



An ISO 9001
Company

Bharat Heavy Electricals Limited

(High Pressure Boiler Plant)

Tiruchirappalli – 620014, TAMIL NADU, INDIA

MM / RM / PURCHASE / TUBES

TITLE : INCOLOY 800 U-TUBES & STRAIGHT TUBES

Phone: +91 431 2577421 /2575730

Fax : +91 431 252 0719

Email : vkaruna@bheltry.co.in

Reference Number:
Enquiry 1501400045

Enquiry Date:
12.07.2014

Due date for submission of
quotation: **11.08.2014**

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 circumstance 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 tender opening.

Sub: INCOLOY 800 U-TUBES & STRAIGHT TUBES.

All U-tubes and straight tubes are to be supplied as per specification Incoloy 800 & PB-M-131/Rev 02. All the U tubes are to be supplied as per drawing 1-93-170-05127/02 & 0-93-170-05096/03.

BHEL commercial terms & conditions with Price Bid formats and all annexure can be downloaded from BHEL web site <http://www.bhel.com> or from the Government tender website <http://tenders.gov.in> (public sector units) Bharath Heavy Electricals Limited) under enquiry reference "1501400045"

Tenders should reach us before 14:00 hours on the due date
Technical bid 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 Bharath Heavy Electricals Limited

SM/ PURCHASE/TUBES

V. KARUNAKARAN
Senior Manager
Purchase / MM / RM / Tubes
BHEL, TRICHY - 620 014.



BHARAT HEAVY ELECTRICALS LIMITED

(A Government of India Undertaking)
HIGH PRESSURE BOILER PLANT
PURCHASE DEPARTMENT - FOSSIL BOILERS
THIRUCHIRAPALLI - 620014
TAMILNADU (INDIA)

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PHONE :2577447
GRAMS : BHARATELEC
FAX NO: 2520719
E-mail: agk@bheltry.co.in
Web:

Enquiry No	Enquiry Date	Due Date for Quotation
1501400045	12.07.2014	11.08.2014
Please quote Enquiry No, Date and due date in all correspondences. This is only a request for quotation and not an order. Bid should be submitted in Two Parts. 1. Techno-commercial Bid (Part-I) and 2. Price Bid (Part-II) in a separate sealed cover and both the covers must be placed in a Third Cover and Sealed. Our Enquiry No., Eng. date & Eng. Due date must be written on all Three covers.		

Item	Description	Unit	Quantity	Delivery Quantity	Schedule Date
10	D13530101187 Straight Tubes-OD 19 x 1.1 THK x 10000 L	M	850.000	850.00	30.04.15
20	D13530101190 U-TUBE VAR-01	NO	45.000	45.00	30.04.15
30	D13530101191 U-TUBE VAR-02	NO	48.000	48.00	30.04.15
40	D13530101192 U-TUBE VAR-03	NO	47.000	47.00	30.04.15
50	D13530101193 U-TUBE VAR-04	NO	48.000	48.00	30.04.15
60	D13530101194 U-TUBE VAR-05	NO	47.000	47.00	30.04.15
70	D13530101195 U-TUBE VAR-06	NO	48.000	48.00	30.04.15
80	D13530101196 U-TUBE VAR-07	NO	47.000	47.00	30.04.15
90	D13530101197 U-TUBE VAR-08	NO	48.000	48.00	30.04.15
100	D13530101198 U-TUBE VAR-09	NO	47.000	47.00	30.04.15
110	D13530101199 U-TUBE VAR-10	NO	48.000	48.00	30.04.15
120	D13530101200 U-TUBE VAR-11	NO	47.000	47.00	30.04.15
130	D13530101201 U-TUBE VAR-12	NO	47.000	47.00	30.04.15
140	D13530101202 U-TUBE VAR-13	NO	47.000	47.00	30.04.15
150	D13530101203 U-TUBE VAR-14	NO	46.000	46.00	30.04.15
160	D13530101204 U-TUBE VAR-15	NO	47.000	47.00	30.04.15
170	D13530101205 U-TUBE VAR-16	NO	46.000	46.00	30.04.15

The offers should reach us 30 minutes before the time of opening of tenders.
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Yours faithfully,
For BHARAT HEAVY ELECTRICALS LIMITED

V. KARUNAKARAN
Senior Manager
Purchase / MM / RM / Tubes
BHEL, TRICHY - 620 014.

MANAGER / PURCHASE
(FOSSIL BOILERS)
Yours faithfully,



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180	D13530101206 U-TUBE VAR-17	NO	45.000	45.00	30.04.15
190	D13530101207 U-TUBE VAR-18	NO	46.000	46.00	30.04.15
200	D13530101208 U-TUBE VAR-19	NO	45.000	45.00	30.04.15
210	D13530101209 U-TUBE VAR-20	NO	46.000	46.00	30.04.15
220	D13530101210 U-TUBE VAR-21	NO	45.000	45.00	30.04.15
230	D13530101211 U-TUBE VAR-22	NO	46.000	46.00	30.04.15
240	D13530101212 U-TUBE VAR-23	NO	45.000	45.00	30.04.15
250	D13530101213 U-TUBE VAR-24	NO	44.000	44.00	30.04.15
260	D13530101214 U-TUBE VAR-25	NO	45.000	45.00	30.04.15
270	D13530101215 U-TUBE VAR-26	NO	44.000	44.00	30.04.15
280	D13530101216 U-TUBE VAR-27	NO	45.000	45.00	30.04.15
290	D13530101217 U-TUBE VAR-28	NO	44.000	44.00	30.04.15
300	D13530101218 U-TUBE VAR-29	NO	43.000	43.00	30.04.15
310	D13530101219 U-TUBE VAR-30	NO	44.000	44.00	30.04.15
320	D13530101220 U-TUBE VAR-31	NO	43.000	43.00	30.04.15
330	D13530101221 U-TUBE VAR-32	NO	42.000	42.00	30.04.15
340	D13530101222 U-TUBE VAR-33	NO	43.000	43.00	30.04.15
350	D13530101223 U-TUBE VAR-34	NO	42.000	42.00	30.04.15
360	D13530101224 U-TUBE VAR-35	NO	41.000	41.00	30.04.15
370	D13530101225 U-TUBE VAR-36	NO	42.000	42.00	30.04.15
380	D13530101226 U-TUBE VAR-37	NO	41.000	41.00	30.04.15
390	D13530101227 U-TUBE VAR-38	NO	38.000	38.00	30.04.15

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Yours faithfully,
For **BHARAT HEAVY ELECTRICALS LIMITED**

V. KARUNAKARAN
Senior Manager
Purchase / MM / RM / Tubes
BHEL, TRICHY - 620 014.
MANAGER / PURCHASE
(FOSSIL BOILERS)
Yours faithfully,



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400	D13530101228 U-TUBE VAR-39	NO	41.000	41.00	30.04.15
410	D13530101229 U-TUBE VAR-40	NO	40.000	40.00	30.04.15
420	D13530101230 U-TUBE VAR-41	NO	39.000	39.00	30.04.15
430	D13530101231 U-TUBE VAR-42	NO	38.000	38.00	30.04.15
440	D13530101232 U-TUBE VAR-43	NO	39.000	39.00	30.04.15
450	D13530101233 U-TUBE VAR-44	NO	38.000	38.00	30.04.15
460	D13530101234 U-TUBE VAR-45	NO	37.000	37.00	30.04.15
470	D13530101235 U-TUBE VAR-46	NO	36.000	36.00	30.04.15
480	D13530101236 U-TUBE VAR-47	NO	37.000	37.00	30.04.15
490	D13530101237 U-TUBE VAR-48	NO	36.000	36.00	30.04.15
500	D13530101238 U-TUBE VAR-49	NO	35.000	35.00	30.04.15
510	D13530101239 U-TUBE VAR-50	NO	34.000	34.00	30.04.15
520	D13530101240 U-TUBE VAR-51	NO	35.000	35.00	30.04.15
530	D13530101241 U-TUBE VAR-52	NO	34.000	34.00	30.04.15
540	D13530101242 U-TUBE VAR-53	NO	33.000	33.00	30.04.15
550	D13530101243 U-TUBE VAR-54	NO	32.000	32.00	30.04.15
560	D13530101244 U-TUBE VAR-55	NO	31.000	31.00	30.04.15
570	D13530101245 U-TUBE VAR-56	NO	30.000	30.00	30.04.15
580	D13530101246 U-TUBE VAR-57	NO	29.000	29.00	30.04.15
590	D13530101247 U-TUBE VAR-58	NO	30.000	30.00	30.04.15
600	D13530101248 U-TUBE VAR-59	NO	29.000	29.00	30.04.15
610	D13530101249 U-TUBE VAR-60	NO	28.000	28.00	30.04.15

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tenderers who have submitted their offer and who may like to be present for the tender
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Yours faithfully,
For BHARAT HEAVY ELECTRICALS LIMITED

V. Karunakaran
V. KARUNAKARAN
Senior Manager / Purchase
Purchase / M/M / RM / Tubes
BHEL, TRICHY - 620 014.
MANAGER / PURCHASE
(FOSSIL BOILERS)
Yours faithfully,



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620	D13530101250 U-TUBE VAR-61	NO	27.000	27.00	30.04.15
630	D13530101251 U-TUBE VAR-62	NO	26.000	26.00	30.04.15
640	D13530101252 U-TUBE VAR-63	NO	25.000	25.00	30.04.15
650	D13530101253 U-TUBE VAR-64	NO	24.000	24.00	30.04.15
660	D13530101254 U-TUBE VAR-65	NO	23.000	23.00	30.04.15
670	D13530101255 U-TUBE VAR-66	NO	20.000	20.00	30.04.15
680	D13530101256 U-TUBE VAR-67	NO	19.000	19.00	30.04.15
690	D13530101257 U-TUBE VAR-68	NO	18.000	18.00	30.04.15
700	D13530101258 U-TUBE VAR-69	NO	17.000	17.00	30.04.15
710	D13530101259 U-TUBE VAR-70	NO	14.000	14.00	30.04.15
720	D13530101260 U-TUBE VAR-71	NO	11.000	11.00	30.04.15
730	D13530101261 U-TUBE VAR-72	NO	8.000	8.00	30.04.15

General Note:


- 1) All the enquiry terms & conditions are given in Annexure-I. Supplier to submit the duly filled " Annexure I & IP " along with the offer.
- 2) Signed integrity pact should be furnished along with the offer. Offers without signed IP will not be considered for evaluation. IP should be signed by authorized official of the bidder/vendor/Contractor. This tender will be monitored by IEM Shri D.R.S Chaudhary, IAS (Retd.).
- 3) Vendor should physically weigh the materials before stuffing them into container and incorporate the same in BL and packing slip.

Enclosures:

"LD clause has to be confirmed without fail."

