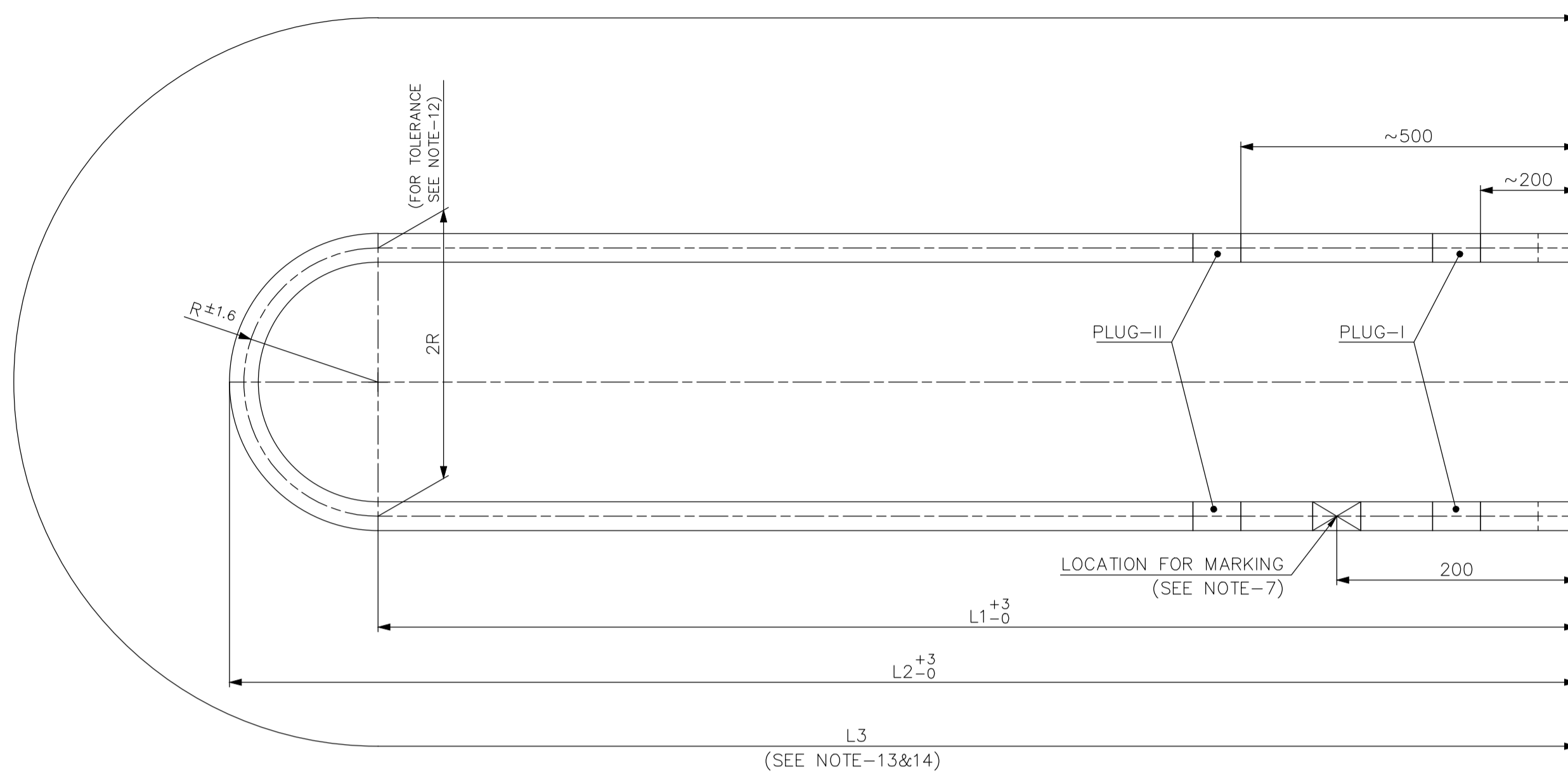


- NOTES: -
- REFER DRG. NO 1-93-170-05156 FOR U-TUBES.
  - THE VIEW SHOWN IS FROM THE PRIMARY SIDE OF TUBE SHEET.
  - THE TOTAL WEIGHT OF EACH BOX SHALL BE APPROXIMATELY 3000-4000KG.
  - MATERIAL MELT NO. AND TUBE POSITION NO. SHALL BE INDICATED ON A TAG TIED TO EACH TUBE.
  - 'TR' INDICATES THE TIEROD POSITIONS AND THERE ARE NO TUBES AT THESE POSITIONS.
  - TUBING THE HEX WILL START FROM LOWER SIDE WITH H=1. HENCE THE PACKING OF THE TUBES SHALL BE CARRIED OUT VICE VERSA i.e., STARTING WITH H=89
  - THE WELDS BETWEEN THE CHANNELS AT THE TOP OF THE LIFTING FRAME SHALL BE SUCH THAT THEY ARE EASILY REMOVABLE.
  - THE BOX NUMBER AND POSITION OF 'U' BEND REGION SHALL BE CLEARLY MARKED ON EACH BOX USING PERMANENT PAINT.
  - FOR LIFTING, USE EVENER BEAM OR SLINGS WITH INCLUDED ANGLE NOT GREATER THAN 45°. THE SUPPLIER SHALL ALSO PAINT THE ABOVE CLEARLY ON THE BOX WITH CAUTION MARK AS A GUIDE LINE AS INDICATED IN THE DRG., FOR HANDLING OUT SIDE HIS WORKS.
  - EACH TUBE SHALL BE PACKED IN A WATER PROOF HALOGEN FREE POLYTHENE COVER.
  - THE CIRCUMFERENCE OF THE POLYTHENE COVER SHALL BE APPROXIMATELY 150 mm TO ENSURE SUFFICIENT FREE SPACE AROUND THE TUBE.
  - THE THICKNESS OF THE POLYTHENE COVER USED FOR INDIVIDUAL TUBE PACKING SHALL BE MINIMUM 120 MICRONS.
  - THE POLYTHENE QUALITY SHALL BE SUCH THAT, THE COVER DOES NOT UNDERGO DISINTEGRATION.
  - △14. EACH INDIVIDUAL WOODEN BOX SHALL BE WATER PROOF IN ORDER NOT TO ALLOW EVEN TRACES OF WATER INTO THE BOX DURING TRANSPORTATION (SEAWORTHY PACKING) AND DURING LONG STORAGE IN TROPICAL CONDITIONS.
  - THE WOOD QUALITY SHALL BE SUCH THAT, THE WOOD DOES NOT UNDERGO DISINTEGRATION.
