



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

Piping Centre , 80, G. N. Chetty Road, CHENNAI – 600 017
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REF: ENQ NO:71

DT: 19.08.2010

Sub: Procurement of CS and AS pipe fittings.

Ref: Enquiry No:PC:4101000071 dt 19.08.2010

Please find the following tender documents for reference.

1. List of items and sample drawings
2. Tech. delivery condition TDG: 102:04.

Pre qualification is the criteria for consideration for other than BHEL approved vendors. After qualifying for registration, the new vendors may be considered for future requirements, in line with BHEL system and policy. Such vendors will not be considered for this enquiry.

This is a limited tender and only vendors who are contacted through e-mail/courier may submit their offers.

New vendors may download vendor registration forms from BHEL web site www.bhel.com and relevant data for formal registration.

Manager / Purchase
BHEL / Piping Centre
80,GN Road, T.Nagar
Chennai-600017
Ph: 044-28161245

Sl no	Material	Description	Drawing no	qty nos	Unit rate
1	925248900000	SR 90DEG ELBOW 457.2X22.2SA234WP22CL1	As per std	16	
2	921175600000	REDUCEROD457.2X25/355.6X32SA234WP22CL1	As per std	4	
3	921174750000	CON.REDUCER 965 X37/864X34SA234WP22CL1	As per std	26	
4	921175100000	RED OD 508 X 48 / OD 355.6 X 36 SA234WPC	4-80-423-69875/00	2	
5	921175130000	RED OD 645X27.5/OD 559X28.58SA234WP22CL1	4-80-321-69526/00	8	
6	921175140000	RED OD 645X27.5/OD 457.2X45 SA234WP22CL1	4-80-321-69527/00	8	
7	921175150000	RED OD 457.2X45/OD 420X40 SA234WP22CL1	4-80-321-69528/00	8	
8	921175730000	REDUCER OD 914X47/ 864X50 SA234WP22CL1	4-80-320-70721/00	2	
9	925058750000	UNEQTEEOD219.1X32/168.3X27.5SA234WPC	As per std	2	
10	925179400000	BW CON RED 558.8X32/508X30SA234WP22CL1	As per std	3	
11	925249740000	BW LR 90DELBOW OD 813 X 35 SA234WP22CL1	4-80-320-70627/00	4	
12	925249790000	BW 90 DEG ELBOW OD 273 X 52 SA234WPC	As per std	78	
13	925249800000	BW 45 DEG ELBOW OD 273 X 52 SA234WPC	As per std	14	
14	925249810000	BW 30 DEG ELBOW OD 273 X 52 SA234WPC	As per std	12	
15	925249860000	BW 90 DEG ELBOW OD 406.4 X 56 SA234WPC	As per std	132	
16	925249870000	BW 45 DEG ELBOW OD 406.4X 56 SA234WPC	As per std	14	
17	925249880000	BW 30 DEG ELBOW OD 406.4X 56 SA234WPC	As per std	32	
18	925249890000	BW SR 90 DEG ELBOW OD 406.4X 56 SA234WPC	As per std	28	
19	925249920000	BBW 90 DEG ELBOW OD 355.6X 64 SA234WPC	As per std	12	
20	925255990000	BW UEQT OD 711X20/273X12.7-SA234WPC	As per std	4	
21	921175630000	BWCONREDOD457X82/OD406.4X72SA234WPC	As per std	6	
22	921175650000	BWRED OD 559X75 / OD 406.4X56 SA234WPC	As per std	24	
23	921175760000	RED OD 406.4X60/168.3X27.5SA234WP22CL1	As per std	28	
24	921175770000	RED OD 406.4 X 60/ 273 X 45 SA234WP22CL1	As per std	28	
25	921175520000	REDUCER OD1016x42/813x35SA234WP22CL1	4-80-320-70618/00	2	
26	921175620000	BWCONREDOD660X116/OD457X82SA234WPC	As per std	4	
27	921175640000	BW RED OD 660X116/OD 558.8X 98 SA234WPC	As per std	2	
28	925249780000	BW 90 DEG ELBOW OD 457 X 82 SA234WPC	As per std	52	
29	925249820000	BW 90 DEG ELBOW OD 660 X 116 SA234WPC	As per std	8	
30	925249830000	BW SR 90 DEG ELBOW OD 660 X 116 SA234WPC	As per std	4	
31	925249840000	BW 90 DEG ELBOW OD 559 X 75 SA234WPC	As per std	40	
32	925249850000	BW 30 DEG ELBOW OD 559 X 75 SA234WPC	As per std	20	
33	925249900000	BW90DEG LR ELL OD864X50 SA234WP22 CL1	As per std	2	
34	925249910000	BW 45 DEG LR ELL OD864X50 SA234WP22 CL1	As per std	2	
35	925249940000	BW LR 90 DEG ELL OD 660 X 81 SA234WPC	4-80-425-70837/01	12	