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Yours faithfully,
For BHARAT HEAVY ELECTRICALS LIMITED


V. KARUNA KARAN MANAGER / PURCHASE
Senior Manager (FOSSIL BOILERS)
Purchase / MM / RM / Tubes Yours faithfully,
BHEL, TRICHY - 620 014.

SPECIFICATION

NO. PB-M-131

**SEAMLESS, COLD WORKED
INCOLOY 800 TUBINGS FOR HEX**

ISSUE

No.	DETAILS	INITIAL	No. OF PAGES	DATE
1.	Original	V.K. Sharma	16	Nov., 1988.
2.	Rev. 1	V.K. Sharma	16	July, 1989.
3.	Rev. 2	V.K. Sharma	16	May, 1990.

File Reference : 33111

PREPARED BY : V.K. SHARMA

V.K. Sharma
22.11.88

APPROVED BY : Ch. SURENDAR

Ch. Surendar
23/11/88

SPECIFICATION

Seamless, Incoloy 800 Tubings For HEX1. SCOPE

This Specification covers the technical requirements for the supply of Seamless Nickel-Iron-Chromium Alloy (Incoloy 800) tubings for Heat Exchangers. All requirements of this specification represent minimum requirements.

2. CONTENTS

The requirements of this specification are presented under following sections:

	<u>Section</u>
Applicable Specifications	3
Material, Process of Manufacture, Workmanship and Requirements.	4
Mechanical Tests	5
Non-Destructive Examination	6
Bending Procedure Qualification	7
Production Control	8
Hydro-Test	9
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Cleaning, Identification, Material Mix-up Test, Packing and Shipment.	12

3. APPLICABLE SPECIFICATIONS

The following codes and standards of the issue in effect on the date of issuing tender document shall form part of this specification. In case of conflict between the Codes/Standards listed below, with the requirements of this specification, the requirements which are more stringent shall govern.

3.1 Relevant ASTM Standards

3.2 ASME - CW Alloy 800 SB 163 (including Code Case N-20-2) and SB 513

3.3 ASME - Section V, Non Destructive Examination. 4

4. MATERIAL, PROCESS OF MANUFACTURE, WORKMANSHIP AND REQUIREMENTS

4.1 Material

The tubing shall comply with ASME-SB-163 Seamless Nickel and Nickel Alloy Condenser and Heat Exchanger Tubes, with particular requirements specified below. The alloy shall be that designated in ASME-SB-163 as UNS No. 8800 with the following restricted chemical composition:

CHEMICAL AND COMPOSITION (Product & Ladle Analysis)

<u>Element</u>	<u>Composition Present</u>
C	0.03 max.
Si	0.3 to 0.7
Mn	0.40 - 1.0
P	0.015 max.
S	0.015 max.
Co	0.015 max. (To be aimed 0.01)
Al	0.15 to 0.45
Ti	0.6 max.
N	0.03 max.
Cu	0.075 max.
Cr	20 - 23
Ni	32 - 35
Fe	Remainder
 <u>Stabilisation</u>	
Ti -----	= 12 minimum
C	
Ti -----	= 8 minimum
C + N	
(N + P)	= 0.045 maximum

4.2 Process of Manufacture and Workmanship

The tubes shall be manufactured by cold working, heat treatment, final cold drawing to enhance yield strength, followed by straightening process. The tubes shall be supplied in U-bent form, in sizes and quantities indicated in the Purchaser's drawing. The tubes shall be cold bent with subsequent glass bead peening to introduce uniform controlled residual compressive stresses at the outside tube surface. The shot peening procedure and the equipment used shall be qualified by demonstrating its effectiveness in producing consistent quality of tubes having compressive stresses extending to a depth of about 0.15 mm. The procedure shall be submitted to the Purchaser for his approval.

Materials, process and workmanship shall be of high quality and in accordance with good practice pertinent to the manufacture of Nickel - Iron - Chromium alloy heat exchanger tubes. Each rolled bar which will be used for tube manufacture shall be ultrasonically checked for internal soundness. Sufficient discard shall be made from the bar corresponding to the top of the ingot to ensure freedom from cavities and slag inclusions. The bars shall be further examined by taking macro specimens from each end and also subjected to chemical analysis, which shall be within the specified limits stated under clause 4.1.

Material shall be manufactured from ingots melted in electric furnace.

4.3 Grain Size

The grain size shall be determined according to ASTM-E-112 and shall be ASTM micro-grain size number 8 or finer. Attempt shall be made to achieve a grain size of 10 or finer.

4.4 Halogen and Sulphur Content

Chemicals, oils, lubricants, paints etc. used during the manufacture, inspection/examination etc. of tubes shall not contain halogen and sulphur in excess of 25 ppm each. These shall also be free from lead. However, if for technical reasons the lubricants used for tube drawing contain halogens in excess of the above stipulated limit, these may be used provided the manufacturing procedure is such that excess of these element does not produce any harmful effect on quality of tubes on a long term trouble free service (40 years) basis. Subsequent cleaning shall, however, ensure cleanliness requirements stipulated in Section 12 of the specification.

4.5 Surface Condition

The tubes shall be in bright finish condition. The inside and outside surfaces of the tubes shall be very smooth and the finish after shot peening shall be better than 1.6 microns(CLA) on internal surfaces and 3.3 microns on external surface.

4.6 Heat Treatment

Tubes shall be supplied in cold worked condition, with glass bead, shot peening of the tube outer surface. The details of annealing temperature, soaking time etc. must be indicated in the test certificate. Detailed procedure of heat treatment shall be submitted for approval before start of manufacture. The details of heat treatment including furnace type, furnace atmosphere, rate of heating, soaking time, rate of cooling, thermocouple location etc. shall be submitted for approval before start of manufacture.

5.0 MECHANICAL TESTS

The following requirements shall be met with after final annealing and cold drawing. Unless otherwise stated testing shall be done in accordance with ASTM B 163.

5.1 Tensile Test

	N/mm ²	<u>At Room Temp.</u>	<u>At 350°C</u>
Tensile strength (Kp/mm ²)		569-697 (58 - 71)	495 min (50.5 min.)
0.2% Yield strength (Kp/mm ²)	N/mm ²	334-471 (34 - 48)	295 min (30.0 min.)
% Elongation on 5d Min.		30	To be reported

5.2 Hardness

The hardness shall be measured on sample tubes and shall be about 170 vickers. The maximum hardness however can be upto 270 Vickers in the cold worked part of the smallest bend. Hardness shall be checked on sample bent tubes before shot peening.

All measurements shall be done on the Vickers Scale.

5.3 Flare Test

Flare test shall be made on both ends of each tube with an expanding tool having an included angle of 60° until the specified outside diameter has been increased by 20%. The pieces cut from the tube ends for flare test shall be checked for freedom from temper discolouration on inside, before subjecting them to flare test.

5.4 Intergranular Corrosion resistance Test

Intergranular corrosion resistance test shall be done in accordance with ASTM-G-28 on one sample from each melt and heat treatment batch. The specimen shall be sensitized by heating it up to 650°C, soaking for 15 minutes and then water quenching. The heating shall be rapid and shall not take more than 1.5 min. The corrosion rate as calculated per G-28 shall not exceed 0.6 mm/year. The guaranteed maximum value of the corrosion rate shall be indicated in the bid. 7

5.5 Stress Corrosion Cracking Test

Stress corrosion cracking test shall be done in accordance with ASTM-G-36 on samples from each melt and heat treatment batch. The tube specimens (with and without shot peening) shall be bent 180° to the shortest radius on order. The bends shall be immersed in boiling MgCl₂ solution for 100 hours. The effect of 100 hours boiling shall show no crack by examining at 400 magnification and also by liquid penetrant examination.

In addition to above SCC test, one sample per heat shall be boiled to determine the time required for initiation of crack or maximum of 500 hrs.

The residual stress developed on the tube shall be measured and reported.

5.6 Test Coupon Numbers and Location

A 'Lot' shall consist of 100 tubes max. from the same melt and heat treatment batch. Test coupons shall be taken from the finished tubes.

- 5.6.1 A ladle analysis for each heat shall be performed. One product analysis chemical shall be made on each 'lot of tubes'.
- 5.6.2 One tension test each at Room Temperature and at 350°C shall be made on each lot of tubes. The mechanical properties like Tensile Strength, Yield Strength and % Elongation etc. shall be recorded.
- 5.6.3 Hardness shall be measured on 3% of tubes in each lot.
- 5.6.4 One flare test shall be made on each end of every tube prior to cutting to length.
- 5.6.5 Intergranular corrosion test shall be done on one sample from each melt and heat treatment batch.
- 5.6.6 Microstructure and grain size shall be determined on one sample from each 'Lot'. Micrographs are to be attached to test reports.
- 5.6.7 One stress corrosion cracking test is to be done on one sample from each lot.
- 5.6.8 Surface roughness on OD and ID shall be measured on 1% tubes completed in each shift.
- 5.6.9 Compressive stress measurement on 3 sample tubes per heat treatment batch.

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6.0 NON DESTRUCTIVE EXAMINATION**6.1 Liquid Penetrant Examination (LPE)**

The bent tubes, shall be subjected to Liquid Penetrant examination on the entire bent portion and on the legs for 150 mm length from each end, in accordance with ASTM-E-165 and SB-513 of ASME Code, Section II Part B. The extent of tubes subjected to Liquid Penetrant examination is set out in para 8.9. Penetrant examination shall be done prior to shot peening but after the hydraulic test. No indications are permitted.

6.2 Ultrasonic Examination

Each tube shall be ultrasonically examined after heat treatment. The procedure of ultrasonic examination shall be generally in accordance with articles of ASME Section V.

The standards for testing and acceptance criteria over and above ASME requirements shall be as follows:-

The reference specimen shall be of the nominal diameter, thickness, nominal composition and heat treated condition as the product being examined. The standard defect shall be internal and external notches both in transverse and longitudinal direction. The notches shall be saw tooth wedge shaped groove having 60° angle opening, with sides at right angle and max. depth of 0.1 mm. The external notches shall be 1.5 mm long and internal notches 2.0 mm long.

The ultrasonic examination shall be done in two opposite circumferential and two opposite axial directions. Defect indications equal to or greater than those from the reference standard shall be unacceptable.

6.3 Eddy Current Examination

Each tube shall be subjected to eddy current examination as per SB 513 of ASME Section II part B except that in the reference standard a through wall hole not exceeding 0.8 mm in diameter shall be used in lieu of 1.6 mm diameter hole stated therein.

Defect indication equal to or greater than those from the reference standard shall be unacceptable.

In the event of an order bidder shall supply at least 10 straight tube pieces of at least 0.5 m length each containing various types of eddy current subsurface indications in mid half length, from the rejected (colour marked) tube stock during production job, eddy current examination. This would enable Purchaser to conduct any investigation using eddy current ID probes at a later date.

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- 6.4 Non-destructive examination indications found to be within the acceptable standards shall be investigated to establish that they are harmless (eg. not cracks or pores) for the intended use of the tubes. Adequate number of such acceptable defects, categorised into various types, shall be metallographically investigated. The results of investigation shall be documented to form a detailed illustrated catalogue of defects.