  - △16. PACKING SHALL BE VERIFIED AND CHECKED AT APPROPRIATE STAGES AS INDICATED IN APPROVED QUALITY PLAN.

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT		700MWe/GHVP-1&2	
Bharat Heavy Electricals Ltd UNIT: HIGH PRESSURE ROTARY PLANT TIRUCHIRAPPALLI - 620014		DATE	110814
REV. DATE ALTERED		BY	AK/SM
01 200218 CHOLAPPD		CHKD	AS
SCALE		WEIGHT (KG)	REP TO ARRY / OLD DRG
1:50		GHVP-1&2/3311/4037/25/ROD	ITEM NO
TITLE		DRAWING NO	REV
PACKING DETAILS U-TUBES(SA-20)		0-93-170-05194	01



NOTES: -

1. APPLICABLE SPECIFICATIONS : PC-M-962
2. MATERIAL SPECIFICATION : ASME SB 163 NICKEL-IRON-CHROMIUM ALLOY UNS N08800 (MODIFIED)
3. SIZE  
OUTSIDE DIAMETER : 19.0<sup>+0.12</sup><sub>-0.03</sub>  
THICKNESS : 1.1 ±10%
4. FOR DETAILS OF TOLERANCE ON BENDING RADIUS, PERMISSIBLE THINNING, MIN. THICKNESS, QUALITY ON BEND REGION, ETC., AND SUPPLY CONDITIONS, REFER THE APPLICABLE SPECIFICATION, PC-M-962.
5. HYDROSTATIC TEST PRESSURE : 25<sup>+1</sup><sub>-0</sub> MPa.
6. TWO PVC/POLYETHYLENE PLUGS ON EITHER END OF THE TUBE SHALL BE PROVIDED AT LOCATIONS AS SHOWN IN THE DRAWING.
7. MARKING ON THE TUBE SHALL BE DONE AT LOCATION SHOWN ; ELECTRICAL ETCHING METHOD SHALL BE ADOPTED FOR THE ABOVE.
8. QUANTITIES INDICATED IN THE DRAWING (TABLE-1) ARE FOR ONE HEAT EXCHANGER ONLY.
9. ALL QUANTITIES SHALL BE COVERED IN AS FEW NUMBER OF MELTS AS PRACTICABLE.
10. REFER DRAWING NO. 0-93-170-05194 & 3-93-170-05395, FOR PACKING DETAILS.
11. IN ADDITION, STRAIGHT TUBES SHALL BE SUPPLIED AS FOLLOWS  
a) 7M/MELT FOR EACH SET OF SG TUBES.  
b) 20 No. OF TUBES OF LENGTH 12M PER EACH SET OF SG TUBES.
12. TOLERANCE ON LEG SPACING SHALL BE AS GIVEN BELOW:

SL.NO.	BEND RADIUS, R (mm)	TOLERANCE ON DIMN 2R (mm)
1	LESS THAN 220	±1.0
2	220 < R < 450	±1.8
3	450 < R < 760	±2.0
4	MORE THAN 760	±2.5

TABLE-1

VAR NO	R (mm)	L1 (mm)	L2 (mm)	L3 (DEVELOPED LENGTH mm)	NO.OFF / HEX. (SEE NOTE-15)	W/UNIT (kg)
1	91.0	10840.5	10941.0	21966.9	42	10.91
2	104.0	10847.0	10960.5	22020.7	45	10.94
3	117.0	10853.5	10980.0	22074.6	44	10.96
4	130.0	10860.0	10999.5	22128.4	45	10.99
5	143.0	10866.5	11019.0	22182.2	44	11.02
6	156.0	10873.0	11038.5	22236.1	45	11.05
7	169.0	10879.5	11058.0	22289.9	44	11.07
8	182.0	10886.0	11077.5	22343.8	45	11.10
9	195.0	10892.5	11097.0	22397.6	44	11.13
10	208.0	10899.0	11116.5	22451.5	45	11.15
11	221.0	10905.5	11136.0	22505.3	44	11.18
12	234.0	10912.0	11155.5	22559.1	44	11.21
13	247.0	10918.5	11175.0	22613.0	44	11.23
14	260.0	10925.0	11194.5	22666.8	43	11.26
15	273.0	10931.5	11214.0	22720.7	44	11.29
16	286.0	10938.0	11233.5	22774.5	43	11.31
17	299.0	10944.5	11253.0	22828.3	42	11.34
18	312.0	10951.0	11272.5	22882.2	43	11.37
19	325.0	10957.5	11292.0	22936.0	42	11.39
20	338.0	10964.0	11311.5	22989.9	43	11.42
21	351.0	10970.5	11331.0	23043.7	42	11.45
22	364.0	10977.0	11350.5	23097.5	43	11.47
23	377.0	10983.5	11370.0	23151.4	42	11.50
24	390.0	10990.0	11389.5	23205.2	41	11.53
25	403.0	10996.5	11409.0	23259.1	42	11.55
26	416.0	11003.0	11428.5	23312.9	41	11.58
27	429.0	11009.5	11448.0	23366.7	42	11.61
28	442.0	11016.0	11467.5	23420.6	41	11.63
29	455.0	11022.5	11487.0	23474.4	40	11.66
30	468.0	11029.0	11506.5	23528.3	41	11.69

VAR NO	R (mm)	L1 (mm)	L2 (mm)	L3 (DEVELOPED LENGTH mm)	NO.OFF / HEX. (SEE NOTE-15)	W/UNIT (kg)
31	481.0	11035.5	11526.0	23582.1	40	11.71
32	494.0	11042.0	11545.5	23635.9	39	11.74
33	507.0	11048.5	11565.0	23689.8	40	11.77
34	520.0	11055.0	11584.5	23743.6	39	11.79
35	533.0	11061.5	11604.0	23797.5	38	11.82
36	546.0	11068.0	11623.5	23851.3	39	11.85
37	559.0	11074.5	11643.0	23905.2	38	11.87
38	572.0	11081.0	11662.5	23959.0	35	11.90
39	585.0	11087.5	11682.0	24012.8	38	11.93
40	598.0	11094.0	11701.5	24066.7	37	11.95
41	611.0	11100.5	11721.0	24120.5	36	11.98
42	624.0	11107.0	11740.5	24174.4	35	12.01
43	637.0	11113.5	11760.0	24228.2	36	12.03
44	650.0	11120.0	11779.5	24282.0	35	12.06
45	663.0	11126.5	11799.0	24335.9	34	12.09
46	676.0	11133.0	11818.5	24389.7	33	12.11
47	689.0	11139.5	11838.0	24443.6	34	12.14
48	702.0	11146.0	11857.5	24497.4	33	12.17
49	715.0	11152.5	11877.0	24551.2	32	12.20
50	728.0	11159.0	11896.5	24605.1	31	12.22
51	741.0	11165.5	11916.0	24658.9	32	12.25
52	754.0	11172.0	11935.5	24712.8	31	12.28
53	767.0	11178.5	11955.0	24766.6	30	12.30
54	780.0	11185.0	11974.5	24820.4	29	12.33
55	793.0	11191.5	11994.0	24874.3	28	12.36
56	806.0	11198.0	12013.5	24928.1	27	12.38
57	819.0	11204.5	12033.0	24982.0	26	12.41
58	832.0	11211.0	12052.5	25035.8	27	12.44
59	845.0	11217.5	12072.0	25089.6	26	12.46
60	858.0	11224.0	12091.5	25143.5	25	12.49