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:-

- a) All pipes used for fittings shall meet the respective specification. The test certificate shall be furnished.
- b) 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
- c) 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
- d) 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.
- e) 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.
- f) Carbon content of SA 234 WPB, WPC, SA 105 fittings shall be restricted to 0.25% max

3.0 PROCESS:-

- a) Process of manufacture shall conform to applicable standards.
- b) All fittings shall be of seamless unless otherwise specified in the purchase order.
- c) In case of welded fittings, WPS, PQR & welder qualification shall be approved by BHEL - PC, prior to start of welding.
- d) 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.
- e) 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.
- f) 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

5.0 TESTING :-

- (a) 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.

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



- (b) One fitting of each specification, heat, heat treatment lot and size shall be subjected to Tension Test as per applicable standard.
- (c) 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.
- (d) Hardness test shall be carried out on each fittings of WP91 / F91. For other fittings hardness shall be checked on 10% of the fittings.
- (e) 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
- (f) 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.
- (g) Metallography:- Metallography shall be carried out on one per heat, per size, per heat treatment lot of WP91 / F91 fittings. Acceptance norms - The Material shall be free from any micro fissures. Microstructure shall show tempered martensite and also to be examined for any grain growth. Photomicrograph with 500x (Min) magnification along with Metallography report to be provided. The actual magnification shall be indicated.

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 PAINTING , COLOUR CODING, MARKING, PACKING & END PROTECTION

7.1 **PAINTING** : All fittings (except stainless steel and galvanised) shall be **painted** on the external surface as given below

- a) surface preparation : Blast cleaning
- b) Primer coat : 50 microns of Red oxide zinc phosphate confirming to IS 12744
- c) Final coat : 70 microns of Synthetic enamel paint confirming to IS2934 .
- d) Shade : (i) smoke grey – shade no 692 of IS5 for all carbon steel fittings
(ii) Sea green -- shade no 217 of IS5 for all Alloy steel fittings

The internal surface shall be protected with rust preventive coating or rust inhibitor. Stainless steel and Galvanised fittings need not be painted.

7.2 **COLOUR CODING** : All fittings shall be colour coded circumferentially at ends as given below

SA 234 WPB / WPBW = Red
WPC / SA105 = Blue

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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

7.3 MARKING :

7.3.1 The fittings dispatched to **BHEL Stores** shall be punched / etched with Material code, Heat number, material specification, maker's emblem, Inspectors seal and Statutory authorities seal (as applicable).

In addition, the above details along with size shall be paint stenciled on the fittings.

If the thickness of the fitting is less than 6 mm, punching is not permitted and the above details shall be paint stenciled only. Fittings of size up to 2" (50mm) shall be tied together and the above details shall be punched / etched in a separate tag and tied to it.

7.3.2 The fittings dispatched directly to project site as **DTS** shall be punched and paint stenciled with DU code (14 digit work order du detail) as given by purchase in addition to marking done as per para 7.3.1.

7.4 **PACKING AND END PROTECTION** : Machined ends of the fittings shall be well protected using end caps and fittings shall be 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. Laddle 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

S. Jayakumar, Engg

P. Elangovan, QA

Approved by

K. Vedaprasad, QC

K. Ganeshan, MPL



17. Metallography Report along with photomicrograph with 500x (min) magnification.
- *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.