The categorised defect indications chosen for metallographic investigation shall be examined prior to sectioning by suitable eddy current ID probes to obtain eddy current signals of the individual defect location and recorded along with corresponding production UT/ET examination signal results to form part of defect catalogue. This is required in connection with signal interpretation during inservice inspection of tubes.

6.5 Thickness Measurement

Wall thickness over the entire length of each tube shall be measured ultrasonically and reported.

7.0 BENDING PROCEDURE QUALIFICATION

Before bending, the procedure of bending shall be qualified as under.

- 7.1 For each 100 number or less of tubes of smallest bend radius, 2 numbers (minimum) of bends of smallest radius shall be bent in each process of bending for qualification. These 2 sample bends shall be made in the presence of Purchaser or his Authorised Inspection Agency and subjected to following examinations:

- 7.1.1 Entire surface shall be visually examined for ripples, scratches and other surface defects. The cross sections at 2 positions minimum (to be agreed upon) for each bend shall be plotted by a suitable device to ascertain non-circularity and ovality.

- 7.1.2 Bending procedure qualification tubes shall be hydrostatic tested and after hydrostatic test entire bend surface shall be liquid penetrant tested. Radius of bend shall be checked by layout.

- 7.1.3 One of the two bends shall be cut transversely into eleven equally spaced sections starting at the start of the bend and finishing at the end of the bend (resulting in 10 rings) for further examination. The other bend is sectioned in longitudinal plane (Plane of flexure) into two halves for further examination.

- 7.1.4 Each of the above sections shall be examined for following:

- a) Visually examine internal surface for ripples, scratches and other surface defects.
- b) Check the surface finish on internals as well as external surface on each bend sections.
- c) Measure the wall thickness at internal and external apex as well as at neutral bending axis for each section and compare with the wall thickness before bending, at minimum of 3 places.
- d) Measure the ovality and non-circularity at each section.
- e) Measure hardness on each cut piece, at minimum of 3 places.
- f) Optical illustration of the outline of the cross sections obtained by the two above said sectional planes (viz., Transverse and Longitudinal) for each of the test bends. Choice of the transverse sections for such illustrations shall be exercised by the Purchaser or his authorised inspection agency.
- g) Non-circularity and ovality, thinning and other dimensions shall meet the requirements as specified in purchase drawing.

8.0 PRODUCTION CONTROL

8.1 The production of U bends shall be taken up after qualification of the bending procedure as stated above. Ovality and out of roundness shall be measured on each tube for the smallest bend radius. Beyond that, for each radius, the first two production bends shall be measured for ovality, non-circularity (outline of cross section), bend radius at 5 locations and surface defects and then every 10th bend shall be measured for these dimensions. Wall thickness at the bends shall be measured by UT on each tube in first and second row. For balance tubes, this shall be measured on first 2 tubes and then every 10th tube for each row. If wall thickness does not conform to the requirements for any bend, all the previous bends shall be checked.

8.2 The ovality in the U-bend portion as measured by micrometer screw gauge, shall not exceed 5%. Ovality for this purpose is defined as:

$$\text{Ovality} = \frac{\text{O.D. max.} - \text{O.D. min.}}{\text{O.D. nominal}}$$

where O.D = outside diameter.

8.3 Out of roundness of tube other than ovality shall be determined using the formula:

$$\frac{\text{maximum radius} - \text{minimum radius}}{\text{maximum radius}} \times 100\%$$

Where maxi radius = outside radius of smallest possible surrounding circle.

Minimum radius = smallest distance of contour from centre of smallest possible surrounding circle.

The out of roundness shall not exceed 6%.

8.4 Each bent tube shall be checked after shot peening by a ball go-through test with a specified ball diameter of 15.77 mm.

8.5 The internal and external surface finish shall be measured on 1% of the tubes completed in each shift. The tubes shall be very smooth and surface condition shall meet requirements stated in section 4.5.

8.6 The tubes shall be free from kinks/local distortions. The straight portion of bent tubes shall be straight within 0.5 mm in one meter. The tolerance on leg spacing shall be as per drg No. TAPP-3&4/33111/5001/DD Rev 0.

8.7 The tolerance on other parameters are as follows:-

Outside diameter : 19.0+0.12 mm
-0.03

Thickness : 1.1±10%

Eccentricity $\left(\frac{t_{max} - t_{min}}{2 \times t_{avg}} \right)$: < 5%

Minimum wall thickness in the bend region : 0.91 mm.

Leg length deviation : +3 mm
-0.0

Leg length difference : 2 mm (maximum)

End squareness deviation : 0.2 mm (maximum)

Bend radius < 300 mm : +0.75 mm
tolerance > 300 mm : ±1.50 mm

8.8 Each tube shall be hydrostatically tested as per requirements of para 9 of this specification. 12

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Hydrostatic test shall be done after bending. For such tubes hydrostatic test on straight length tubes prior to bending is not required.

- 8.9 After hydrostatic test, U-Bends shall be examined by liquid penetrant method over complete U bend portion and also 150 mm from each end. The scope of LP shall be as follows.
- 8.9.1 All the tube bends of the smallest bend radius shall be L.P. checked. In case of any unacceptable indication found in this examination, all the bends in next higher radius shall also be subjected to LP check. This process will continue till all the bends in a particular radius are defect free. The charges for this examination are considered to be included in the cost of the product.
- 8.9.2 For remaining tube bends not covered under 8.9.1 shall be subjected to random LP examination upto a maximum of 2% of the remaining tube bends at purchaser's option. If any unacceptable defect is found in the examination all the tube bends in that radius and all the bends in lower radii shall be subjected to LP examination free of cost. The charges for this examination shall be on "unit rate" (LP charge/bend) indicated by the bidder for this random 2% LP check.
- 8.9.3 With above limited LP examination scope, the manufacturer shall be obliged to replace (free of cost) all the tubes having unacceptable defect revealed during LP examination conducted by the purchaser.
- 8.9.4 Alternatively, manufacturer may indicate LPE charges for all bent tubes on unit rate basis.
- 8.10 Glass bead peening procedure shall be qualified on sample tubes before taking up the production tubes. For sample tubes, 3 tubes must be taken out and kept for acceptance purposes with respect to uniformity and adequacy of peening operation as follows:
- a) with maximum acceptance level
 - b) with normal acceptance level
 - c) with minimum acceptance level.

These samples shall be used as comparators for checking the peening operation. Separate sets of samples shall be made for comparison with straight and bent portion of U-tubes. The compressive stress values verses depth from the O.D. and I.D. tube surfaces shall be determined for the above three acceptance levels by an accurate method (such as x-ray diffraction). The procedure and stress values/profile shall be subjected to Purchaser's approval. The bidder shall indicate the method and the guaranteed stress values/profile in his bid. The compressive

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stresses shall exist upto a minimum of 0.12 mm depth from the tube outside surface both in the straight and bent portions of the tube.

- 8.11 During production, internal and external surfaces of all tubes shall be visually inspected using optical aids such as boroscope for ascertaining freedom from surface defects and temper colours. If necessary, test pieces from tubes shall be taken and investigated. The complete external surface of the tubes shall be inspected for adequate and uniform peening effect and compared with reference standards for acceptance. U-tubes shall be in a free condition while their dimensions, straightness etc are being checked with respect to the specified values.

O.D. of each tube shall be checked either automatically by UT or manually by limit gauges at both ends and also over the entire length at random intervals. However, actual dimensions are to be recorded at those locations for a minimum of 1% of tubes, distributed over the whole production quantity.

8.12 REPAIRS

Repairs are generally not allowed. However, superficial external surface defects may be removed by mechanical means prior to the shot peening operation provided the minimum wall thickness requirement after repair are still complied with and the surface area is blended smoothly. The repaired area shall be re-examined by appropriate non-destructive examination to ascertain freedom from defects and subjected to wall thickness measurement. The repair procedure shall be prepared by the supplier and subject to purchaser's approval prior to its application on production tubes. Tubes repaired shall be clearly identified and reported to purchaser.

9.0 HYDROSTATIC TESTING

Each tube shall be hydrostatic tested at an internal pressure of 25 plus one minus zero MPa. The water used shall be demineralised water and shall have conductivity $10 \mu\text{s/cm}$ (max.) at inlet. An increase of $3 \mu\text{s/cm}$ (max.) at the outlet is permissible. The test pressure shall be maintained for a duration of 10 seconds minimum. The water used shall not have halogen and sulphur in excess of 25 ppm each.

10. DOCUMENTATION

10.1 Procedures And Plans

The following procedures and plans shall be submitted to the Purchaser for review and approval in six copies each before start of manufacture. No manufacturing activity shall start unless written approval of related documents is obtained.

- a) Manufacturing procedure giving sequence of operations right from melting, ingot pouring, tube manufacturing and testing.
- b) Heat treatment plan.
- c) Mechanical testing procedures.
- d) Non-destructive Examination procedures.
- e) Wall thickness measurement procedure.
- f) Glass bead peening procedure.
- g) Quality Assurance Manual/plan
- h) Cleaning procedure adopted during various stages of manufacture.
- i) Repair procedure.
- j) Tube bending qualification and production bending/control procedures (to include measurement/plotting of ovality, non-circularity/cross section).
- k) Material samples and testing plan.
- l) Metallurgical examination procedures (macro etch, microstructure and grainsize)
- m) Dimensional control procedures (for ID, OD and bend radius etc.).
- n) Surface finish measurement and inspection procedures.
- o) Hydrotest procedure
- p) Ball-pass through test procedure
- q) Compressive stress measurement procedure.
- r) Quantitative measurement of contaminants such as Chloride, SiO_2 , halogens, sulphur and lead.
- s) Corrosion resistance test procedure.
- t) Any other procedure having bearing on tube quality.

10.2 Reports

The following reports shall be submitted to the Purchaser in Nine copies each.

- a) Chemical analysis - ladle and product
- b) Mechanical test report

- c) Non-destructive examination report (along with properly identified recording strips for ultrasonic and Eddy current examinations showing defects accepted).
- d) Heat treatment charts
- e) Visual and dimensional inspection report
- f) Hardness survey report
- g) Metallurgical examination reports, with photographs (such as Macro-etch, Micro-structure/grain size).
- h) Illustrated catalogue of defects
- i) Corrosion resistance test reports, with photographs.
- j) Compressive stress measurement report
- k) Tube bending qualification and production bend reports.
- l) Surface finish reports
- m) Hydrotest reports
- n) Liquid penetrant examination reports
- o) Ball-pass through test reports
- p) Cleanliness/quantitative measurement of contaminants reports
- q) Material mix up test reports
- r) Any other reports on examinations/inspections/tests conducted on tubes for ensuring tube quality.

One set of test reports/certificates including packing list shall be sent along with the material in a suitable fashion to facilitate inventory control identification, and release of material to fabricators of heat exchangers from Purchaser's stores.