VAR NO	R (mm)	L1 (mm)	L2 (mm)	L3 (DEVELOPED LENGTH mm)	NO.OFF / HEX. (SEE NOTE-15)	W/UNIT (kg)
61	871.0	11230.5	12111.0	25197.3	24	12.52
62	884.0	11237.0	12130.5	25251.2	23	12.54
63	897.0	11243.5	12150.0	25305.0	22	12.57
64	910.0	11250.0	12169.5	25358.8	21	12.60
65	923.0	11256.5	12189.0	25412.7	20	12.62
66	936.0	11263.0	12208.5	25466.5	17	12.65
67	949.0	11269.5	12228.0	25520.4	16	12.68
68	962.0	11276.0	12247.5	25574.2	15	12.70
69	975.0	11282.5	12267.0	25628.1	14	12.73
70	988.0	11289.0	12286.5	25681.9	11	12.76
71	1001.0	11295.5	12306.0	25735.7	8	12.78
72	1014.0	11302.0	12325.5	25789.6	5	12.81

13. TOLERANCE ON BEND RADIUS SHALL BE AS PER PC-M-962 EFFORTS SHALL BE TAKEN TO MAKE TUBE BENDS WITH HIGHER TOLERANCES THAN THOSE SPECIFIED IN PC-M-962. THE TOLERANCE ACHIVED ON BEND RADIUS SHOULD ENSURE MAXIMUM GAP BETWEEN ADJACENT TUBE IN FINAL ASSEMBLY. EACH TUBE SHOULD BE LOCATED IN THE CENTER OF THE TWO ADJACENT TUBE ENSURING MAXIMUM TUBE TO TUBE GAP.
14. SUITABLE ASSEMBLY MOCK UP SHALL BE CARRIED OUT FOR ALL TUBES IN EACH ROW AT TUBE SUPPLIER'S SHOP SIMULATING ACTUAL ASSEMBLY SUPPORTING CONDITIONS DURING MOCK UP. IT SHOULD BE ENSURED THAT TUBE TO TUBE GAP IN BEND PORTION ON WELL AS AROUND TANGENT PORTION IS SUFFICIENT TO ENSURE MINIMUM TUBE TO TUBE GAP 4.5 mm DURING ACTUAL ASSEMBLY.
15. SPARE QUANTITY :  
SPARE TUBES SHALL BE SUPPLIED AS SPECIFIED IN THE PURCHASE DOCUMENTS.
16. WEIGHT :  
i) WITHOUT SPARE TUBES : 29151 Kg

TOLERANCE IF NOT SPECIFIED SHALL BE AS BELOW (REFER IS 2102-m)