Rev 04 : a) Para 5.0 (g), 7.0 and 8.0 (17) are revised.

S. Jayakumar, Engg

P. Elangovan, QA

Approved by

K. Vedaprasad, QC

K. Ganeshan, MPL

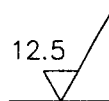
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REV	DATE	ALTERED : N.MEGANATHAN
01	28/5/10	CHD & APPD : K.V.RAMANI

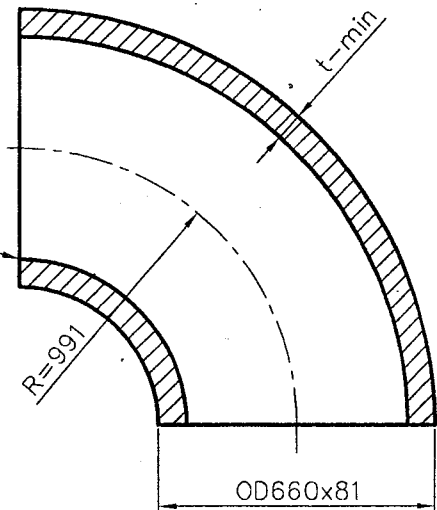
MATERIAL CODE ADDED.

NOTES:

- 1) DESIGN PRESSURE : 319.6 Kg/Cm²(g)
- 2) DESIGN TEMPERATURE : 320 °C
- 3) WORKING MEDIUM : WATER
- 4) FOLLOW TDC No. : TDG-102 (LATEST REVISION)
- 5) ALL DIMENSIONS ARE FINISHED DIMENSIONS
- 6) DESIGN, MANUFACTURING, INSPECTION, TOLERANCES AND TESTING SHALL BE AS PER IBR ANSI B16.9 AND SA 234.
- 7) FLOW AREA SHALL NOT BE LESS THAN 80% OF NOMINAL FLOW AREA.
- 8) t-min SHALL NOT BE LESS THAN 0.875 TIMES OF THE WALL THICKNESS (i.e 0.875 x THICKNESS)



EDGE PREPARATION
AS PER DRG NO:
3-80-300-19825
STYLE-P, d1=498
(TYP)



-	BW LR 90DEG ELBOW OD660x81	92 524 994 0000	A	2186 000		
				1		
VAR No.	DESCRIPTION	STD	MATERIAL CODE	A/C/P	UNIT	UNIT WT. (KG)
			MATERIAL SPECN			QUANTITY



BIHARAT HEAVY ELECTRICALS LIMITED
PIPING CENTRE
CHENNAI 600 017

	NAME	SIGNATURE	DATE
DRN	N.MEGANATHAN	..sc..	26/04/2010
CHD	N.MEGANATHAN	..sd..	
APPD	K.V.RAMANI	..sd..	

DEPT	ALL DIMENSIONS ARE IN MM	PROJECTION	SCALE	WEIGHT (Kg)	REF TO ASSY / OLD DWG
CODE			N.T.S	2186.000	-

TITLE	DRAWING NO :	REV
ASME B16.9 BW LR 90DEG ELBOW OD660x81	4-80-425-70837	01

3-80-000-08-3

DRAWING No.

NOTES: -

- 01. APPLICABLE FOR P91 MATERIAL
- 02. FOR OD MISMATCHING REF. FIGURE - Xa.
- 03. $\alpha = 6^\circ$ FOR WALL THICKNESS ≤ 30 mm
- 04. $\alpha = 10^\circ$ FOR WALL THICKNESS > 30 mm

