



**Bharat Heavy Electricals Limited
(A Govt. of India Undertaking)**

Piping Centre , 80, G. N. Chetty Road, CHENNAI – 600 017
Phone : 91 (044) 2815 8821, Fax : 91 (044) 2815 8869
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REF: ENQ NO:PC:8027

DT: 12.01.09

Open Tender for indigenous manufacturers only.

Sub: Rate contract for manufacture of seamless pipe fittings- elbow from raw material pipe supplied by BHEL.

Ref: Enquiry No:PC:8027 dt 12.01.09

Due date for opening : 29.01.09 at 2.30 PM

Pre qualification is the criteria for qualifying in this enquiry.

The following tender documents are enclosed

1. Part A - Criteria for pre-qualification (Revised)
2. List of items – Annexure-A1
3. Elbow drawings
4. Technical Delivery Conditions: TDG:102:rev03
5. Part B - Terms and conditions
6. List of likely projects

The supplier has to submit their offer for the conversion work in two parts

Part A – Criteria for pre-qualification - Details shall be provided by the vendor in Sealed cover.

Part B - This part shall be submitted in two sealed cover in two parts 1) B1- Technical cum commercial part and 2) B2- Price part.

All 3 sealed covers to be packed in a sealed cover and submitted before the due date.

Only those bidders who qualify the pre qualification criteria (Part-A), will be considered for this tender. Only such of those qualified vendor bids will be considered for (Part B 1- Technical and commercial) opening.

Only those bidders who qualify for Part B 1 will be considered for (Part B 2- Price part) opening.

P.Ravi Shankar
DGM / Purchase
BHEL / Piping Centre
80,GN Road, T.Nagar
Chennai-600017
e-mail – prs@bhelmpc.co.in
Phone:044-28161245

Ref: PC8027 dt.12.01.09

PART – A

CRITERIA FOR PRE QUALIFICATION

The scope of this Enquiry is for manufacturing of Carbon steel , Alloy Steel Elbows with BHEL Raw materials. BHEL will supply Raw Materials Pipes to vendors on freight paid basis and vendors have to convert the Pipes to Elbows as per BHEL drawing and specification, which is enclosed.

Details of sizes of the Elbows to be manufactured and the raw material pipe sizes to be supplied by BHEL are indicated in –Annexure A1.Vendors are not permitted to quote raw material other than that specified and such offers will not be considered.

Following are the criteria required by the vendors to quote for this tender.

1. Vendors should provide details of having manufactured the seamless elbows of sizes as indicated below . Welded construction is not acceptable.
 - a) For P91 material – Proof of manufacturing elbows of sizes 8 inches and above
 - b) For P22 and WPC material – Proof of manufacturing elbows of sizes 22 inches and above.
2. Supplier's customer reference list , PO copies, as a proof for having supplied these Elbows.
3. If vendor is already approved by any of the BHEL units for fittings (as per SI no 1) the details of the same to be given.
4. The following manufacturing facilities are required.
 - a) Vendor should have a single press with a capacity of 1200 T
 - b) Heat treatment furnace with controller to achieve temperature with tolerance of + / - 10 deg C and capacity to accommodate above elbows. The furnace shall be within the same premises where press is located.
 - c) Positive material Identification (PMI) and tensile testing equipment .
 - d) Machining facility.
 - e) Non destructive testing (NDT) facilities viz penetrant testing (PT) , magnetic particle testing (MT) & ultrasonic testing (UT)
5. Suppliers works should have IBR approval.
6. Quality Management system procedure of the supplier to be submitted which should indicate order processing (Raw material to final product).
7. Supplier to have ISO 9000 certification.
8. Supplier to submit Quality plan for review by BHEL.
9. Supplier to submit 3 years balance sheet and P&L statement for our review.
10. The manufacturing process shall be inspected by BHEL/Third party inspection agency.
11. To confirm supply of fittings as per Technical delivery conditions TDG:102:rev03 & ASME B16.9.
12. Vendor shall submit the above details for evaluation by BHEL .
13. Bank guarantee for 10% of raw material cost of the ordered items has to be provided by the vendor in the event of placement of order.
14. In the event of the vendor meeting pre qualification criteria and successful in this tender, Developmental order will be placed. Only after successful completion of the first manufactured Elbow, duly inspected by BHEL ,the balance Elbows can be taken up for manufacture.

Enquiry No: PC8027

LIST OF ELBOWS

ANNEXURE A 1

SLNO.	DESCRIPTION	SPECN	DRAWING NO	QTY	Pipe raw matl offered by BHEL
1	90 DEG LR ELBOW 219.1 X 25	SA234WP91	4-80-999-93177/00	32	219.1 X 25
2	45 DEG LR ELBOW 323.9 X 31	SA234WP91	4-80-999-93094/00	66	323.9 x 38
3	90 DEG LR ELBOW 323.9 X 31	SA234WP91	4-80-999-93093/00	197	323.9 x 38
4	45 DEG LR ELBOW 323.9 X 35	SA234WP91	4-80-999-93087/00	8	323.9 x 42
5	90 DEG LR ELBOW 323.9 X 35	SA234WP91	4-80-999-93084/00	20	323.9 x 42
6	30 DEG LR ELBOW 660 X 36	SA234WP22CL1	4-80-999-93092/01	24	660 x 45
7	45 DEG LR ELBOW 660 X 36	SA234WP22CL1	4-80-999-93088/01	24	660 x 45
8	90 DEG LR ELBOW 660 X 36	SA234WP22CL1	4-80-999-93085/00	204	660 x 45
9	30 DEG LR ELBOW 711.2 X 40	SA234WP22CL1	4-80-999-93174/00	24	720 X 49
10	90 DEG LR ELBOW 711.2 X 40	SA234WP22CL1	4-80-999-93086/00	132	720 X 49
11	90 DEG LR ELBOW 660 X 20	SA106GRC	4-80-999-93176/00	96	660 X 20
				827	