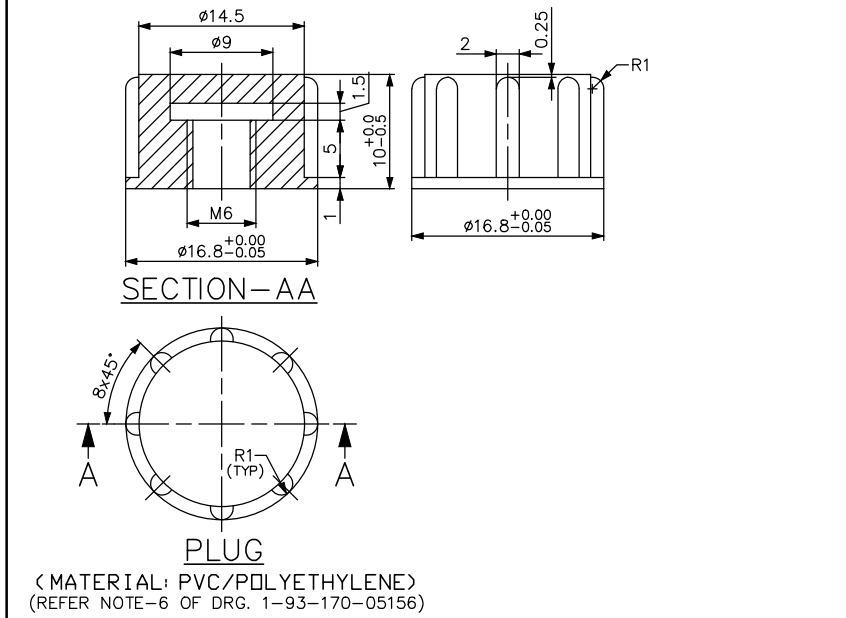
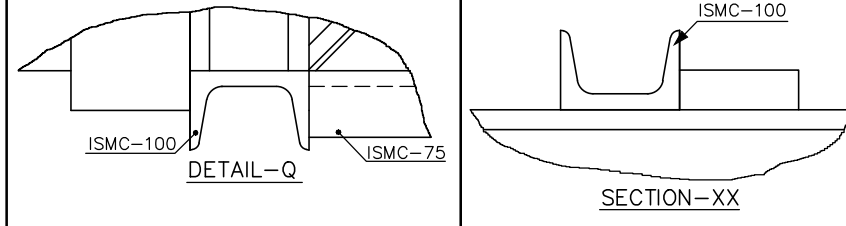
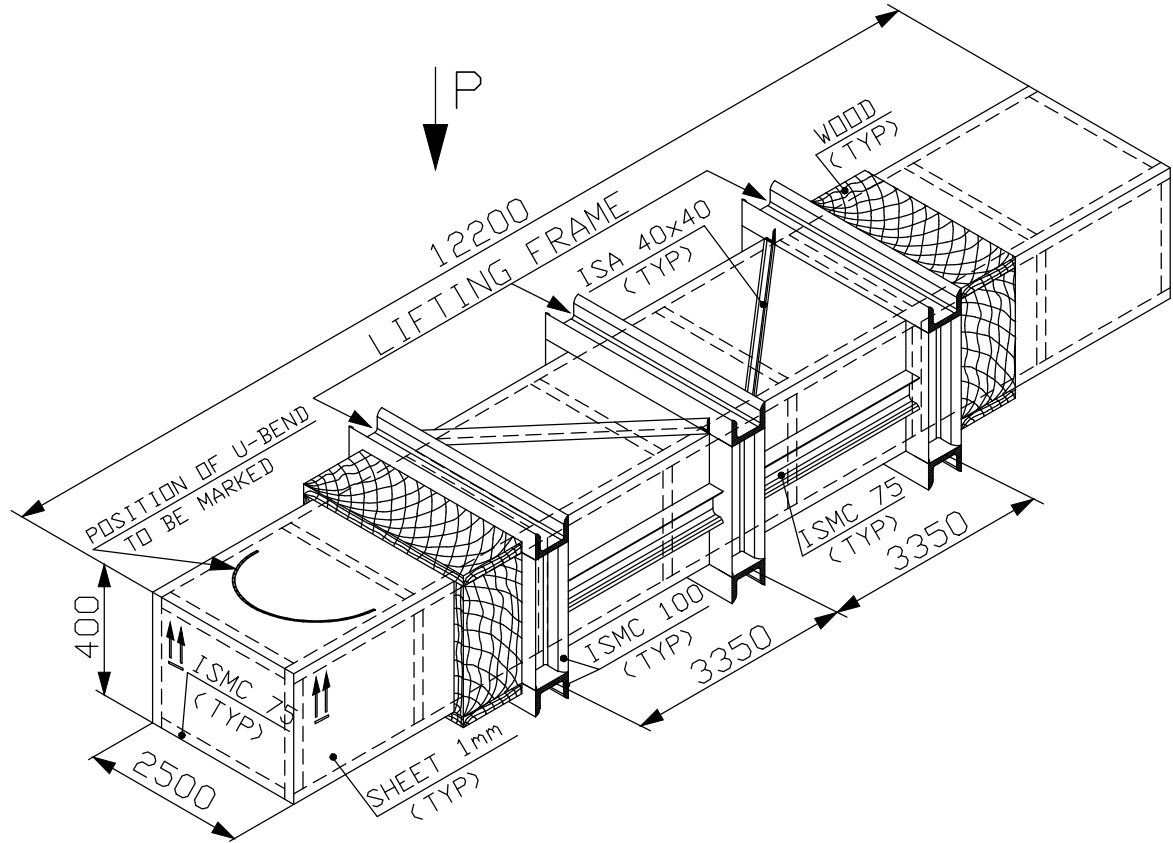
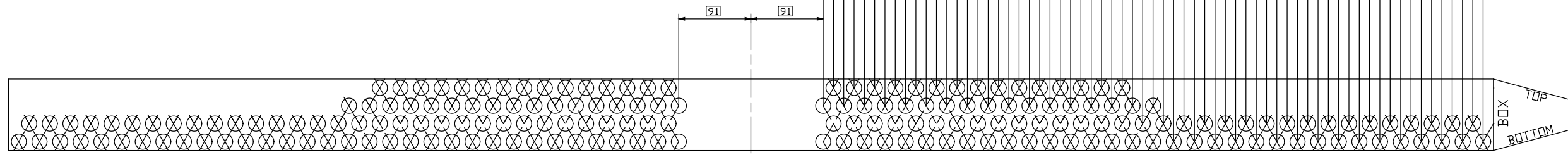
LINEAR		ANGULAR	
0.5 TO 3	± 0.1	400 TO 1000	± 0.8
3 TO 6	± 0.1	1000 TO 2000	± 1.2
6 TO 30	± 0.2	2000 TO 4000	± 2.0
30 TO 120	± 0.3	-	120 TO 400
120 TO 400	± 0.5	-	OVER 400