11.0 QUALITY SURVEILLANCE

The material covered in this specification shall be subjected to quality surveillance by the Purchaser or his Authorised inspection agency. The Purchaser and/or his Authorised Inspection Agency shall have access to the suppliers works at all reasonable times to carry out quality surveillance on the item ordered. The Supplier shall render all necessary help and extend inspection and testing facilities to the Purchaser/Authorised Inspection Agency to satisfy him that the material is being furnished in accordance with this specification.

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The Purchaser or his 'Authorised Inspection Agency' will witness the tests at various stages as indicated below. The stages shall be clearly identified in the manufacturing plan to be submitted by the supplier in the required format. The supplier shall notify the inspection agency and the Purchaser atleast a fortnight before the commencement of each stage of testing.

- a) Heat Treatment
- b) Ultrasonic Tests
- c) Eddy Current Tests
- d) Mechanical Tests
- e) Corrosion Resistance Test
- f) Bending Procedure Qualification
- g) Hydrostatic Test
- h) Liquid Penetrant Examination
- i) Preparation of reference samples for tube bends and for glass bead peering
- j) Glass bead peering qualification
- k) Ball-test on first three small radii U-bends
- l) Final Visual Examination & Marketing
- m) Cleanliness before packing
- n) Packaging for shipment

12.0 CLEANING, IDENTIFICATION MATERIAL MIX-UP TEST, PACKING & SHIPMENT

12.1 Cleaning

Each tube shall be thoroughly cleaned inside and outside prior to packing. Outside may be cleaned by wiping with cloth soaked in acetone. Inside cleaning shall be done by passing a clean felt sponge ball with the help of oil free dry air or Nitrogen until the ball at exist shows no discolouration during its passage through the tube. The cleanliness shall be checked by wiping test as follows:

- a) Qualitative evaluation of unacceptable dust, oil etc.
- b) Quantitative evaluation of chlorides, silica, lead, halogens and sulphur. These contaminants shall be as low as possible. The bidder shall give in their bid the guaranteed maximum values which shall be less than the following:

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Chlorides	20	$\mu\text{g}/\text{dm}^2$
Silica	30	$\mu\text{g}/\text{dm}^2$
Halogens & Sulphur (total)	25	p.p.m.
Lead, Flourides and sulphate		to be indicated

Cleanliness check shall be carried out on one tube per 500 tubes.

- c) Chemicals, lubricants, cleaning agents and any other materials used in the manufacture, inspection testing & packaging shall be free from contaminants such as halogens and sulphur. In any case sulphur & halogens shall not exceed 25 ppm each.

12.2 Identification

The tube number shall be marked on each tube by electro etching or by any other suitable permanent marking method, at approximately 200 mm from each end. Complete history of each tube shall be available in Check List/Test Certificates which shall be placed in box containing the tube. As a minimum, following information shall be provided in the Check List: Material Specification, Melt Heat No. & Lot No., Supply Condition, Tube Identification number and Radius of Bend.

In addition each box containing tubes shall bear the Purchase Order number, destination, size and number of tubes, manufacturer's symbol and authorised inspection agency's seal.

12.3 Testing For Material Mix-up

Spectroscopic, semiquantitative, non-destructive (sigma test) check shall be carried out to ascertain the tube of the same type of alloy from different quality manufacture are not mixed up during production and testing.

12.4 Packing And Shipment

After cleaning, both ends of each tube shall be plugged with special plug. At each end two plugs and one plastic cap (halogen free) shall be put.

Each tube shall be packed in halogen free polythene sleeve and heat sealed on both ends. The polythene sleeve shall be of soft grade (transparent) and at least 0.1 mm thick. The U bends shall be packed in a proper sequence and other packing requirements as per BHEL drawing for packing details-U-tubes indicated in the tender document.

The tubes shall be packed full length in suitable padded water proof containers suitable not only for transpor-

tation but also for long storage in tropical conditions. Special precautions shall be taken to ensure that no hard or sharp object such as nails etc. project into the container to possibly damage the tubing. Each package shall also contain corresponding packing list. The container is likely to be subjected to multiple handling at docks in an event of trans-shipment. The containers should be designed sturdily to withstand such multiple handling and would require the approval of Purchaser. The packing boxes shall be reinforced by welded cross steel beams. The packing cases may be inspected on arrival as a precautionary measure by the Purchaser.

12.5 The supplier shall be responsible for the shipment and safe delivery of tubes to the destination, specified in the pertinent tender document or purchase order. The tubes shall be shipped 'UNDER DECK' only in the ship to avoid sea water entry into the boxes during the shipment. The tubes shall be protected and covered to prevent damages, corrosion and ingress of foreign material.

12.6 Identification During Shipment

Each package shall be clearly and legibly marked in suitable permanent manner with following information:

- a) Purchase Order Number
- b) Destination
- c) Size and Number of Tubes
- d) Manufacturer's Emblem
- e) Seal of the Authorised Inspection Agency

BHARAT HEAVY ELECTRICALS LIMITED
MM/RM/PURCHASE/TUBES
BHEL / TRICHY-620 014.

ANNEXURE- I

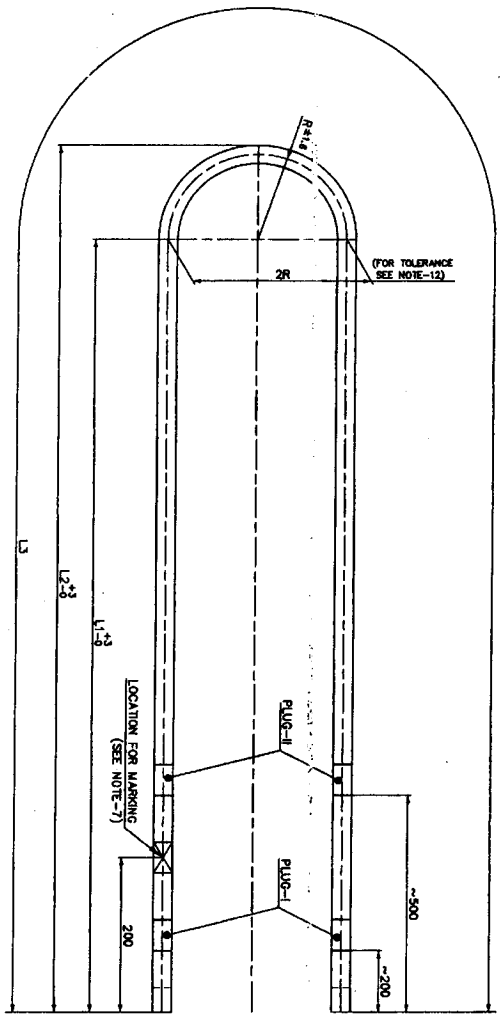
Enquiry Terms & Conditions for Open tender

Note: This Annexure has to be mandatorily filled & signed by the manufacturer (or) mill and submitted along with Technical bid.

Sl No	BHEL Requirements	Supplier Comments (Acceptance or otherwise for each point to be given)
01	<p><u>Material specification:</u> Supply shall be made strictly as per Specifications mentioned in the enquiry.</p>	
02	<p><u>Specification, Size & Quantity:</u></p> <ol style="list-style-type: none"> 1) U tubes and straight tubes are to be supplied as per specification INCOLOY 800 & PB-M-131/Rev02. All the U tubes are to be supplied as per drawing 1-93-170-05127/02 & 0-93-170-05096/03. 2) Additional spare tubes of 3 NO. in each variant from SL NO 20-730 are to be supplied as per drawing no.SK-3-D131-150/ 01. These additional tubes, Quantity 3 No. for each variant to be packed separately in one box as per sketch SK-3-D131-151 Rev 01. 3) Additional straight tubes as indicated in the drawing 1-93-170-05127 / 02 of 500 mtrs comprising minimum of 30 mtrs per melt in lengths of 5-10 mtrs. 4) Inspection should be done by any of the three authorized third party inspection agencies – TUV (Nord) or BV or SGS for import vendors. For indigenous vendors, inspection is to be done by BHEL/Trichy & NPCIL. 5) The actual production of materials is permitted only after review/approval of manufacturing/testing/ Inspection drawings /documents and quality assurance plans (QAP) by BHEL, Trichy & NPCIL. 6) Three sets of additional documents containing test certificates, copies of the approved procedures DCR, Drawings etc. apart from contractual requirements are required. 7) Supplier should have supplied similar Incoloy 800 U tubes at least one set to Nuclear Power Corporation of India Limited (NPCIL) or any other Nuclear Power Station. Also, the supplier has to furnish the test certificate for the similar finished tubes, backed with detailed reference list with name and address of the customer to whom the material has been supplied. 8) <i>Final acceptance of the offers shall be based on NPCIL recommendation.</i> 9) End use certificate will not be issued. 10) Offers will be evaluated on the basis of combined lowest of all items (both straight tubes and U tubes). Hence offer for partial items will not be considered. 	
03	<p><u>Offer Submission:</u></p> <ul style="list-style-type: none"> ➤ Tenders will be finalized on conventional "TWO part basis". ➤ The offer is to be submitted within 2.00 P.M on or before the due date. Late offers will not be considered. ➤ The covers should be duly super scribed with the ENQUIRY NO and DUE DATE in BOLD letter without fail. 	
04	<p><u>Terms of Delivery :</u></p> <p>A. <u>Indigenous:</u></p> <ol style="list-style-type: none"> a) Bidders should submit their offer for FOR Destination BHEL Stores, Trichy. The quote should be inclusive of all charges, including testing packing, inspection etc. For FOR destination quote, for freight breakup purpose BHEL finalized freight will be considered. b) Any other extra charges like ED, CST/VAT etc. are to be indicated clearly. The offer will be evaluated on total landed cost to BHEL Trichy. c) MODVAT CREDIT: If any excise Duty is payable, the chapter head / sub-head reference and the rate of the duty should be quoted. If the tenderer is availing MODVAT credit for this input material, the effect of preformed credit should be passed on to the purchaser. Tenderer under MODVAT shall be preferred. <p>B. <u>Imports:</u></p> <ol style="list-style-type: none"> a) Bidders should submit their offer for net FOB, Nearest port and CFR, Chennai with freight break up details. BHEL reserves the right to order on FOB or CFR basis. If FOB rates are not indicated offer may be liable for rejection. We also request you to submit your quotations for the destination port of Karaikkal & Tuticorin in your offer without fail. The quote should be all inclusive of all charges, including testing packing, inspection etc. b) For CFR terms, moved through CONTAINERS (Suppliers should clearly specify this in their offer) it would be presumed by 	