EP Drawing: 3-80-300-19825/01

Tolerance Drawing: 4-80-301-26192/01



TERMS & CONDITIONS FOR PROCUREMENT OF FITTINGS

PART B


SL NO	BHEL REQUIREMENT	SUPPLIER CONFIRMATION
1	<p>This is a rate contract enquiry and the prices offered shall be kept valid for a period of one year from the date of entering into rate contract. The L1 (lowest rates) will be counter offered to other vendors and ordering will be done on the following basis</p> <p>a) 50% of the items will be ordered on original L1 vendors and balance will be distributed equally among vendors accepting counter offered rates.</p> <p>b) Clause (a) will be operated subject to capacity, performance and meeting the delivery commitment of previous orders.</p> <p>TYPE OF BID – The vendor shall submit the offer in TWO PARTS as below And the following procedure shall be followed.</p> <p>Part- B1 (Sl nos 1 to 16) TECHNICAL - CUM COMMERCIAL PART :-</p> <p>This part of the Bid shall contain Technical and Commercial Points only (Except Price Portion)</p> <ul style="list-style-type: none"> Acceptance to our TDC (Technical delivery condition) as given in the tender. Deviation if any shall be clearly indicated. If there is no specific indication about deviation it will be taken as totally accepted and processed. Copy of price bid without price part to know the items for which you are quoting against this tender. (Money values shall not be indicated i.e. un priced bid). <p>PART B2 PRICE PART :</p> <p>THE PRICES SHALL BE QUOTED AS RATE PER PIECE IN RS, FOR Project site in India /BHEL Trichy stores basis and shall include all testing, inspection, packing, forwarding and freight charges. THE FREIGHT SHALL BE SAME FOR ANY PROJECT SITE /TRICHY STORES. THE PRICE BID SHALL BE EVALUATED ON THE BASIS OF TOTAL COST TO BHEL.</p> <p>This part of the Bid shall contain item-wise Price details against each Enquiry Sl.No. and the same shall be put in a sealed cover duly indicating Tender No, Tender Opening date, and "Price Bid" on the Sealed cover. Both the above referred parts (PART B1 & PART B2) of the Bid each sealed in a separate cover shall be put in a sealed outer cover duly indicating Tender No. & Date, Tender Opening date and to be sent to</p> <p style="text-align: center;">DGM/PURCHASE/FITTINGS BHEL : PIPING CENTRE 80, G.N CHETTY STREET T.NAGAR, CHENNAI 600 017</p>	
2.	<p>Tolerances for dimensions other than edge preparation shall be as per ASME B 16.9/B 16.28/B 16.11:</p>	
3	<p>Forwarding of Documents.</p> <p>Documents as listed below should be sent to DGM Purchase / Piping centre BHEL Chennai immediately after the shipment / dispatch of items and not through Bank.</p> <p>a) Purchase documents.</p> <p>Original LR to be sent as CC attached to the consignee and not through bank. ,copy of the LR ,invoice to be sent to DGM/Purchase.</p> <p>b) Quality Documents.</p> <p>i) Three sets of original certificates item-wise (ie) Works TC, IBR Form III C, UT Report, MPI report, Dimensional report, Raw Material TC (Xerox copy)</p> <p>ii) 10 copies of IBR Form III C for each item duly attested by the makers representative who has signed in IBR Form III C. The company seal shall be affixed below the signature in case the ordered quantity of an item is 10 and above, (otherwise you can restrict the number of attested copies to the ordered quantity of an item). These certificates are to be dispatched along with the other TC and not through Bank.</p>	

SL NO	BHEL REQUIREMENT	
	All the above documents are to be submitted in soft copy apart from the hard copies as above, if the materials are not ready on the date of visit by BHEL INSPECTOR against specific call for inspection by vendor, all the expenses incurred for the visit shall be liable for recovery from, the invoices of the vendor. Further, this will also have an adverse bearing on the performance rating of the vendor.	
4	Year of Code for Viz. the standards ASME B16.9, ASME B16. 28 & ASME B.16.11 etc. shall be latest and the specific year is to be mentioned in the Manufacturer's test certificates, as well as in IBR Form III-C. Also the relevant Year Code for material standard and the NDT standard (ie PT,MT,UT) has to be mentioned.	
5	VALIDITY OF THE OFFER :- The quotation shall be valid for a period of 120 days from price bid opening date for entering into rate contract..The rate should be kept firm for a period of 1 year from the date of contract. Offer with lesser validity will not be considered.	
6	DELIVERY SCHEDULE :- within 60 days from the receipt of raw material.	
7	TERMS OF DELIVERY :- FOR BHEL/ Trichy stores/ any destination of project site in India.	
8	TAXES & DUTIES :- Please indicate clearly the percentages of applicable taxes, duties like CST, Excise Duty or any other taxes / duties in your offer.	
9	TRANSPORT :- All the Items are to be dispatched to our Trichy Stores/Project Site in various states within India. Likely projects sites is enclosed.	
10	PRESERVATION :- Fittings shall be cleaned and the following painting shall be applied. <u>On External surface.</u> Primer Coat :- One coat of Red oxide Zinc Phosphate Primer (Alkyd Base) to IS 12744; DFT= 30 microns minimum. FINISH COAT :- TWO COATS OF SYNTHETIC ENAMEL PAINT (LONG OIL ALKYD) TO IS 2932; SMOKE GREY SHADE No 692 OF IS 5 DFT 20 microns minimum per coat. Total coating thickness 30+ 40 = 70 DFT <u>ON INTERNAL SURFACE</u> ONE COAT OF METALLIC VARNISH. ENDS OF THE FITTINGS SHALL BE PROTECTED WITH METALLIC STRIPS.	
11	INSPECTION :- A) IBR & BHEL / QC Inspection or Third Party inspection agency for CS & AS materials.	
12	CERTIFICATION :- IBR TC in form III C, inspection report of BHEL Third Party inspection agency, Mfg TC, incorporating BHEL Specification requirement /ASME requirement. Mechanical / Hardness & Heat treatment and other Lab test reports to be furnished. Confirmation report to BHEL Specification to be furnished. Basic raw material (Mill) TC & other requirements as per TDC / Specns shall be submitted. Inspection Charges:- Inspection charges of BHEL/ Their representative are to BHEL A/c. Any other testing charges and IBR inspection charges should be included in the quoted prices. If entire P O quantity is manufactured in one lot but dispatched in phased manner, original IBR should be sent along with the first consignment and the same shall be attested by vendor for subsequent consignments on Xerox copies.	
13	IDENTIFICATION As per Technical delivery condition TDG:102:rev03	
14	GUARANTEE : Vendors shall guarantee the supplies for a period of 24 months from the date of dispatch of materials or 18 months from the date of their commissioning which ever is later.	
15	TERMS OF PAYMENT : 90% payment against presentation of following documents to our Finance Departments Directly with a copy of Invoice alone to Purchase department. <ol style="list-style-type: none"> Invoice in Triplicate Delivery Challan in duplicate. Guarantee certificate in duplicate. Lorry Way Bill Copy- one copy (Original copy of LWB should be sent through the carrier) 	

	<p>E. Inspection report copy – one copy F. IBR Form III-C- one copy G. ED gate pass original or copy with a confirmation that the original is sent with the goods.</p> <p>Balance 10% will be paid on submission of Invoice along with proof of receipt of material at project site / BHEL Trichy stores. BG for 10% of raw material value shall be provided as per our format.</p>	
16	<p>GENERAL :-</p> <ul style="list-style-type: none"> • The PO copy with all details will be given to successful bidders in soft mode also. However Hard copy will be used for record purpose. The same soft copy should be utilized by the suppliers to furnish information as called for in the format. See attached format for details. This soft copy will go up and down between BHEL and the supplier for tracking the full process and smooth closing of the PO • During the Contract period, any of our sister units of BHEL Piping Centre will be entitled to place order for this item on the same terms and conditions • BHEL reserves the right to cancel this tender without assigning any reasons what so ever. • Deviation taken after placement of order will not be accepted (Both technical & on delivery) • Suppliers to analyze in detail, at the time of submission of offer with reference to our "delivery" requirement of fittings and confirm compliance or otherwise. • To ensure correct & timely submission of all original test certificates including IBR Form III-C. There should not be any discrepancies in detail leading to time wastage in clarification and revisions. • The quantity indicated in the tender is only tentative, BHEL reserves the right to increase or decrease the tendered quantity . • Lowest prices received against BHEL tenders does not mean order will be placed on that Supplier. BHEL reserves the right not to consider the same. • BHEL reserves the right to negotiate or re-float the tender opened if L1 price /or other details are not acceptable to them • BHEL reserves the right to negotiate the L1 rate. • BHEL reserves the right to order on more than one vendor at the lowest acceptable price to BHEL • The vendor to submit material account , return the offcuts available out of material supplied by BHEL to BHEL/Trichy Stores on freight paid. Basis.Only after this balance 10% payment will be made. • Any rejections/ damage for the raw material supplied by BHEL will be recovered from suppliers bills / BG. 	

Note : Please confirm your acceptance/other wise to all the points indicated above positively and submit this format duly filled, signed & stamped along with the technical bid.

