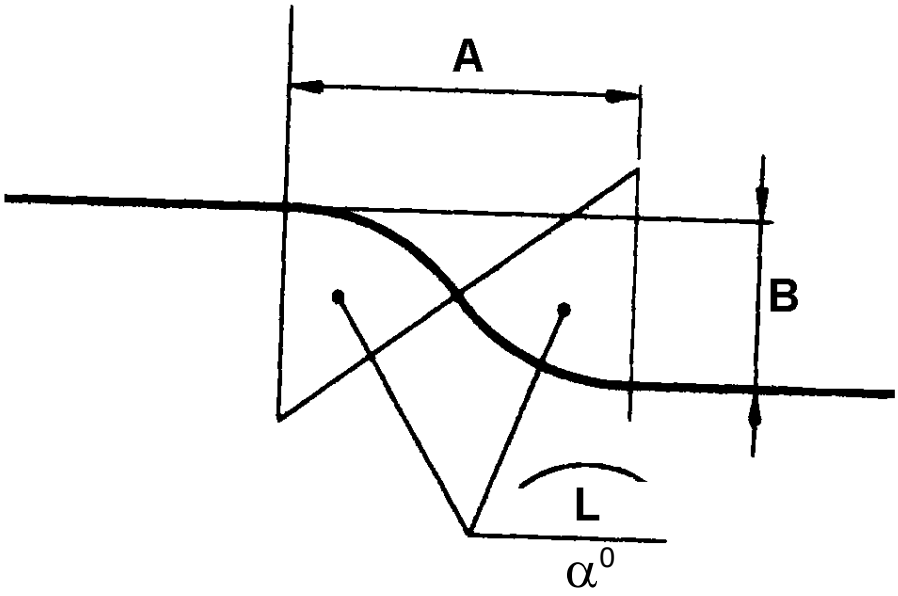
RADIUS OF BEND : 500mm
OD of PIPE : 127mm



BEND CONFIGURATION - 6
DRG No. CABS-1-15-06

BHEL, TIRUCHIRAPPALLI

‘S’ BEND CONFIGURATION



RADIUS OF BEND : 500mm
OD of PIPE : 127mm

VARIANTS All dimensions are in ‘mm’

S.No	A	B	Arc Length L	Angle α
1	557.5	169.8	295.5	$33^0$52’
2	636.5	228.6	344.5	$39^0$31’
3	771.5	363.5	440.5	$50^0$28’
4	802.5	403.4	439.0	$53^0$22’
5	922.0	613.0	586.5	$67^0$13’
6	992.5	879.4	724.0	83^0

DRG NO. CABS-1-15-07

BHEL, TIRUCHIRAPPALLI