	<p>BHEL that the freight charges quoted is on LIFO (LINER IN LINER OUT) basis including extra charges, if any, like Container Imbalance Charges, Trade Imbalance charges or any other charges payable to the Liner. No other charges other than the quoted Freight rate will be paid by BHEL excepting applicable Terminal Handling Charges, Container cleaning Charges, DO charges to Shipping Liner at Discharge Port. If any deviation is taken by Tenderer, a loading of 22% on the freight rate per MT shall be considered by BHEL for arriving at the Total landed Cost.</p> <p>c) For CFR terms, moved through BREAK BULK BASIS (Suppliers should clearly specify this in their offer) it would be presumed by BHEL that the freight charges quoted is on LIFO (LINER IN LINER OUT) basis.</p> <p>d) In case of shipment through Containers on CFR basis, the BL should bear the endorsement that "14 free days for Container Detention is applicable".</p>	
<p>05</p>	<p>Payment terms:</p> <p>A. Indigenous:</p> <p>i) BHEL Payment term is 100% direct EFT payment after 45 days from the date of receipt and acceptance of materials.</p> <p>ii) The duplicate copy of the invoice meant for the transporters should accompany the material as stipulated under C.E. rules 52a and 173c (or) 57gg. A Photostat copy of the above invoice for each Delivery Chelan should be submitted along with the original bills routed through bank or submitted directly to BHEL finance department.</p> <p>iii) Any deviation in the above payment term will attract loading as mentioned below. "Base rate of SBI (as applicable on the date of bid opening. Techno-commercial bid opening in case of two part bids) + 6% shall be considered for loading for the period of relaxation sought by bidders.</p> <p>iv) Payment through bank is not preferred. In case of payment through bank is opted by supplier, BHEL prefers documents submission through bank with copy of LR and door delivery of goods to site/stores with consignee copy attached. In this case loading will be 3% on the offered value.</p> <p>v) Offers of indigenous Suppliers with payment terms as LC / Advance Payment are liable for rejection.</p> <p>B. Imports:</p> <p>i) BHEL Payment term is 100% payment on CAD basis after 45 days from the date of receipt of documents, specified in PO, at BHEL bank. Respective bank charges to respective account.</p> <p>ii) Any deviation in the above payment term will attract loading as mentioned below. "Base rate of SBI (as applicable on the date of bid opening. Techno-commercial bid opening in case of two part bids) + 6% shall be considered for loading for the period of relaxation sought by bidders.</p> <p>iii) If the LC payment is insisted, TWO sets of original TCs to be submitted prior to dispatch and a certificate to that effect from BHEL should form a part of the documents to be negotiated. If this condition is not complied by the vendor, the offer is liable for rejection.</p> <ul style="list-style-type: none"> ➤ In the case of Usance LCs the loading will be considered @ 1.5% on the offered Value. ➤ For LC at sight the loading will be considered @ 3.5% on the offered Value. ➤ Normally CAD at sight and Confirmed LCs are liable for rejection. 	
<p>06</p>	<p>Delivery: The offer shall clearly indicate delivery period in fixed number of weeks/Months from the date of Purchase Order.</p>	
<p>07</p>	<p>Liquidated Damage (Indigenous & Imports):</p> <ol style="list-style-type: none"> 1. Liquidated damages shall be 0.5% of the total order value per week or part thereof subject to a maximum of 10% of the total order value. 2. Any deviation from the above LD clause, loading will be applied to the extent to which it is not agreed by the bidder (at offered value). 3. a) IMPORT: For CFR / CIF terms, LD will be calculated from the B/L date. For FOB terms, LD will be calculated from final inspection agency's signed date in the TC. b) INDIGENOUS: For "FOR Delivery terms", Lorry way bill date and for "Ex-work delivery terms" final inspection certificate date / intimation of readiness whichever is later will be taken for LD calculation. 	
<p>08</p>	<p>Risk Purchase clause : BHEL at its option will be entitled to terminate the contract and to purchase elsewhere at the risk and cost of the seller either the whole of the goods or any part which the supplier has failed to deliver or despatch within the time stipulated as aforesaid or if the same were not available, the best and the nearest available substitute thereof. The supplier shall be liable for any loss which BHEL may sustain by reason of such risk purchases in addition to LD at the maximum rate mentioned in the LD clause above. Confirm your acceptance.</p>	
<p>09</p>	<p>Performance Bank Guarantee : The Bidder, in the event of an order, should furnish a bank Guarantee from BHEL's consortium banks (List attached) or counter – guaranty by vendor's bank to BHEL's consortium banks, at no extra cost to BHEL, in a proforma prescribed by BHEL, provided along with the order, for an amount equivalent to 10% of the contract value. The BG shall be valid for period of 18 months from the date of last shipment or 12 months from the date of receipt / acceptance at BHEL, Trichy whichever is later, with a claim period of two months.</p>	
<p>10</p>	<p>Validity: Offer/Price validity of 60 days is required after the price bid opening in case you are technically and commercially qualified.</p>	
<p>11</p>	<p>Agency Commission :</p>	

	<ul style="list-style-type: none"> ➤ In respect of offers from overseas suppliers, agency commission, if any, payable to their agents in India, shall invariable be shown separately in the Performa invoice and this will be paid by us in India, in Indian rupees, on satisfactory completion of the contract. ➤ It overseas principal has any tie-up with any third party in respect of agency commission it should be declared while submitting offers. ➤ Copies of current agency agreement / authorization letter in respect of agency commission shall be furnished along with offer, if not made available earlier. ➤ For calculation of rupee equivalent agency commission, exchange rate as prevailing on the date of order will be taken. 	
<p>12</p>	<p>General condition:</p> <ul style="list-style-type: none"> a) We require the shipment of the tubes to be as per the dates mentioned against the individual items in the enquiry. b) No revision of prices will be entertained after the tenders are opened. c) For the evaluation purposes, exchange rate (TT selling rate of SBI) as on schedule date of tender opening (Part I, i.e technical bid, in case of two part bid) shall be considered. d) BHEL will consider the ranking after the loading is applied as referred above wherever deviations are observed. e) Lowest price received against BHEL tenders need not be the technically acceptable one and in that case, BHEL reserves the right not to consider the same. f) The offer is to be signed and sealed in original by the bidder without fail. g) BHEL reserves the right to negotiate L1 rate or re-float the tender opened if L1 price is not the lowest acceptable price to them inter-alia other reasons. h) Any other conditions which might have been quoted by the seller and are in contravention to the terms prescribed in the order and which have not been specifically accepted in by purchaser will not be applicable to the contract. i) The offers of the bidders who are on the banned list as also the offer of bidders who engage the services of the banned firms, shall be rejected. The list of banned firms is available on the BHEL website -www.bhel.com. j) Tenders can be deposited in our tender box designated as "MM-TUBES-FB-150-SEC 25" located at discussion room, 4th floor, 24 building, With official date seal issued by our dispatch section located at 4th floor, 24 Building. 	
<p>13</p>	<p>Integrity Pact (IP): Signed Integrity pact should be furnished along with the offer. Offers without signed IP will not be considered for evaluation. IP should be signed by authorized official of the bidder / Vendor / Contractor. This tender will be monitored by JEM Shri XXXX</p>	
<p>(On behalf of BHEL)</p>		<p><u>SIGNED BY MANUFACTURER / MILL</u></p> <p>Name of Mill: Designation / Department: Seal & Signature</p>



NOTES:-

ALL DIMENSIONS ARE IN MILLIMETERS

1. APPLICABLE SPECIFICATIONS : PB-M-131
2. MATERIAL SPECIFICATION : INCOLOY-800.
3. SIZE : 19.0-24.8
- OUTSIDE DIAMETER : 1.1 size
- THICKNESS : 1.1 size
4. FOR DETAILS OF TOLERANCE ON BENDING RADIUS, PERMISSIBLE THINNING, MIN. THICKNESS, OVALITY ON BEND REGION, ETC., AND SUPPLY CONDITIONS REFER THE APPLICABLE SPECIFICATION, PB-M-131.
5. HYDROSTATIC TEST PRESSURE : 25-30 MPa.
6. TWO FELT 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 ARE FOR ONE HEAT EXCHANGER ONLY.
9. ALL QUANTITIES SHALL BE COVERED IN AS FEW NUMBER OF MELTS AS PRACTICABLE.
10. REFER SKETCH NO. SK-3-D131-151, FOR PACKING DETAILS.
11. IN ADDITION, 600 METERS OF STRAIGHT TUBES IN LENGTHS OF 6 TO 10 METERS SHALL BE SUPPLIED ENSURING THAT:
 - > ALL METERS ARE COVERED-
 - > MINIMUM OF 30 M/M MELT IS PROVIDED-
12. TOLERANCE ON LEG SPACING SHALL BE AS GIVEN BELOW:

SL NO	BEND RADIUS, R (mm)	TOLERANCE ON DIMT 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

VAR NO	R (mm)	L1 (mm)	L2 (mm)	L3 (DEVELOPED LENGTH) (mm)	NO OFF/W/UNIT	HEX	(kg)
1	91.0	10820.5	10847.0	21926.5	3	10.85	
2	104.0	10827.0	10840.5	21980.7	3	10.88	
3	117.0	10833.5	10850.0	22034.6	3	10.90	
4	130.0	10840.0	10879.5	22088.4	3	10.93	
5	143.0	10846.5	10899.0	22142.2	3	10.96	
6	156.0	10853.0	11018.5	22196.1	3	10.98	
7	169.0	10859.5	11038.0	22249.9	3	11.01	
8	182.0	10866.0	11057.5	22303.8	3	11.04	
9	195.0	10872.5	11077.0	22357.6	3	11.06	
10	208.0	10879.0	11096.5	22411.5	3	11.09	
11	221.0	10885.5	11116.0	22465.3	3	11.12	
12	234.0	10892.0	11135.5	22519.1	3	11.14	
13	247.0	10898.5	11155.0	22573.0	3	11.17	
14	260.0	10905.0	11174.5	22626.8	3	11.19	
15	273.0	10911.5	11194.0	22680.7	3	11.22	
16	286.0	10918.0	11213.5	22734.5	3	11.25	
17	299.0	10924.5	11233.0	22788.3	3	11.28	
18	312.0	10931.0	11252.5	22842.2	3	11.30	
19	325.0	10937.5	11272.0	22896.0	3	11.33	
20	338.0	10944.0	11291.5	22949.9	3	11.35	
21	351.0	10950.5	11311.0	23003.7	3	11.38	
22	364.0	10957.0	11330.5	23057.5	3	11.41	
23	377.0	10963.5	11350.0	23111.4	3	11.44	
24	390.0	10970.0	11369.5	23165.2	3	11.46	
25	403.0	10976.5	11389.0	23219.1	3	11.49	
26	416.0	10983.0	11408.5	23272.9	3	11.52	
27	429.0	10989.5	11428.0	23326.7	3	11.54	
28	442.0	10996.0	11447.5	23380.5	3	11.57	
29	455.0	11002.5	11467.0	23434.4	3	11.59	
30	468.0	11009.0	11486.5	23488.3	3	11.62	