VENDOR

	Bharat Heavy Electricals Limited, Piping Centre, Chennai Technical Delivery Conditions Conditions for Butt welded – Fittings as per Indian Boiler Regulations.	TDG : 102 Rev. 03 Date : 16.02.2008 Page : 1 of 3
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1.0 CODES:-

The fittings shall meet Indian Boiler Regulations (IBR) and the following requirements in addition to the standards specified in the Purchase Order (PO).

2.0 RAW MATERIALS:-

- All pipes used for fittings shall meet the respective specification. The test certificate shall be furnished.
- All mother pipes used for fittings shall be subjected to a hydraulic test as per SA 530 or UT as per ASTM E 213 at the mill
- All plates used for fittings shall be UT tested as per S1 of SA578 and acceptance norms shall be as per Level B of SA578
- The raw material forging shall be ultrasonically tested as per SA 388 and the acceptance norm shall be as per 3.3.4 of ASME Sec VIII Div 2.
- Steel for SA182 F11, F12 & F22 if indigenously procured, to be from following manufacturers approved under IBR for creep resistant steels: i) Alloy Steel Plant Durgapur, ii) Tata Iron & Steel company, Jamshedpur & iii) Mahindra Ugine Steel Company, Mumbai..

3.0 PROCESS:-


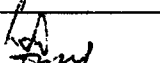
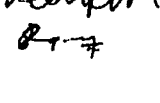

- Process of manufacture shall conform to applicable standards.
- All fittings shall be of seamless unless otherwise specified in the purchase order.
- In case of welded fittings, WPS, PQR & welder qualification shall be approved by BHEL PC, prior to start of welding.
- All fittings shall have smooth surfaces, workman like finish and free from loose scales and defects like laps, seams, folds, cracks, pitting etc.. Repair by welding is NOT permitted.
- Dimensions shall be as per ASME B16.9 or B16.28, Butt Weld edges shall be as given in Purchase Order. The ends of reducers shall have a straight portion of Minimum 13mm.
- Unless otherwise specified in the P.O SA 234 WP 11/12/22 fittings shall be supplied as per class 1, SA 182 F11/12 shall be supplied as class 2, SA 182 F22 shall be of class 3 only.

4.0 HEAT TREATMENT:-

4.1 All fittings shall be heat treated as below.

SA 234 WP B	- As per specification
SA 105, SA234 WP C	- Normalised
SA234 WP11/ WP12/ WP22	- Normalised & Tempered
SA182 F11/ F12/ F22	- Normalised & Tempered
Stainless Steel :-	
SA 182 F304/ 316/ 321/ 347	- Solution annealed
SA 403 WP304/ 316/ 321/ 347	- Solution annealed

4.2 Fittings conforming to SA 234 WP91 and SA182 F91 shall be normalised at 1040 to 1070 deg C (for wall thickness larger than 75 mm, accelerated cooling may be done to obtain a fully martensitic structure) and tempered at 760 ± 10 deg C

S. Jayakumar, Engg		Approved by K. Vedaprasad, QC	
P. Elangovan, QA		K. Ganeshan, MPL	



5.0 TESTING :-

- (a) Carbon content of SA 234 WPB, WPC, SA 105 fittings shall be restricted to 0.25% max.
- (b) All ferrous fittings shall be tested by MPI as per ASTM E-709 and SS fittings shall be LPI tested as per ASTM E 165.
- (c) One fitting of each specification, heat, heat treatment lot and size shall be subjected to Tension Test as per applicable standard.
- (d) All fittings of wall thickness above 6mm or NB 200mm and above shall be Ultrasonically Tested as per SA 388; acceptance norms shall be 3.3.4 of ASME section VIII Div.2.
- (e) Hardness test shall be carried out on each fittings of WP91 / F91. For other fittings hardness shall be checked on 10% of the fittings.
- (f) In case of welded fittings; all the welds shall be 100% RT tested and acceptance norms shall be UW 51 of ASME Sec VIII DIV-1
- (g) The following supplementary tests shall be carried out for specifications namely SA105, SA 182 F11 / F12 / F22 / F91, SA 234 WPC / WP11 / WP12 / WP22 / WP91 (No supplementary test applicable for SA 234 WPB)
 - a) Product analysis – one / heat / size.
 - b) Tension test – one / heat / heat treatment lot / size.
- (h) Metallography:- Metallography shall be carried out one per heat, per size, per heat treatment lot of WP91 / F91 fittings.

6.0 POSITIVE MATERIAL IDENTIFICATION (PMI) FOR ALLOY STEEL FITTINGS.

Each alloy steel fitting shall be checked for the correctness of the material during manufacturing and final inspection using X-ray fluorescence principle or spark emission spectrography.

7.0 MARKING, COLOUR CODING, PACKING AND PRESERVATION :-

- 7.1** All fittings shall be PUNCHED OR ETCHED with specification, Grade, Heat No, maker's emblem and Inspection Authorities Seal. In addition, specification, grade, heat no and size shall be stencilled on fittings of sizes above 76mm.

7.2 COLOUR CODING:-

SA 234 WPB / WPBW	=	Red
WPC / SA105	=	Blue
WP11 / SA182 F11	=	Green & White
WP12 / SA182 F12	=	Black & Red
WP22 / SA182 F22	=	Blue & Red
WP91 / SA182 F91	=	Brown & Red
SA182 / SA 403 F / WP 304	=	Blue & Yellow
316	=	Black & Green
321	=	Blue & Brown
347	=	Yellow & Black


S. Jayakumar, Engg

P. Elangovan, QA

Approved by

K. Vedaprasad, QC

K. Ganeshan, MPI

	Bharat Heavy Electricals Limited, Piping Centre, Chennai Technical Delivery Conditions Conditions for Butt welded – Fittings as per Indian Boiler Regulations.	TDG : 102 Rev. 03 Date : 16.02.2008 Page : 3 of 3
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7.3 PACKING AND PRESERVATION :-

All fittings except SS to be applied with resin type rust preventive coating with visibility to punched and stenciled details on outside and either with rust preventive coating or rust inhibitor inside. SS fittings to be surface treated as per ASTM A380 both inside and outside. Ends to be closed, with end caps secured for storage and suitably packed in box/crate to avoid transit/other damages.

8.0 INSPECTION & CERTIFICATION :-

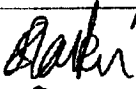
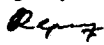
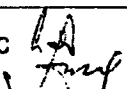

All fittings are to be inspected at the manufacturer's works by the inspection agencies / authorities as per IBR and as indicated in the P.O. Inspection certificate in IBR Form III C shall be submitted along with the Work Test Certificate countersigned by the above authorities and shall include the following.

1. Test Certificate Number & date.
2. BHEL P.O Number & Amendment Number
3. BHEL P.O. Serial Number
4. BHEL TDC Number
5. Size-wise Quantity
6. Specification, Grade & Year of code.
7. Heat/Melt Number
8. Starting material details.
9. Steel making process
10. Ladle Analysis of Raw Material and product analysis of fitting.
- *11. Positive Material Identification (PMI) report for Alloy steel fittings.
- *12. Supplementary Test(Product analysis, Tension test..) results.
- *13. Heat Treatment Chart.
- *14. NDE report. (VISUAL,MPI, LPI,UT)
- *15. Tensile Test Report
- *16. Hardness Test Report
- *17. Metallography as applicable.
- *18. Dimensional conformance.
- *19. RT test report / Results (for welded fittings)
- *20. Guarantee of HTP shall be given as follows:- "Fittings are capable of withstanding without failure, leakage or impairment of their serviceability a hydrostatic test pressure equal to that prescribed for the specified matching pipe of equivalent material".