REV	DATE	ALTERED BY	CHD&APPD	REV	DATE	ALTERED BY	CHD&APPD	REV	DATE	ALTERED BY	CHD&APPD
03	07.07.21			02	15/03/18			01	02/03/18		

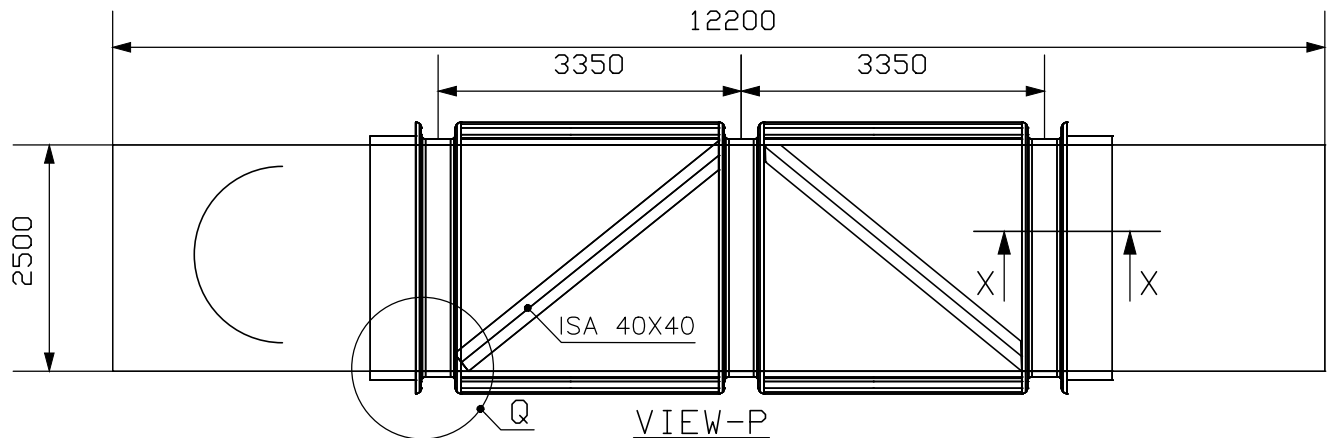
NOTE Nos. 06, 11, 15 & 16 ARE REVISED. NOTE-15&16 MODIFIED. SPARE TUBES PACKING DRAWING NO. ADDED IN NOTE-10

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT		700MWe/GHAVP-1&2			
Bharat Heavy Electricals Ltd		DRN	NAME	SIGNATURE	DATE
UNIT: HIGH PRESSURE BOILER PLANT		CHD	AK/SM		11/08/14
TIRUCHIRAPALLI - 620014		APPD	A.S		11/08/14
DEPT	NC	GRADE OF UNTOOL DIM	C/M/F	SCALE	WEIGHT (Kg)
CODE	150			NTS	
TITLE		CARD CODE	DRAWING NO :		REV
U-TUBES (SA-20)		U 01	1-93-170-05156		03