VAR NO	R (mm)	L1 (mm)	L2 (mm)	L3 (DEVELOPED LENGTH) (mm)	NO OFF/W/UNIT	HEX	(kg)
31	481.0	11015.5	11506.0	23542.1	3	11.65	
32	494.0	11022.0	11525.5	23595.9	3	11.68	
33	507.0	11028.5	11545.0	23649.6	3	11.70	
34	520.0	11035.0	11564.5	23703.5	3	11.73	
35	533.0	11041.5	11584.0	23757.3	3	11.76	
36	546.0	11048.0	11603.5	23811.3	3	11.78	
37	559.0	11054.5	11623.0	23865.2	3	11.81	
38	572.0	11061.0	11642.5	23919.1	3	11.84	
39	585.0	11067.5	11662.0	23972.9	3	11.86	
40	598.0	11074.0	11681.5	24026.8	3	11.89	
41	611.0	11080.5	11701.0	24080.6	3	11.92	
42	624.0	11087.0	11720.5	24134.4	3	11.94	
43	637.0	11093.5	11740.0	24188.2	3	11.97	
44	650.0	11100.0	11759.5	24242.0	3	11.99	
45	663.0	11106.5	11779.0	24295.9	3	12.02	
46	676.0	11113.0	11798.5	24349.6	3	12.05	
47	689.0	11119.5	11818.0	24403.5	3	12.08	
48	702.0	11126.0	11837.5	24457.3	3	12.10	
49	715.0	11132.5	11857.0	24511.2	3	12.13	
50	728.0	11139.0	11876.5	24565.0	3	12.15	
51	741.0	11145.5	11896.0	24618.8	3	12.18	
52	754.0	11152.0	11915.5	24672.6	3	12.20	
53	767.0	11158.5	11935.0	24726.5	3	12.23	
54	780.0	11165.0	11954.5	24780.4	3	12.26	
55	793.0	11171.5	11974.0	24834.3	3	12.28	
56	806.0	11178.0	11993.5	24888.1	3	12.32	
57	819.0	11184.5	12013.0	24942.0	3	12.34	
58	832.0	11191.0	12032.5	24995.8	3	12.37	
59	845.0	11197.5	12052.0	25049.6	3	12.39	
60	858.0	11204.0	12071.5	25103.5	3	12.42	

VAR NO	R (mm)	L1 (mm)	L2 (mm)	L3 (DEVELOPED LENGTH) (mm)	NO OFF/W/UNIT	HEX	(kg)
61	871.0	11210.5	12091.0	25157.3	3	12.45	
62	884.0	11217.0	12110.5	25211.2	3	12.48	
63	897.0	11223.5	12130.0	25265.0	3	12.50	
64	910.0	11230.0	12149.5	25318.8	3	12.53	
65	923.0	11236.5	12169.0	25372.7	3	12.56	
66	936.0	11243.0	12188.5	25426.5	3	12.58	
67	949.0	11249.5	12208.0	25480.4	3	12.61	
68	962.0	11256.0	12227.5	25534.2	3	12.64	
69	975.0	11262.5	12247.0	25588.1	3	12.66	
70	988.0	11269.0	12266.5	25641.9	3	12.69	
71	1001.0	11275.5	12286.0	25695.7	3	12.72	
72	1014.0	11282.0	12305.5	25749.6	3	12.74	

REV	DATE	ALTERED :	CHD/APPD :
01	240614	CHD/APPD :	SK

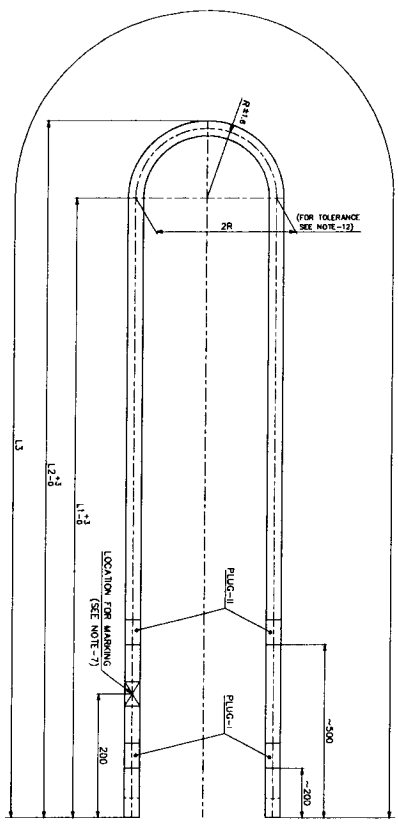
NOTE-8 & 11 DELETED. NOTE-10 SKETCH NO. CORRECTED.

DRN	N.K.	TITLE:	SK NO.
CHD	SOGAT	U-TUBES (SPARE)	SK-3-D131-150
APPD	AS SL.		
DATE	23.02.2013		



42150-021-03-1
ON DRAWING

ALL DIMENSIONS ARE IN MILLIMETERS



VARI NO	R (mm)	L1 (mm)	L2 (mm)	L3 (DEVELOPED LENGTH) (mm)	NO OFF/WARRANT HEX	WARRANT (kg)
1	91.0	10820.0	10821.0	21908.9	42	10.85
2	144.0	10827.0	10830.5	21900.7	44	10.88
3	190.0	10840.0	10839.5	22044.9	44	10.89
4	230.0	10846.0	10839.5	22142.2	44	10.86
5	260.0	10853.0	11016.5	22196.1	44	11.01
6	290.0	10859.0	11028.0	22249.9	44	11.04
7	320.0	10866.0	11038.0	22303.8	44	11.06
8	350.0	10872.0	11047.5	22357.8	44	11.09
9	380.0	10878.0	11057.0	22411.5	44	11.12
10	410.0	10884.0	11066.5	22465.3	44	11.15
11	440.0	10890.0	11076.0	22519.1	44	11.17
12	470.0	10896.0	11085.5	22572.8	44	11.20
13	500.0	10902.0	11095.0	22626.6	43	11.22
14	530.0	10908.0	11104.5	22680.7	44	11.25
15	560.0	10914.0	11114.0	22734.5	43	11.28
16	590.0	10920.0	11123.5	22788.3	42	11.30
17	620.0	10926.0	11133.0	22842.2	43	11.33
18	650.0	10932.0	11142.5	22896.2	42	11.35
19	680.0	10938.0	11152.0	22950.1	42	11.38
20	710.0	10944.0	11161.5	23004.1	42	11.41
21	740.0	10950.0	11171.0	23058.1	43	11.44
22	770.0	10956.0	11180.5	23112.1	42	11.47
23	800.0	10962.0	11190.0	23166.1	41	11.50
24	830.0	10968.0	11200.0	23220.1	41	11.53
25	860.0	10974.0	11210.0	23274.1	41	11.56
26	890.0	10980.0	11220.0	23328.1	41	11.59
27	920.0	10986.0	11230.0	23382.1	41	11.62
28	950.0	10992.0	11240.0	23436.1	40	11.65
29	980.0	10998.0	11250.0	23490.1	40	11.68
30	1010.0	11004.0	11260.0	23544.1	41	11.71

VARI NO	R (mm)	L1 (mm)	L2 (mm)	L3 (DEVELOPED LENGTH) (mm)	NO OFF/WARRANT HEX	WARRANT (kg)
31	1040.0	11010.5	11260.5	23598.1	40	11.74
32	1070.0	11016.5	11270.5	23652.1	39	11.77
33	1100.0	11022.5	11280.5	23706.1	39	11.80
34	1130.0	11028.5	11290.5	23760.1	38	11.83
35	1160.0	11034.5	11300.5	23814.1	38	11.86
36	1190.0	11040.5	11310.5	23868.1	38	11.89
37	1220.0	11046.5	11320.5	23922.1	37	11.92
38	1250.0	11052.5	11330.5	23976.1	37	11.95
39	1280.0	11058.5	11340.5	24030.1	36	11.98
40	1310.0	11064.5	11350.5	24084.1	35	12.01
41	1340.0	11070.5	11360.5	24138.1	35	12.04
42	1370.0	11076.5	11370.5	24192.1	34	12.07
43	1400.0	11082.5	11380.5	24246.1	34	12.10
44	1430.0	11088.5	11390.5	24300.1	33	12.13
45	1460.0	11094.5	11400.5	24354.1	32	12.16
46	1490.0	11100.5	11410.5	24408.1	32	12.19
47	1520.0	11106.5	11420.5	24462.1	31	12.22
48	1550.0	11112.5	11430.5	24516.1	31	12.25
49	1580.0	11118.5	11440.5	24570.1	30	12.28
50	1610.0	11124.5	11450.5	24624.1	29	12.31
51	1640.0	11130.5	11460.5	24678.1	29	12.34
52	1670.0	11136.5	11470.5	24732.1	28	12.37
53	1700.0	11142.5	11480.5	24786.1	28	12.40
54	1730.0	11148.5	11490.5	24840.1	27	12.43
55	1760.0	11154.5	11500.5	24894.1	27	12.46
56	1790.0	11160.5	11510.5	24948.1	26	12.49
57	1820.0	11166.5	11520.5	25002.1	26	12.52
58	1850.0	11172.5	11530.5	25056.1	25	12.55
59	1880.0	11178.5	11540.5	25110.1	25	12.58
60	1910.0	11184.5	11550.5	25164.1	25	12.61

VARI NO	R (mm)	L1 (mm)	L2 (mm)	L3 (DEVELOPED LENGTH) (mm)	NO OFF/WARRANT HEX	WARRANT (kg)
61	1940.0	11190.5	11560.5	25218.1	24	12.64
62	1970.0	11196.5	11570.5	25272.1	23	12.67
63	2000.0	11202.5	11580.5	25326.1	22	12.70
64	2030.0	11208.5	11590.5	25380.1	21	12.73
65	2060.0	11214.5	11600.5	25434.1	20	12.76
66	2090.0	11220.5	11610.5	25488.1	20	12.79
67	2120.0	11226.5	11620.5	25542.1	19	12.82
68	2150.0	11232.5	11630.5	25596.1	18	12.85
69	2180.0	11238.5	11640.5	25650.1	18	12.88
70	2210.0	11244.5	11650.5	25704.1	17	12.91
71	2240.0	11250.5	11660.5	25758.1	17	12.94
72	2270.0	11256.5	11670.5	25812.1	16	12.97

S.NO	BOND RADIUS R (mm)	TOLERANCE ON QUANT 2R
1	LESS THAN 220	±1.0
2	220 < R < 450	±1.6
3	450 < R < 760	±2.0
4	MORE THAN 760	±2.5