*Details furnished in the Tests certificate in lieu of chart/report is acceptable.

9.0 RECORDS OF REVISION :-

- Rev 01 : a) Fully revised for better clarity.
: b) Para 2.0 e added.
- Rev 02 : a) Para 2.0 (c): UT acceptance norms revised from level A to B.
- Rev 03 : a) Fully revised for better clarity.
: b) Para 4.2,6.0, 8.0 (11) added.
: c) Para 2 (d) ,4.1, 5 (d) are revised.

S. Jayakumar, Engg P. Elangovan, QA	 	Approved by K. Vedaprasad, QC K. Ganeshan, MRL  
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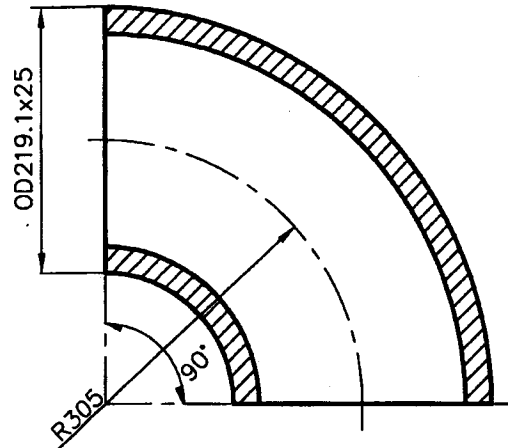
LIST OF LIKELY PROJECT SITES

Sl No	Project site
1	BHUSAWAL 1 (Maharastra)
2	BHUSAWAL 2 (Maharastra)
3	KHAPERKHEDA 500MW (Maharastra)
4	SIMHADRI -1 (A.P)
5	SIMHADRI -2 (A.P)
6	ARAVALI -1 (Haryana)
7	ARAVALI -2 (Haryana)
8	ARAVALI -3 (Haryana)
9	ENNORE (T.N)
10	KODERMA -1 (Jharkand)
11	KODERMA -2 (Jharkand)
12	DURGAPUR 1 (W.B)
13	DURGAPUR 2 (W.B)
14	MAITHAN (Jharkand)
15	ANPARA (U.P)
16	UKAI 500 MW PCP U6 (Gujarat)
17	BELLARY (Karnataka)
18	KOTHAGUDAM (A.P)
19	Nabinagar -1 (Bihar)
20	Nabinagar -2 (Bihar)
21	BONGAIGAON (Assam)
22	Satpura (Maharastra)

ALL DIMENSIONS ARE IN MILLIMETRES

REV	DATE	ALTERED
01		APPROVED

DESIGN PRESSURE AT 540°C : 226 Kg/sq.cm(g)
 RAW MATL SPECN.: SA 335 P91 (A).
 FITTING SPECN. : SA 234 WP91 (A).
 FINISHED FITTING MATERIAL CODE:
 WEIGHT OF FINISHED FITTING: 57kg.



NOTES: -

01. ALL DIMENSIONS ARE FINISHED DIMENSIONS.
02. FOR TOLERANCES REFER STANDARD DRG.4-80-301-26192.
03. MANUFACTURING, INSPECTION AND TESTING SHALL BE AS PER IBR, ASME B16.9 & SA234.
04. EDGE PREPARATION DETAIL SHALL BE AS PER DRAWING No:3-80-300-19825
STYLE X d1=175.5
05. O.D AT ANY SECTION SHALL BE WITHIN 216.9 TO 221.3mm.
06. ACTUAL THICKNESS AT ANY POINT SHALL NOT VARY MORE THAN 12.5% OF THE NOMINAL THICKNESS (21.88 to 28.13).
07. ALTERNATE RAW MATERIAL CAN ALSO BE USED.

STANDARD

PIPE OD 219.1 x 28 L=880	15 958 106 4150	A	116.000
	SA 335 P91		
DESCRIPTION	RAW MATL CODE	A	UNIT WT.
	MATL. SPECN.	C	QTY



BHARAT HEAVY ELECTRICALS LTD

 PIPING CENTRE
 CHENNAI 600 017

	NAME	SIGN	DATE
DRN	R.ANANTH		24-11-08
CHD	R.ANANTH		24-11-08
APPD	M.N.VASUDEVAN		24-11-08

DEPT	GRADE OF UNTOL DIM	SCALE	WEIGHT (KG).	REF. TO ASSY./OLD DRG.	
CODE	C / M / F		116.000		
TITLE			CARD CODE	DRAWING NO.	REV
BW LR 90 DEG. ELBOW			U 01	4-80-999-93177	00
OD219.1x25 WP91					

Size A4

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REV	DATE	ALTERED
01		APPROVED

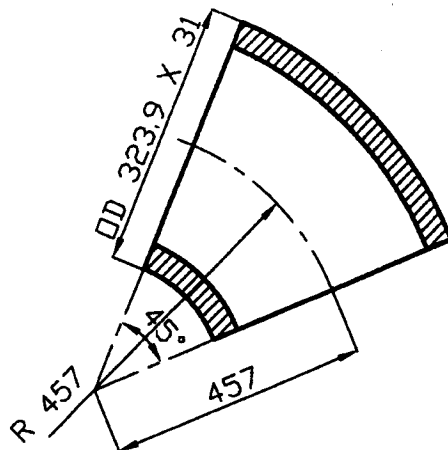
ALL DIMENSIONS ARE IN MILLIMETRES

DESIGN PRESSURE AT 540°C : 198.5 Kg/sq.cm(g)

RAW MATL SPECN.: SA 335 P91 (A)

FITTING SPECN. : SA 234 WP91 (A)

FINISHED FITTING MATERIAL CODE:



NOTES: -

01. ALL DIMENSIONS ARE FINISHED DIMENSIONS.
02. FOR TOLERANCES REFER STANDARD DRG.4-80-301-26192.
03. MANUFACTURING, INSPECTION AND TESTING SHALL BE AS PER IBR, ASME B16.9 & SA234.
04. EDGE PREPARATION DETAIL SHALL BE AS PER DRAWING No: 3-80-300-19825
FIG X d1=266
05. O.D AT ANY SECTION SHALL NOT VARY MORE THAN 3mm(320.9 to 326.9)
06. ACTUAL THICKNESS AT ANY POINT SHALL NOT VARY MORE THAN 12.5% OF THE NOMINAL THICKNESS. (27.13 to 34.88)
07. ALTERNATE RAW MATERIAL CAN ALSO BE USED.