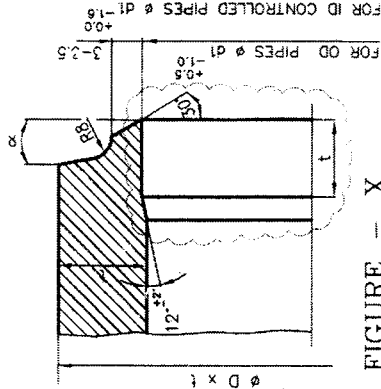


FIGURE - X

MATCHING EDGE PREPARATION FOR MISMATCH OD

- DIAMETRICALLY GREATER THAN 8 mm
(i.e. OD1 - OD2 > 8mm) APPLICABLE FOR ELBOWS OTHER THAN P91 MATERIALS

NOTES: -

- 01. OD = OUTSIDE DIA OF CONNECTING PIPE (STRAIGHT) TO BE PHYSICALLY MEASURED/VERIFIED.
- 02. t = THK OF CONN. PIPE (STRAIGHT)

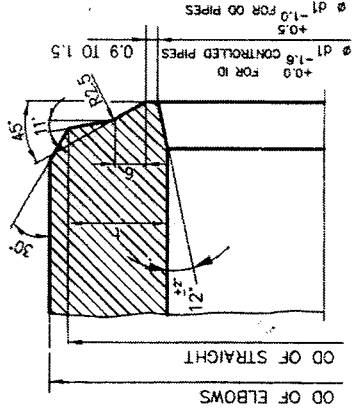


FIGURE - Z

MATCHING EDGE PREPARATION FOR MISMATCH OD

- DIAMETRICALLY GREATER THAN 8 mm
(i.e. OD1 - OD2 > 8mm) APPLICABLE FOR BENDS/FITTINGS OF P91 MATERIALS

NOTES: -

- 01. OD OF STRAIGHT TO BE PHYSICALLY MEASURED/VERIFIED.
- 02. $\alpha = 6^\circ$ FOR WALL THICKNESS ≤ 30 mm
- 03. $\alpha = 10^\circ$ FOR WALL THICKNESS > 30 mm

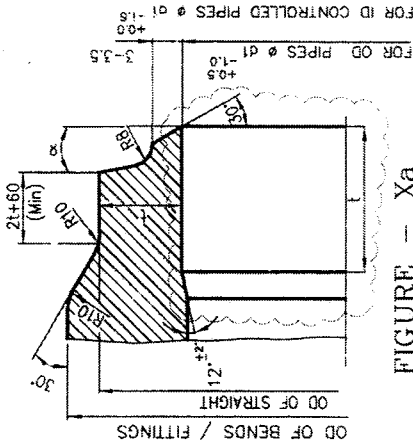
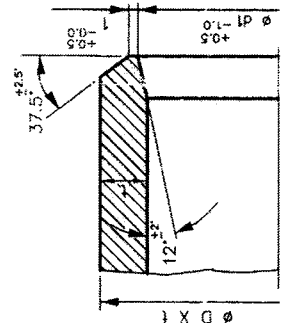


FIGURE - Xa



STYLE - D

NOTES: -

- 01. USE WHEN t < 14.2 mm.

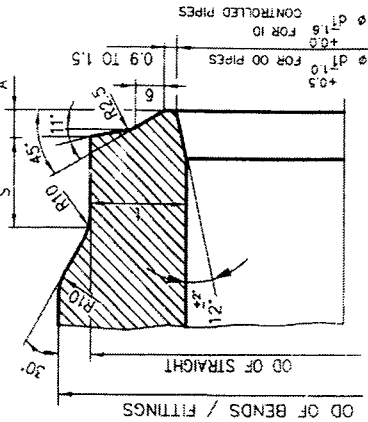
REV	DATE	ISSUED BY	APPROVED BY	NAME
01	11-05-04	R. Sankar	V. Sankar	
NOTE: PROJECT NAME REMOVED AND STANDARD INCORPORATED IN TITLE BLOCK.				

MATCHING EDGE PREPARATION FOR MISMATCH OD

- DIAMETRICALLY GREATER THAN 8 mm
(i.e. OD1 - OD2 > 8mm) APPLICABLE FOR BENDS/FITTINGS OTHER THAN P91 MATERIALS

NOTES: -

- 01. OD OF STRAIGHT TO BE PHYSICALLY MEASURED/VERIFIED.
- 02. WHEN $t < 6S$, $S+t = 6S$ Min. & $t < 6S$, $S=6S$ Min. WHERE t = THK OF CONN. PIPE (STRAIGHT)



STYLE - Pa

GENERAL NOTES: -

- 01. THE MINIMUM THICKNESS AT WELD END SHALL NOT BE LESS THAN
 - a) 0.875 TIMES t NOM. FOR OD PIPES.
 - b) t MIN. FOR ID CONTROLLED PIPES.
- 02. t NOM & t MIN SHALL BE AS PER SPECIFIED PIPE SIZE.