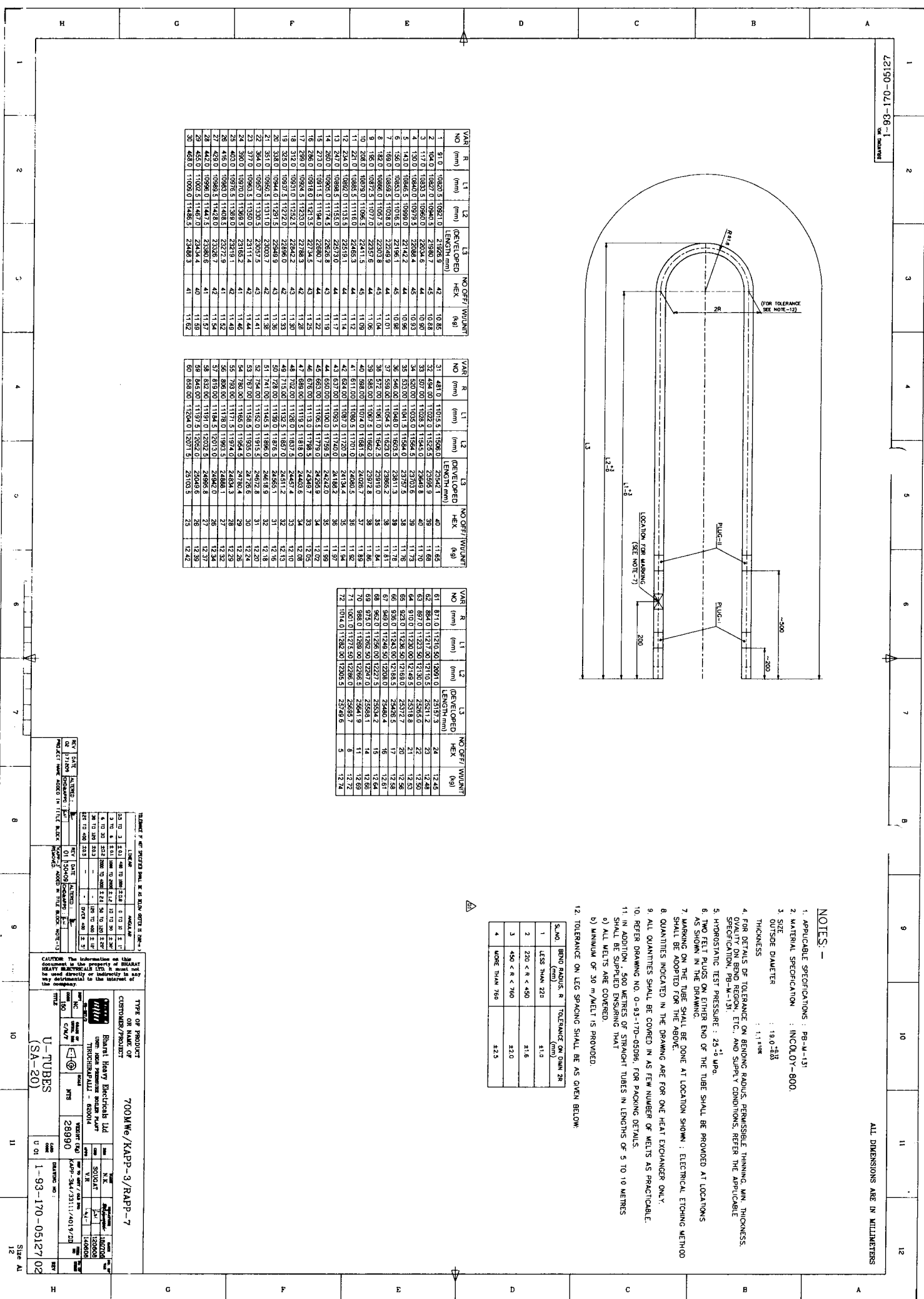
- NOTES: -
1. APPLICABLE SPECIFICATIONS : PB-M-131
 2. MATERIAL SPECIFICATION : INCOLOY-800.
 3. SIZE : 19.0-42.8
 4. FOR DETAILS OF TOLERANCE ON BENDING RADIUS, PERMISSIBLE THINNING, MIN. THICKNESS, QUALITY ON BOND REGION, ETC., AND SUPPLY CONDITIONS, REFER THE APPLICABLE SPECIFICATION: PB-M-131.
 5. HYDROSTATIC TEST PRESSURE : 25-5 MPa.
 6. TWO FELT 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 ARE FOR ONE HEAT EXCHANGER ONLY.
 9. ALL QUANTITIES SHALL BE COVERED IN AS FEW NUMBER OF MELTS AS PRACTICABLE.
 10. REFER DRAWING NO. O-93-170-05096, FOR PACKING DETAILS.
 11. IN ADDITION, 500 METRES OF STRAIGHT TUBES IN LENGTHS OF 5 TO 10 METRES SHALL BE SUPPLIED ENSURING THAT :
 - a) ALL MELTS ARE COVERED.
 - b) MINIMUM OF 30 m/MELT IS PROVIDED.
 12. TOLERANCE ON LEG SPACING SHALL BE AS GIVEN BELOW.