PIPE OD 323.9 x 38 L=759	15 958 114 3550	A	203.336
	SA 335 P91		
DESCRIPTION	RAW MATL CODE	A	UNIT WT.
	MATL SPECN.	C	QTY

STANDARD



BHARAT HEAVY ELECTRICALS LTD

PIPING CENTRE
CHENNAI 600 017

	NAME	SIGN	DATE
DRN	M.C.SEKARAN		12-06-08
CHD	C.SARAVANAN		12-06-08
APPD	S.JAYAKUMAR		12-06-08

DEPT	GRADE OF UNTOL DIM	SCALE	WEIGHT (KG).	REF. TO ASSY./OLD DRG.	
CODE	C / M / F		203.336		
TITLE			CARD CODE	DRAWING NO.	REV
BW LR 45 DEG. ELBOW OD 323.9 x 31			U 01	4-80-999-93094	00

Size A4

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REV	DATE	ALTERED
01		APPROVED

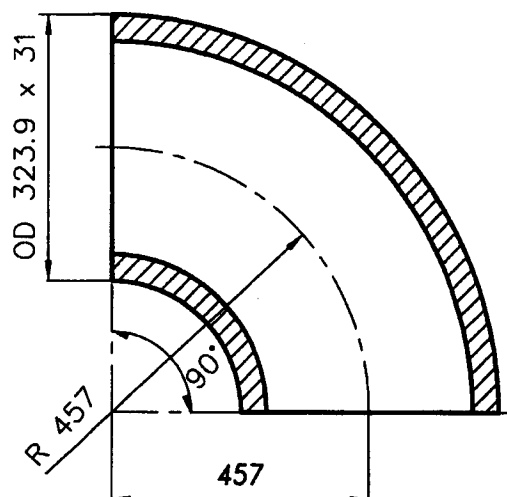
ALL DIMENSIONS ARE IN MILLIMETRES

DESIGN PRESSURE AT 540°C : 198.5 Kg/sq.cm(g)

RAW MATL SPECN.: SA 335 P91 (A)

FITTING SPECN. : SA 234 WP91 (A)

FINISHED FITTING MATERIAL CODE:



NOTES: -

01. ALL DIMENSIONS ARE FINISHED DIMENSIONS.
02. FOR TOLERANCES REFER STANDARD DRG.4-80-301-26192.
03. MANUFACTURING, INSPECTION AND TESTING SHALL BE AS PER IBR, ASME B16.9 & SA234.
04. EDGE PREPARATION DETAIL SHALL BE AS PER DRAWING No: 3-80-300-19825
FIG X d1=266
05. O.D AT ANY SECTION SHALL NOT VARY MORE THAN 3mm(320.9 to 326.9)
06. ACTUAL THICKNESS AT ANY POINT SHALL NOT VARY MORE THAN 12.5% OF THE NOMINAL THICKNESS. (27.13 to 34.88)
07. ALTERNATE RAW MATERIAL CAN ALSO BE USED.

DESCRIPTION	PIPE OD 323.9 x 38 L=1118	15 958 114 3950	A	299.512
		SA 335 P91		
		RAW MATL. CODE	A	UNIT WT.
		MATL. SPECN.	C	QTY

STANDARD



BHARAT HEAVY ELECTRICALS LTD

PIPING CENTRE
CHENNAI 600 017

NAME	SIGN	DATE
DRN M.C.SEKARAN		12-06-08
CHD C.SARAVANAN		12-06-08
APPD S.JAYAKUMAR		12-06-08

DEPT	GRADE OF UNTOL. DIM	SCALE	WEIGHT (KG).	REF. TO ASSY./OLD DRG.	
CODE	C / M / F		299.512		
TITLE			CARD CODE	DRAWING NO.	REV
BW LR 90 DEG. ELBOW			U 01	4-80-999-93093	00
OD 323.9 x 31					

Size A4

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REV	DATE	ALTERED
01		APPROVED

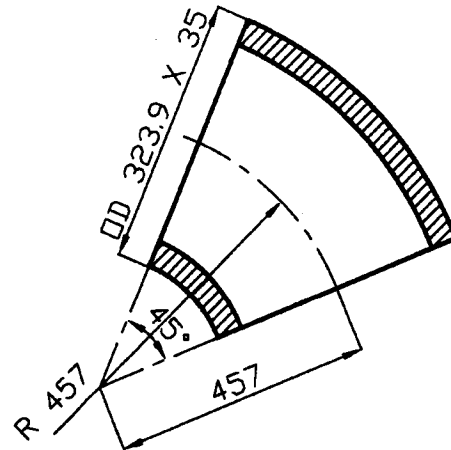
ALL DIMENSIONS ARE IN MILLIMETRES

DESIGN PRESSURE AT 540° : 227.5 Kg/sq.cm(g)

RAW MATL SPECN.: SA 335 P91 (A)



FITTING SPECN. : SA 234 WP91 (A)

FINISHED FITTING MATERIAL CODE:



NOTES: —

01. ALL DIMENSIONS ARE FINISHED DIMENSIONS.
02. FOR TOLERANCES REFER STANDARD DRG.4-80-301-26192.
03. MANUFACTURING, INSPECTION AND TESTING SHALL BE AS PER IBR, ASME B16.9 & SA234.
04. EDGE PREPARATION DETAIL SHALL BE AS PER DRAWING No: 3-80-300-19825
FIG X d1=261
05. O.D AT ANY SECTION SHALL NOT VARY MORE THAN 3mm(320.9 to 326.9)
06. ACTUAL THICKNESS AT ANY POINT SHALL NOT VARY MORE THAN 12.5% OF THE NOMINAL THICKNESS. (30.63 to 39.25)
07. ALTERNATE RAW MATERIAL CAN ALSO BE USED.

PIPE OD 323.9 x 42 L=857		15 958 102 3550 SA 335 P91	A	254.621
DESCRIPTION		RAW MATL CODE	A	UNIT WT.
		MATL SPECN.	C	QTY
STANDARD				
 BHARAT HEAVY ELECTRICALS LTD PIPING CENTRE CHENNAI 600 017				
		NAME	SIGN	DATE
		DRN	M.C.SEKARAN	12-06-08
		CHD	C.SARAVANAN	12-06-08
		APPD	S.JAYAKUMAR	12-06-08
DEPT	GRADE OF UNTOLD DIM	SCALE	WEIGHT (KG).	
CODE	C / M / F		254.621	
TITLE		REF. TO ASSY./OLD DRG.		
BW LR 45 DEG. ELBOW OD 323.9 x 35		CARD CODE	DRAWING NO.	REV
		U 01	4-80-999-93087	00

Size A4

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REV	DATE	ALTERED
01		APPROVED

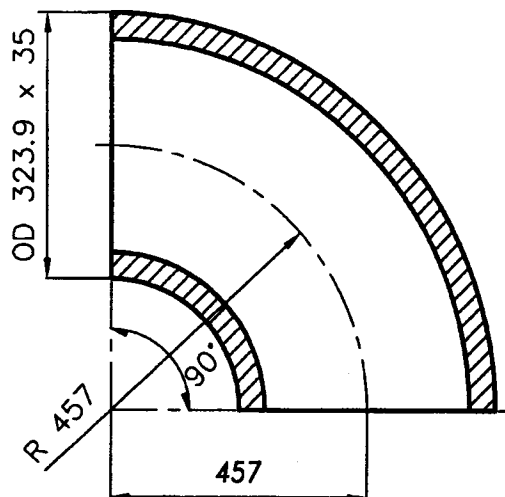
ALL DIMENSIONS ARE IN MILLIMETRES

DESIGN PRESSURE AT 540° : 227.5 Kg/sq.cm(g)

RAW MATL SPECN.: SA 335 P91 (A)

FITTING SPECN. : SA 234 WP91 (A)

FINISHED FITTING MATERIAL CODE:



NOTES: -

01. ALL DIMENSIONS ARE FINISHED DIMENSIONS.
02. FOR TOLERANCES REFER STANDARD DRG.4-80-301-26192.
03. MANUFACTURING, INSPECTION AND TESTING SHALL BE AS PER IBR, ASME B16.9 & SA234.
04. EDGE PREPARATION DETAIL SHALL BE AS PER DRAWING No: 3-80-300-19825
FIG X d1=261
05. O.D AT ANY SECTION SHALL NOT VARY MORE THAN 3mm(320.9 to 326.9)
06. ACTUAL THICKNESS AT ANY POINT SHALL NOT VARY MORE THAN 12.5% OF THE NOMINAL THICKNESS. (30.63 to 39.25)
07. ALTERNATE RAW MATERIAL CAN ALSO BE USED.