NOTES FOR WELDING: -

- 01. WELD REINFORCEMENT TO BE FLUSH GROUND AND MERGED WITH PARENT METAL WITHOUT ANY UNEVENNESS.

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT

STANDARD

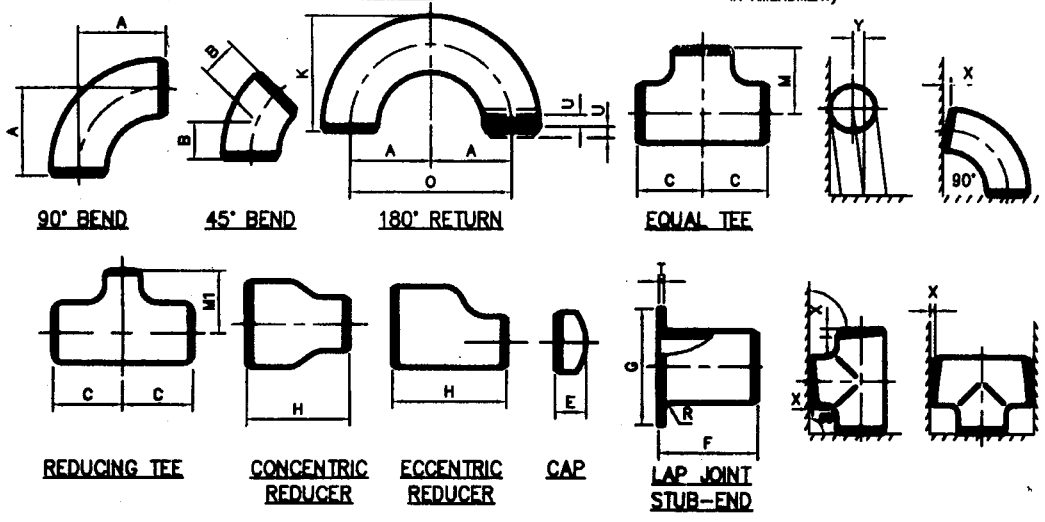
DEPT	GRADE OF UN TOL DIM	SCALE	WEIGHT (KG)	NAME OF ORIGINAL ORGANISATION	DATE	SIGN	NO OF ITEMS
	C/M/F			BHARAT HEAVY ELECTRICALS LTD., PIPING CENTRE, CHENNAI	11.10.01		11.10.01
CODE					11.10.01		11.10.01
TITLE	EDGE PREPARATION DETAILS						
CARD CODE	U 01						
DRAWING No.	3-80-300-19825						
REV	01						

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REV	DATE	ALTERED	<i>[Signature]</i>
01	05.02.05	APPROVED	<i>[Signature]</i> APMK

TITLE BLOCK AND DRAWING ALTERED

(REFERENCE : ISR ,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	I.D AT END	WALL THICKNESS	CENTER TO END A,B,C,M,M1	OVERALL LENGTH H	CENTER TO CENTER O	BACK TO FACE K	ALIGNMENT OF END U	OVER ALL LENGTH E	END TO END F	RADIUS R	DI.A OF LAP G	THICKNESS OF LAP	
15 TO 65	+1.6 -0.8	±0.8	NOT LESS THAN 87 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	±9.5	±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	±9.5	±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 550	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 UNTOL DIM		SCALE	WEIGHT (KG).	REF. TO ASSY./OLD DRG.		ITEM NO.	NO. OF ITEMS
CODE	C / M / F		N.T.S	-	-	-	-	-
TITLE			CARD CODE	DRAWING NO.			REV	
TOLERANCES ON FITTINGS			U 01	4-80-301-26192			01	