RADIUS OF TUBE	2104	1173	1435	1697	1959	22111	24713	27315	29917	32519	35121	37723	40325	42927	45529	48131	50733	53335	55937	58539	61141	63743	66345	68947	71549	74151	76753	79355	81957	84559	87161	89763	92365
ROW NO.	91	117	143	169	195	221	247	273	299	325	351	377	403	429	455	481	507	533	559	585	611	637	663	689	715	741	767	793	819	845	871	897	923
RADIUS OF TUBE	91	117	143	169	195	221	247	273	299	325	351	377	403	429	455	481	507	533	559	585	611	637	663	689	715	741	767	793	819	845	871	897	923



- NOTES: -**
- REFER DRAWING NO. : 1-93-170-05156 FOR U-TUBES.
  - THE REMAINING 2 SPARE TUBES OF RADIUS 91mm SHALL BE KEPT INTACT IN THE SPARE TUBES BOX AT A CONVENIENT LOCATION AND SENT TO BHEL WITHOUT ANY DAMAGE.
  - THE TOTAL WEIGHT OF EACH BOX SHALL BE APPROXIMATELY 3000-4000 KG.
  - MATERIAL MELT NO. AND TUBE POSITION NO. SHALL BE INDICATED ON A TAG TIED TO EACH TUBE.
  - THE WELDS BETWEEN THE CHANNELS AT THE TOP OF THE LIFTING FRAME SHALL BE SUCH THAT THEY ARE EASILY REMOVABLE.
  - FOR LIFTING, USE EVENER BEAM OR SLINGS WITH INCLUDED ANGLE NOT GREATER THAN 45°. THE SUPPLIER SHALL ALSO PAINT THE ABOVE CLEARLY ON THE BOX WITH CAUTION MARK AS A GUIDE LINE AS INDICATED IN THE DRG., FOR HANDLING OUTSIDE HIS WORKS.
  - EACH TUBE SHALL BE PACKED IN A WATER PROOF HALOGEN FREE POLYTHENE COVER.
  - THE CIRCUMFERENCE OF THE POLYTHENE COVER SHALL BE APPROXIMATELY 150 mm TO ENSURE SUFFICIENT FREE SPACE AROUND THE TUBE.
  - THE THICKNESS OF THE POLYTHENE COVER USED FOR INDIVIDUAL TUBE PACKING SHALL BE MINIMUM 120 MICRONS.
  - THE POLYTHENE QUALITY SHALL BE SUCH THAT, THE COVER DOES NOT UNDERGO DISINTEGRATION.
  - EACH INDIVIDUAL WOODEN BOX SHALL BE WATER PROOF IN ORDER NOT TO ALLOW EVEN TRACES OF WATER INTO THE BOX DURING TRANSPORTATION (SEAWORTHY PACKING) AND DURING LONG STORAGE IN TROPICAL CONDITIONS.
  - THE WOOD QUALITY SHALL BE SUCH THAT, THE WOOD DOES NOT UNDERGO DISINTEGRATION.
  - PACKING SHALL BE VERIFIED AND CHECKED AT APPROPRIATE STAGES AS INDICATED IN APPROVED QUALITY PLAN.
  - POSITION OF U-BEND REGION SHALL BE CLEARLY MARKED ON THE BOX USING PAINT.
  - THE OVERALL DIMENSIONS OF THE PACKING BOX SHOWN IS TENTATIVE.



TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT		700MWe/GHAVP-1				
DEPT NC CODE 150	Bharat Heavy Electricals Ltd UNIT: HIGH PRESSURE BOILER PLANT TIRUCHIRAPALLI - 620014		DRN	NAME A. DL	DATE 07.07.21	NO. OF VAR
			CHD	MAK	07.07.21	
			APPD	RAK	07.07.21	
SCALE 1:50 ; NTS	WEIGHT (Kg) --	REF TO ASSY / OLD DWG		ITEM NO	No OF ITEMS	
TITLE			CARD CODE	DRAWING NO :		REV
PACKING DETAILS U-TUBES (SPARE)			U 01	3-93-170-05561		00

REV	DATE	ALTERED :
		CHD&APPD :

CAUTION: The information on this document is the property of BHARAT HEAVY ELECTRICALS LTD. It must not be used directly or indirectly in any way detrimental to the interest of the company.