STANDARD



BHARAT HEAVY ELECTRICALS LTD

PIPING CENTRE
CHENNAI 600 017

PIPE OD 323.9 x 42 L=1118	15 958 102 3950	A	375.055
	SA 335 P91		
DESCRIPTION	RAW MATL CODE	A	UNIT WT.
	MATL SPECN.	C	QTY

DEPT	GRADE OF UNTOL DIM		SCALE 	WEIGHT (KG).	REF. TO ASSY./OLD DRG.		
CODE				C / M / F	375.055		
TITLE BW LR 90 DEG. ELBOW OD 323.9 x 35				CARD CODE	DRAWING NO.		REV
				U 01	4-80-999-93084		00

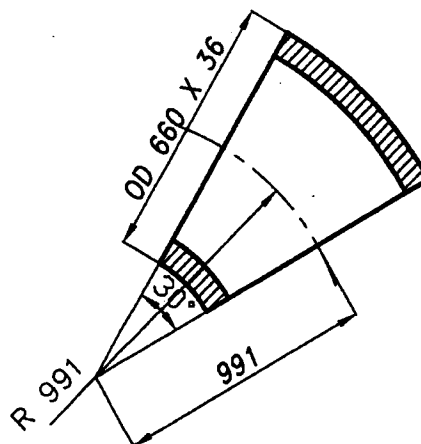
Size A4

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REV	DATE	ALTERED: MCS
01	23.06.08	APPROVED: CS
NOTE NO. 06 REVISED.		



ALL DIMENSIONS ARE IN MILLIMETRES

DESIGN PRESSURE AT 540°C : 52.5 Kg/sq.cm(g)
 RAW MATL SPECN.: SA 335 P22 (A).
 FITTING SPECN. : SA 234 WP22 (A).
 FINISHED FITTING MATERIAL CODE:



NOTES: -

01. ALL DIMENSIONS ARE FINISHED DIMENSIONS.
02. FOR TOLERANCES REFER STANDARD DRG.4-80-301-26192.
03. MANUFACTURING, INSPECTION AND TESTING SHALL BE AS PER IBR, ASME B16.9 & SA234.
04. EDGE PREPARATION DETAIL SHALL BE AS PER DRAWING No: 3-80-300-19825
STYLE P d1=595
05. O.D AT ANY SECTION SHALL NOT VARY MORE THAN 4mm(656 to 664)
06. ACTUAL THICKNESS AT ANY POINT SHALL NOT VARY MORE THAN 12.5% OF THE NOMINAL THICKNESS. (31.5 to 40.5)
07. ALTERNATE RAW MATERIAL CAN ALSO BE USED.

PIPE OD 660 x 45 L=919		15 991 707 4200	627.218
		SA 335 P22	
DESCRIPTION		RAW MATL CODE	A UNIT WT.
		MATL SPECN.	C QTY
STANDARD			
 BHARAT HEAVY ELECTRICALS LTD PIPING CENTRE CHENNAI 600 017			
		NAME	SIGN
		DRN	M.C.SEKARAN
		CHD	C.SARAVANAN
		APPD	S.JAYAKUMAR
		DATE	12-06-08
		DATE	12-06-08
		DATE	12-06-08
DEPT	GRADE OF UNTOL DIM	SCALE	WEIGHT (KG).
CODE	C / M / F		627.218
TITLE		REF. TO ASSY./OLD DRG.	
BW LR 30 DEG. ELBOW			
OD 660 x 36			
CARD CODE	DRAWING NO.	REV	
U 01	4-80-999-93092	01	

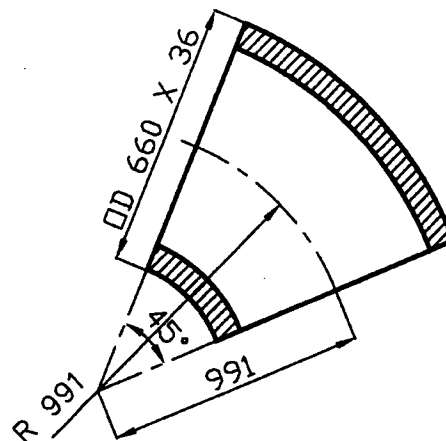
Size A4

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REV	DATE	ALTERED: MCS
01	23.06.08	APPROVED: CS
NOTE NO. 06 REVISED.		

ALL DIMENSIONS ARE IN MILLIMETRES

DESIGN PRESSURE AT 540°C : 52.5 Kg/sq.cm(g)
 RAW MATL SPECN.: SA 335 P22 (A).
 FITTING SPECN. : SA 234 WP22 (A).
 FINISHED FITTING MATERIAL CODE:



NOTES: -

01. ALL DIMENSIONS ARE FINISHED DIMENSIONS.
02. FOR TOLERANCES REFER STANDARD DRG.4-80-301-26192.
03. MANUFACTURING, INSPECTION AND TESTING SHALL BE AS PER IBR, ASME B16.9 & SA234.
04. EDGE PREPARATION DETAIL SHALL BE AS PER DRAWING No: 3-80-300-19825
STYLE P d1=595
05. O.D AT ANY SECTION SHALL NOT VARY MORE THAN 4mm(656 to 664)
06. ACTUAL THICKNESS AT ANY POINT SHALL NOT VARY MORE THAN 12.5% OF THE NOMINAL THICKNESS. (31.5 to 40.5)
07. ALTERNATE RAW MATERIAL CAN ALSO BE USED.

PIPE D 660 x 45 L=1178	15 991 707 4450	A	803.985
	SA 335 P22		
DESCRIPTION	RAW MATL. CODE	A	UNIT WT.
	MATL. SPECN.	C	QTY

STANDARD



BHARAT HEAVY ELECTRICALS LTD

PIPING CENTRE
CHENNAI 600 017

NAME	SIGN	DATE
DRN M.C.SEKARAN	-SD.-	12-06-08
CHD C.SARAVANAN	-SD.-	12-06-08
APPD S.JAYAKUMAR	-SD.-	12-06-08

DEPT	GRADE OF UNTOLEDIM	SCALE	WEIGHT (KG).	REF. TO ASSY./OLD DRG.	
CODE	C / M / F		803.985		
TITLE			CARD CODE	DRAWING NO.	REV
BW LR 45 DEG. ELBOW			U 01	4-80-999-93088	01
OD 660 x 36					

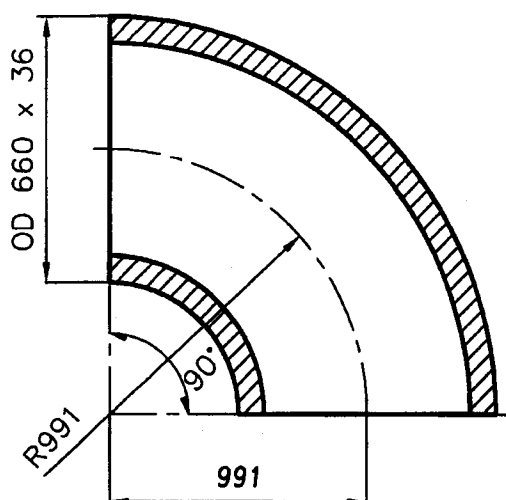
Size A4

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REV	DATE	ALTERED
01		APPROVED

ALL DIMENSIONS ARE IN MILLIMETRES

DESIGN PRESSURE AT 540° : 52.5 Kg/sq.cm(g)
 RAW MATL SPECN.: SA 335 P22 (A).
 FITTING SPECN. : SA 234 WP22 (A).
 FINISHED FITTING MATERIAL CODE:



NOTES: —

1. ALL DIMENSIONS ARE FINISHED DIMENSIONS.
2. FOR TOLERANCES REFER STANDARD DRG.4-80-301-26192.
3. MANUFACTURING, INSPECTION AND TESTING SHALL BE AS PER IBR, ASME B16.9 & SA234.
4. EDGE PREPARATION DETAIL SHALL BE AS PER DRAWING No: 3-80-300-19825
STYLE P d1=595
5. O.D AT ANY SECTION SHALL NOT VARY MORE THAN 4mm(656 to 664)
6. ACTUAL THICKNESS AT ANY POINT SHALL NOT VARY MORE THAN 12.5% OF THE NOMINAL THICKNESS. (31.5 to 40.5)
7. ALTERNATE RAW MATERIAL CAN ALSO BE USED.

STANDARD



BHARAT HEAVY ELECTRICALS LTD

PIPING CENTRE
CHENNAI 600 017

PIPE D 660 x 45 L=1957	15 991 707 5300	A	1335.653
	SA 335 P22		
DESCRIPTION	RAW MATL CODE	A	UNIT WT.
	MATL SPECN.	C	QTY

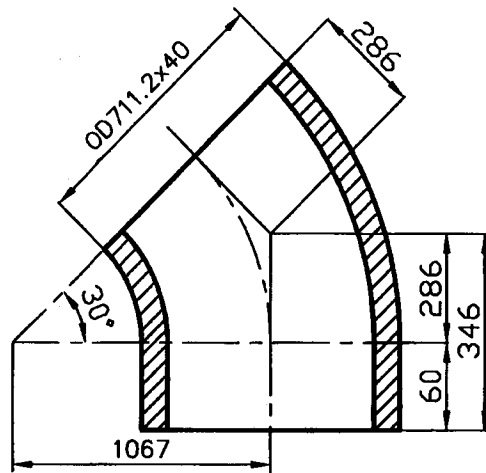
DEPT	GRADE OF UNTOL.DIM	SCALE	WEIGHT (KG).	REF. TO ASSY./OLD DRG.	NAME	SIGN	DATE
CODE	C / M / F		1335.653		DRN	M.C.SEKARAN	12-06-08
					CHD	C.SARAVANAN	12-06-08
					APPD	S.JAYAKUMAR	12-06-08
TITLE	BW LR 90 DEG. ELBOW OD 660 x 36			CARD CODE	DRAWING NO.		REV
				U 01	4-80-999-93085		00

Size A4

ALL DIMENSIONS ARE IN MILLIMETRES

REV	DATE	ALTERED
01		APPROVED

DESIGN PRESSURE AT 540° : 54 Kg/sq.cm(g)
 RAW MATL SPECN.: SA 335 P22 (A).
 FITTING SPECN. : SA 234 WP22 (A).
 FINISHED FITTING MATERIAL CODE:
 WEIGHT OF FINISHED FITTING: 410kg.



NOTES: —

- ALL DIMENSIONS ARE FINISHED DIMENSIONS.
- FOR TOLERANCES REFER STANDARD DRG.4-80-301-26192.
- MANUFACTURING, INSPECTION AND TESTING SHALL BE AS PER IBR, ASME B16.9 & SA234.
- EDGE PREPARATION DETAIL SHALL BE AS PER DRAWING No: 3-80-300-19825
FIGURE P d1=635mm.
- O.D. AT ANY SECTION SHALL NOT VARY MORE THAN 4mm(707.2 to 715.2)
- ACTUAL THICKNESS AT ANY POINT SHALL NOT VARY MORE THAN 12.5% OF THE NOMINAL THICKNESS. (35 to 45mm)
- ALTERNATE RAW MATERIAL CAN ALSO BE USED.
- A STRAIGHT ARM LENGTH OF 60mm IS REQUIRED AT ONE END OF ELBOW.

STANDARD

PIPE D 720 x 49 L=960	15 991 708 4250	A	778 000
	SA 335 P22		
DESCRIPTION	RAW MATL CODE	A	UNIT WT.
	MATL SPECN.	C	QTY



BHARAT HEAVY ELECTRICALS LTD

PIPING CENTRE
CHENNAI 600 017

	NAME	SIGN	DATE
DRN	R.ANANTH		14-11-08
CHD	R.ANANTH		14-11-08
APPD	M.N.VASUDEVAN		14-11-08

DEPT	GRADE OF UNTOL DIM	SCALE	WEIGHT (KG).	REF. TO ASSY./OLD DRG.
CODE	C / M / F		778	
TITLE				REV
BW LR 30DEG ELBOW WP22 OD711.2x40 (with extended arm)				00
CARD CODE				
U 01				
DRAWING NO.				
4-80-999-93174				

Size A4

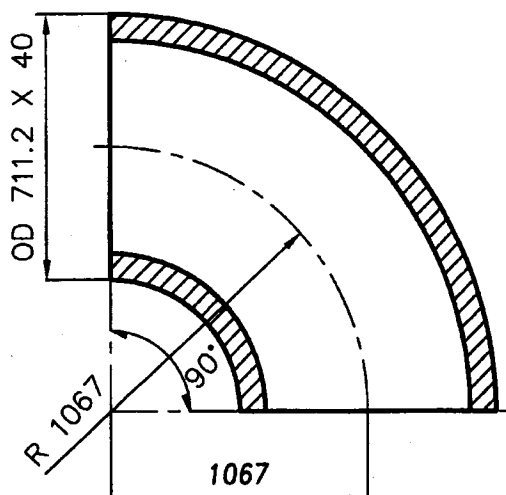
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REV	DATE	ALTERED
01		APPROVED

ALL DIMENSIONS ARE IN MILLIMETRES



DESIGN PRESSURE AT 540° : 54 Kg/sq.cm(g)
 RAW MATL SPECN.: SA 335 P22 (A).
 FITTING SPECN. : SA 234 WP22 (A).
 FINISHED FITTING MATERIAL CODE:



NOTES: -

01. ALL DIMENSIONS ARE FINISHED DIMENSIONS.
02. FOR TOLERANCES REFER STANDARD DRG.4-80-301-26192.
03. MANUFACTURING, INSPECTION AND TESTING SHALL BE AS PER IBR, ASME B16.9 & SA234.
04. EDGE PREPARATION DETAIL SHALL BE AS PER DRAWING No: 3-80-300-19825
STYLE P d1=635
05. O.D AT ANY SECTION SHALL NOT VARY MORE THAN 4mm(707.2 to 715.2)
06. ACTUAL THICKNESS AT ANY POINT SHALL NOT VARY MORE THAN 12.5% OF THE NOMINAL THICKNESS. (35 to 45)
07. ALTERNATE RAW MATERIAL CAN ALSO BE USED.