## ANNEXURE-1

PO Sl. No.	M.Code	VR.NO	Radius	No. of tube /SG	Required spare Qty for 2 SG	PR Qty.
			(mm)	(No.)	(No.)	(No.)
10	D15730313001	1	91.0	42	2	86
20	D15730313002	2	104.0	45	2	92
30	D15730313003	3	117.0	44	2	90
40	D15730313004	4	130.0	45	2	92
50	D15730313005	5	143.0	44	2	90
60	D15730313006	6	156.0	45	2	92
70	D15730313007	7	169.0	44	2	90
80	D15730313008	8	182.0	45	2	92
90	D15730313009	9	195.0	44	2	90
100	D15730313010	10	208.0	45	2	92
110	D15730313011	11	221.0	44	2	90
120	D15730313012	12	234.0	44	2	90
130	D15730313013	13	247.0	44	2	90
140	D15730313014	14	260.0	43	2	88
150	D15730313015	15	273.0	44	2	90
160	D15730313016	16	286.0	43	2	88
170	D15730313017	17	299.0	42	2	86
180	D15730313018	18	312.0	43	2	88
190	D15730313019	19	325.0	42	2	86
200	D15730313020	20	338.0	43	2	88
210	D15730313021	21	351.0	42	2	86
220	D15730313022	22	364.0	43	2	88
230	D15730313023	23	377.0	42	2	86
240	D15730313024	24	390.0	41	2	84
250	D15730313025	25	403.0	42	2	86
260	D15730313026	26	416.0	41	2	84
270	D15730313027	27	429.0	42	2	86
280	D15730313028	28	442.0	41	2	84
290	D15730313029	29	455.0	40	2	82
300	D15730313030	30	468.0	41	2	84
310	D15730313031	31	481.0	40	2	82
320	D15730313032	32	494.0	39	1	79
330	D15730313033	33	507.0	40	2	82
340	D15730313034	34	520.0	39	1	79
350	D15730313035	35	533.0	38	1	77
360	D15730313036	36	546.0	39	1	79
370	D15730313037	37	559.0	38	1	77
380	D15730313038	38	572.0	35	1	71

*[Signature]*  
16/11/21

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16/11/21

390	D15730313039	39	585.0	38	1	77
400	D15730313040	40	598.0	37	1	75
410	D15730313041	41	611.0	36	1	73
420	D15730313042	42	624.0	35	1	71
430	D15730313043	43	637.0	36	1	73
440	D15730313044	44	650.0	35	1	71
450	D15730313045	45	663.0	34	1	69
460	D15730313046	46	676.0	33	1	67
470	D15730313047	47	689.0	34	1	69
480	D15730313048	48	702.0	33	1	67
490	D15730313049	49	715.0	32	1	65
500	D15730313050	50	728.0	31	1	63
510	D15730313051	51	741.0	32	1	65
520	D15730313052	52	754.0	31	1	63
530	D15730313053	53	767.0	30	1	61
540	D15730313054	54	780.0	29	1	59
550	D15730313055	55	793.0	28	1	57
560	D15730313056	56	806.0	27	1	55
570	D15730313057	57	819.0	26	1	53
580	D15730313058	58	832.0	27	1	55
590	D15730313059	59	845.0	26	1	53
600	D15730313060	60	858.0	25	1	51
610	D15730313061	61	871.0	24	1	49
620	D15730313062	62	884.0	23	1	47
630	D15730313063	63	897.0	22	1	45
640	D15730313064	64	910.0	21	1	43
650	D15730313065	65	923.0	20	1	41
660	D15730313066	66	936.0	17	1	35
670	D15730313067	67	949.0	16	0	32
680	D15730313068	68	962.0	15	1	31
690	D15730313069	69	975.0	14	0	28
700	D15730313070	70	988.0	11	1	23
710	D15730313071	71	1001.0	8	0	16
720	D15730313072	72	1014.0	5	1	11
				2489	101	5079

*E. Arun Kumar*  
16/11/21  
**E. ARUN KUMAR**  
Deputy Manager  
Enge & RPD / ATP  
BHEL TRICHY - 620 014

*Ashwin Kumar Maroli*  
16/11/21  
**ASHWIN KUMAR MAROLI**  
Manager - MP & SC  
Advanced Technology Products  
BHEL, TRICHY - 620 014.