STANDARD

 BHARAT HEAVY ELECTRICALS LTD PIPING CENTRE CHENNAI 600 017		PIPE OD 720 x 49 L=2076		15 991 708 5400 SA 335 P22		1683.221	
DESCRIPTION		RAW MATL CODE		A		UNIT WT.	
MATL SPECN.		C		QTY			
DEPT CODE		GRADE OF UNTOL DIM C / M / F		SCALE 		WEIGHT (KG). 1683.221.	
TITLE BW LR 90 DEG. ELBOW OD 711.2 x 40		CARD CODE U 01		REF. TO ASSY./OLD DRG.		DATE 12-06-08 12-06-08 12-06-08	
DRAWING NO. 4-80-999-93086		REV 00					

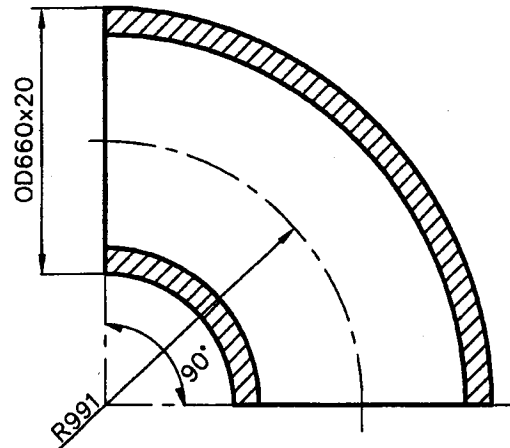
Size A4

20/23

ALL DIMENSIONS ARE IN MILLIMETRES

REV	DATE	ALTERED
01		APPROVED

DESIGN PRESSURE AT 370°C : 60 Kg/sq.cm(g)
 RAW MATL SPECN.: SA 106 GRC (A).
 FITTING SPECN. : SA 234 WPC (A).
 FINISHED FITTING MATERIAL CODE:
 WEIGHT OF FINISHED FITTING: 491kg.

**NOTES: -**

01. ALL DIMENSIONS ARE FINISHED DIMENSIONS.
02. FOR TOLERANCES REFER STANDARD DRG.4-80-301-26192.
03. MANUFACTURING, INSPECTION AND TESTING SHALL BE AS PER IBR, ASME B16.9 & SA234.
04. EDGE PREPARATION DETAIL SHALL BE AS PER DRAWING No: 3-80-300-19825
STYLE P d1=624
05. O.D AT ANY SECTION SHALL NOT VARY MORE THAN 4mm(656 to 664)
06. ACTUAL THICKNESS AT ANY POINT SHALL NOT VARY MORE THAN 12.5% OF THE NOMINAL THICKNESS. (17.5 to 22.5)
07. ALTERNATE RAW MATERIAL CAN ALSO BE USED.

STANDARD

PIPE OD 660 x 22 L=1957	15 983 548 6000	677.000
	SA 106 GRC	
DESCRIPTION	RAW MATL CODE	UNIT WT.
	MATL. SPECN.	QTY

**BHARAT HEAVY ELECTRICALS LTD**
 PIPING CENTRE
 CHENNAI 600 017

	NAME	SIGN	DATE
DRN	R.ANANTH		24-11-08
CHD	R.ANANTH		24-11-08
APPD	M.N.VASUDEVAN		24-11-08

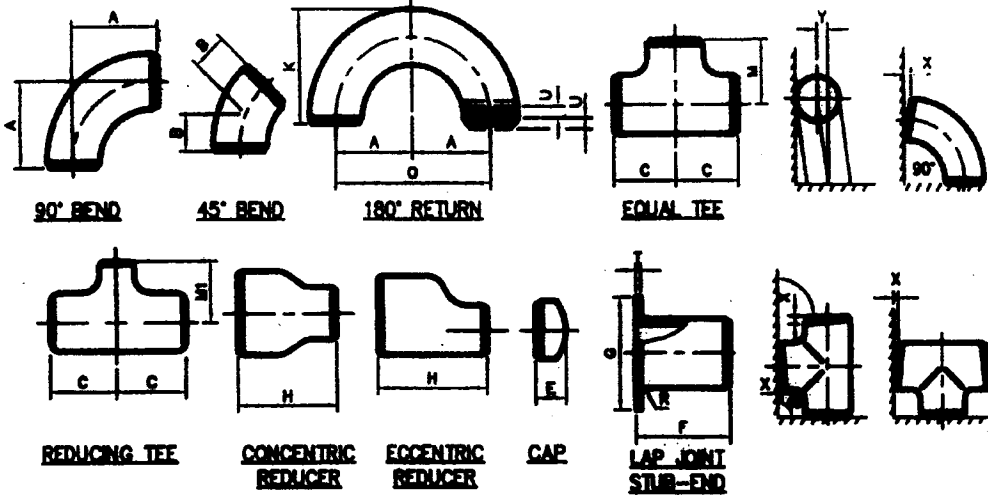
DEPT	GRADE OF UNTOLD DIM	SCALE	WEIGHT (KG).	REF. TO ASSY./OLD DRG.
CODE	C / M / F		677.000	
TITLE			CARD CODE	DRAWING NO.
BW LR 90 DEG. ELBOW			U 01	4-80-999-93176
OD660x20 WPC				REV
				00

Size A4

REV	DATE	ALTERED
01	05.02.05	APPROVED APMK

TITLE BLOCK AND DRAWING ALTERED

(REFERENCE : IIR, REG.NO 381(A) INCLUDED IN AMENDMENT)



ALL FITTINGS				90°&45° ELBOWS AND TEES	REDUCER	180° RETURNS			CAPS	LAP-JOINT		STUB END	
DN	O.D AT BEVEL	L.D AT END	WALL THICK NESS	CENTER TO END A,B,C,M,M1	OVERALL LENGTH H	CENTER TO CENTER O	BACK TO FACE K	ALIGN- MENT OF END U	OVER ALL LENGTH V	END TO END P	RADIUS R	DIA OF LAP Q	THICKNESS OF LAP
15 TO 65	+1.6 -0.8	±0.8	NOT LESS THAN 67 1/2% OF NOMINAL THICKNESS	±1.6	±1.6	±6.4	±6.4	±0.8	±3.2	±1.6	+ 0 -0.8	+ 0 -0.8	+1.6 - 0
80 TO 90	±1.6	±1.6		±1.6	±1.6	±6.4	±6.4	±0.8	±3.2	±1.6	+ 0 -0.8	+ 0 -0.8	+1.6 - 0
100	±1.6	±1.6		±1.6	±1.6	±6.4	±6.4	±0.8	±3.2	±1.6	+ 0 -0.8	+ 0 -0.8	+1.6 - 0
125 TO 200	+2.4 -1.6	±1.6		±1.6	±1.6	±6.4	±6.4	±0.8	±6.4	±1.6	+ 0 -0.8	+ 0 -0.8	+1.6 - 0
250 TO 400	+4.0 -3.2	±3.2		±2.4	±2.4	±9.6	±6.4	±1.6	±6.4	±2.4	+ 0 -1.6	+ 0 -1.6	+1.6 - 0
500 & ABOVE	+6.4 -4.8	±4.8		±2.4	±2.4	±9.6	±6.4	±1.6	±6.4	±2.4	+ 0 -1.6	+ 0 -1.6	+1.6 - 0

OFF-SQUARE TOLERANCES		
NOMINAL SIZE OF FITTING	OFF SQUARE TOLERANCE, X	OFF SQUARE TOLERANCE, Y
UP TO AND INCLUDING 100	0.8	1.6
125 TO 150	1.2	2.4
200 TO 500	1.6	3.2
600 & ABOVE	3.2	6.4

NOTES : 1. ALL DIMENSIONS ARE IN MILLIMETRES

STANDARD

BHARAT HEAVY ELECTRICALS LIMITED PIPING CENTRE CHENNAI 600 017		DRN	NAME	SIGN	DATE	NO. OF VAR
		CHD	R.ANANTH	Sd	15.10.1986	
		APPD	J.JUDE	Sd	15.10.1986	
DEPT	GRADE OF UNTOLO DIM	SCALE	WEIGHT (KG).	REF. TO ASSY./OLD DRG.		REV
CODE	C / M / P	N.T.S	-	-		-
TITLE			CARD CODE	DRAWING NO.		REV
TOLERANCES ON FITTINGS			U 01	4-80-301-26192		01

V:A4

Size A4

23/23