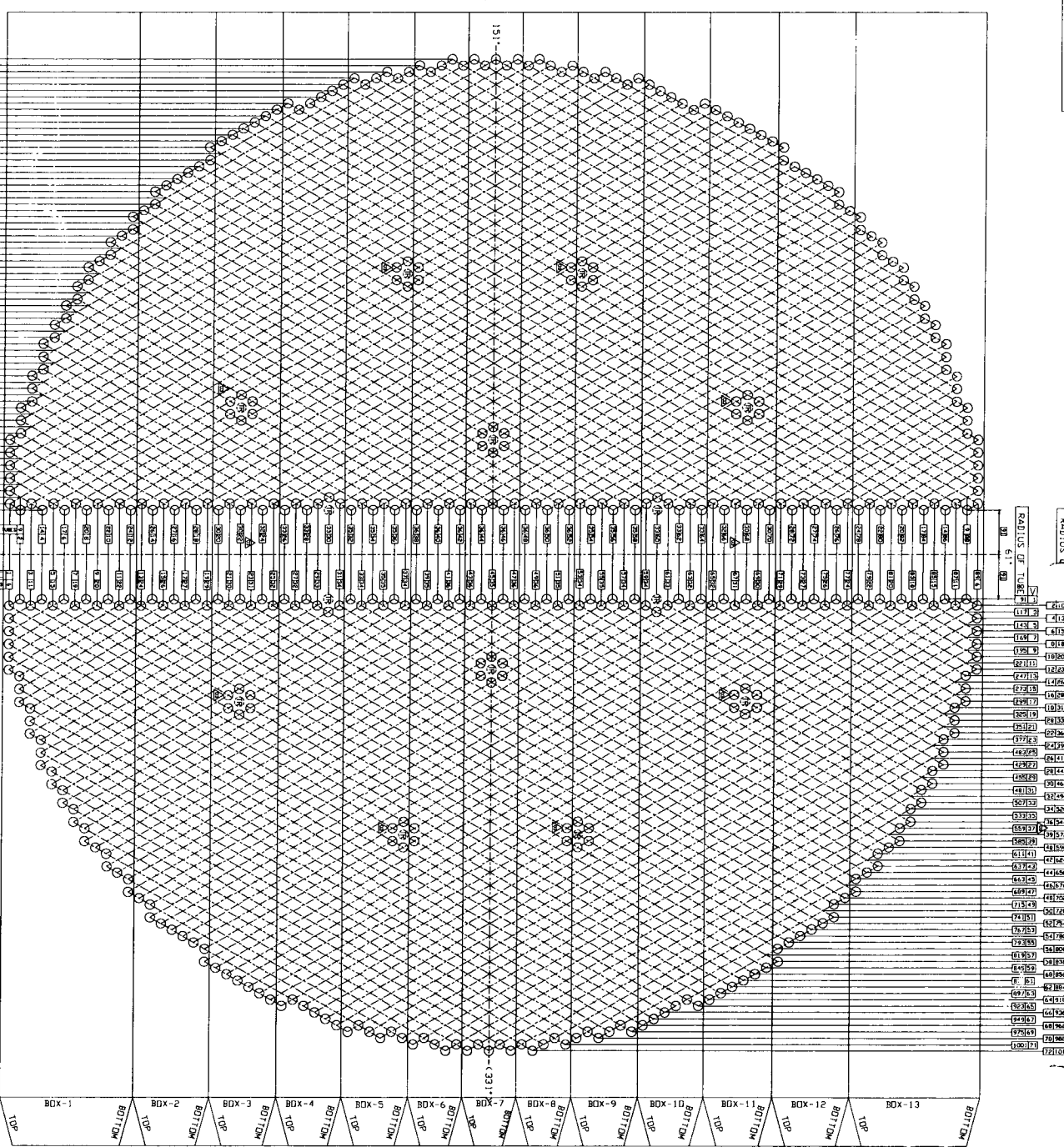
700Mw/KAPP-3/RAP-7

Customer: Bharat Heavy Electricals Ltd
 Order No: 28990
 Date: 1-93-170-05127 02

SA-20

1-93-170-05127 02



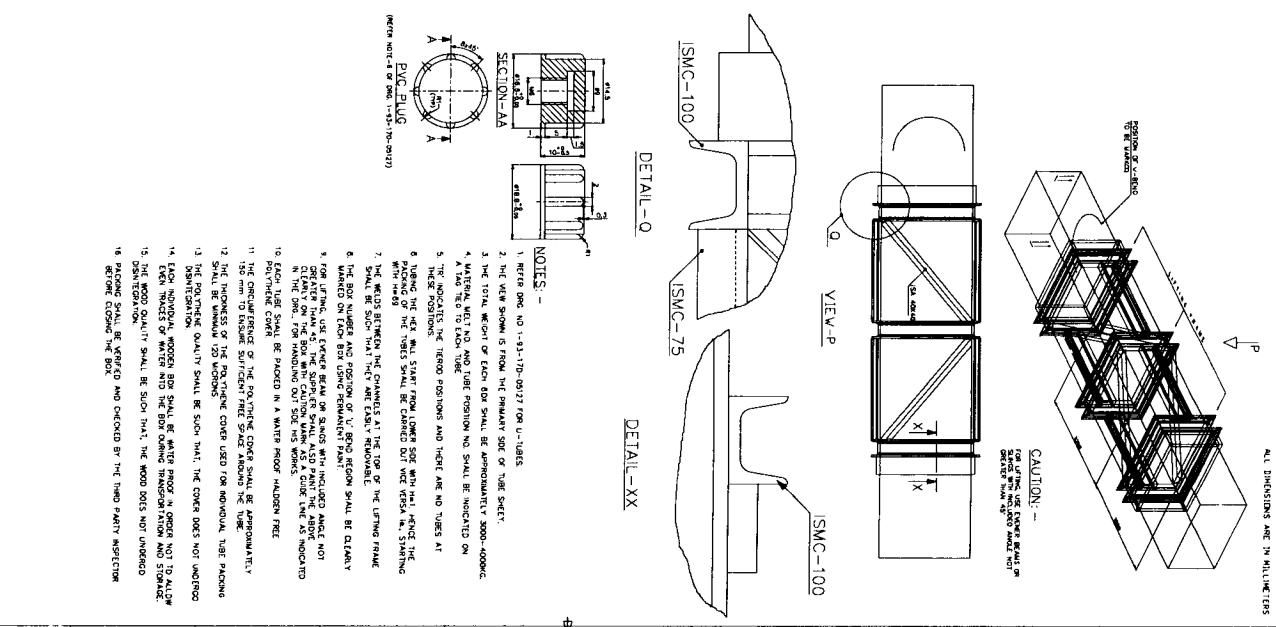


VIEW FROM PRIMARY SIDE

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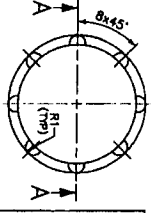
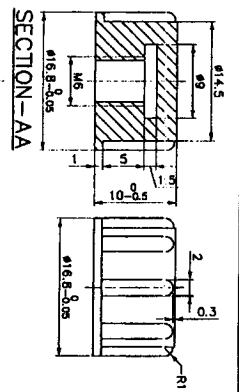
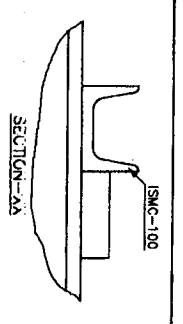
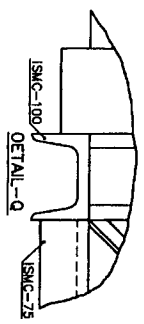
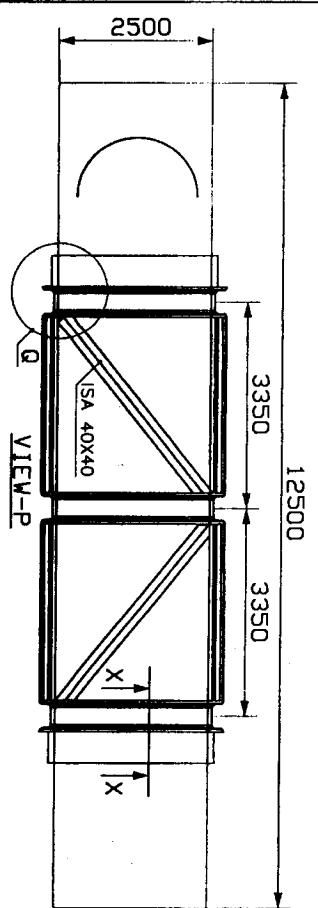
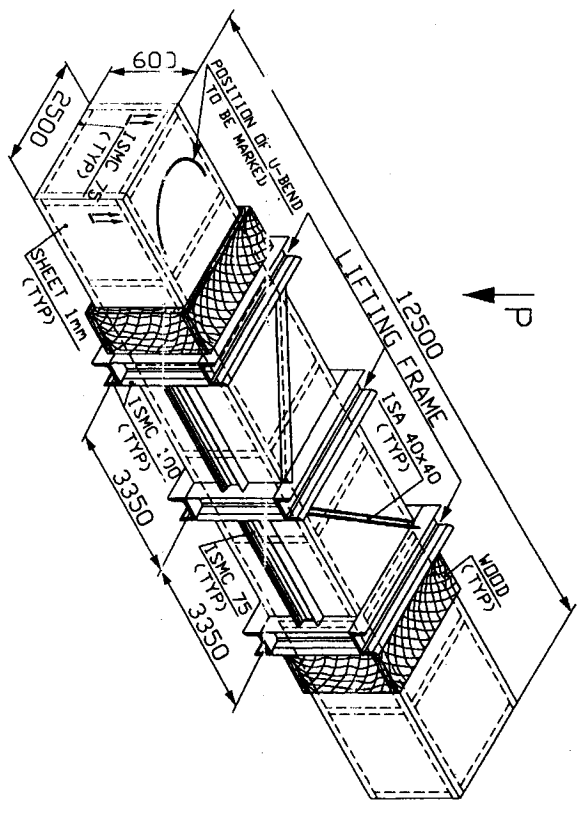


- NOTES:**
1. REFER DRC. NO. 1-83-10-0537 FOR ALL UNITS.
 2. THE VIEW SHOWN IS FROM THE PRIMARY SIDE OF THE SHEET.
 3. THE TOTAL WEIGHT OF EACH BOX SHALL BE APPROXIMATELY 3000-4000G.
 4. THE TOTAL WEIGHT OF EACH BOX SHALL NOT EXCEED 4000G.
 5. THE BOXES SHALL BE PACKED IN A WATER PROOF PLYWOOD CASE.
 6. THE BOXES SHALL BE PACKED IN A WATER PROOF PLYWOOD CASE.
 7. THE BOXES SHALL BE PACKED IN A WATER PROOF PLYWOOD CASE.
 8. THE BOXES SHALL BE PACKED IN A WATER PROOF PLYWOOD CASE.
 9. THE BOXES SHALL BE PACKED IN A WATER PROOF PLYWOOD CASE.
 10. THE BOXES SHALL BE PACKED IN A WATER PROOF PLYWOOD CASE.
 11. THE BOXES SHALL BE PACKED IN A WATER PROOF PLYWOOD CASE.
 12. THE BOXES SHALL BE PACKED IN A WATER PROOF PLYWOOD CASE.
 13. THE BOXES SHALL BE PACKED IN A WATER PROOF PLYWOOD CASE.
 14. THE BOXES SHALL BE PACKED IN A WATER PROOF PLYWOOD CASE.
 15. THE BOXES SHALL BE PACKED IN A WATER PROOF PLYWOOD CASE.
 16. THE BOXES SHALL BE PACKED IN A WATER PROOF PLYWOOD CASE.
 17. THE BOXES SHALL BE PACKED IN A WATER PROOF PLYWOOD CASE.
 18. THE BOXES SHALL BE PACKED IN A WATER PROOF PLYWOOD CASE.
 19. THE BOXES SHALL BE PACKED IN A WATER PROOF PLYWOOD CASE.
 20. THE BOXES SHALL BE PACKED IN A WATER PROOF PLYWOOD CASE.

1	1-BOX	TOP
2	1-BOX	BOTTOM
3	2-BOX	TOP
4	2-BOX	BOTTOM
5	3-BOX	TOP
6	3-BOX	BOTTOM
7	4-BOX	TOP
8	4-BOX	BOTTOM
9	5-BOX	TOP
10	5-BOX	BOTTOM
11	6-BOX	TOP
12	6-BOX	BOTTOM
13	7-BOX	TOP
14	7-BOX	BOTTOM
15	8-BOX	TOP
16	8-BOX	BOTTOM
17	9-BOX	TOP
18	9-BOX	BOTTOM
19	10-BOX	TOP
20	10-BOX	BOTTOM
21	11-BOX	TOP
22	11-BOX	BOTTOM
23	12-BOX	TOP
24	12-BOX	BOTTOM
25	13-BOX	TOP
26	13-BOX	BOTTOM
27	14-BOX	TOP
28	14-BOX	BOTTOM
29	15-BOX	TOP
30	15-BOX	BOTTOM
31	16-BOX	TOP
32	16-BOX	BOTTOM
33	17-BOX	TOP
34	17-BOX	BOTTOM
35	18-BOX	TOP
36	18-BOX	BOTTOM
37	19-BOX	TOP
38	19-BOX	BOTTOM
39	20-BOX	TOP
40	20-BOX	BOTTOM
41	21-BOX	TOP
42	21-BOX	BOTTOM
43	22	

ALL DIMENSIONS ARE IN MILLIMETERS

ROW NO.	RADIUS OF TUBE
1	101.2
2	101.2
3	101.2
4	101.2
5	101.2
6	101.2
7	101.2
8	101.2
9	101.2
10	101.2
11	101.2
12	101.2
13	101.2
14	101.2
15	101.2
16	101.2
17	101.2
18	101.2
19	101.2
20	101.2
21	101.2
22	101.2
23	101.2
24	101.2
25	101.2
26	101.2
27	101.2
28	101.2
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30	101.2
31	101.2
32	101.2
33	101.2
34	101.2
35	101.2
36	101.2
37	101.2
38	101.2
39	101.2
40	101.2
41	101.2
42	101.2
43	101.2
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45	101.2
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85	101.2
86	101.2
87	101.2
88	101.2
89	101.2
90	101.2
91	101.2
92	101.2
93	101.2
94	101.2
95	101.2
96	101.2
97	101.2
98	101.2
99	101.2
100	101.2



PVC PLUG
(REFER NOTE-6 OF SKETCH NO. SK-3-D131-150)

NOTES:-

1. REFER SKETCH NO. SK-3-D131-150 FOR U-TUBES.
2. THE TOTAL WEIGHT OF EACH BOX SHALL BE APPROXIMATELY 3000-4000 KG.
3. MATERIAL, METL NO. AND TUBE POSITION NO. SHALL BE INDICATED ON A TAG TIED TO EACH TUBE.
4. THE WELDS BETWEEN THE CHANNELS AT THE TOP OF THE LIFTING FRAME SHALL BE SUCH THAT THEY ARE EASILY REMOVABLE.
5. 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.
6. EACH TUBE SHALL BE PACKED IN A WATER PROOF HALOGEN FREE POLYTHENE COVER.
7. THE CLEARANCE OF THE POLYTHENE COVER SHALL BE APPROXIMATELY 150 mm TO ENSURE SUFFICIENT FREE SPACE AROUND THE TUBE.
8. THE THICKNESS OF THE POLYTHENE COVER USED FOR INDIVIDUAL TUBE PACKING SHALL BE MINIMUM 120 MICRONS.
9. THE POLYTHENE QUALITY SHALL BE SUCH THAT, THE COVER DOES NOT UNDERGO DISINTEGRATION.
10. EACH INDIVIDUAL WOODEN BOX SHALL BE WATER PROOF IN ORDER NOT TO ALLOW EVEN FRANCES OF WATER INTO THE BOX DURING TRANSPORTATION AND STORAGE.
11. THE WOOD QUALITY SHALL BE SUCH THAT, THE WOOD DOES NOT UNDERGO DISINTEGRATION.
12. PACKING SHALL BE VERIFIED AND CHECKED BY THE THIRD PARTY INSPECTOR BEFORE CLOSING THE BOX.
13. PACKING BOX OVERALL DIMENSIONS IS TENTATIVELY SHOWN.

REV	DATE	ALTERED BY	CHD/APPD.
01	24/06/14	CHD/APPD.	SK

NOTE-1 SKETCH NO. CORRECTED & ALSO CORRECTED IN NOTE FOR PVC PLUG.

DRN	N.K.	TITLE	SK NO.	REV.
CHD	SOUGAT	PACKING DETAILS	SK-3-D131-151	01
APPD	AS	U-TUBES (SPARE)		
DATE	23.02.2013			

Size A3

(TO BE STAMPED IN ACCORDANCE WITH STAMP ACT AND THE EXPIRY DATE OF BG MUST BE AFTER 60 DAYS FROM THE DATE OF COMPLETION OF WARRANTY PERIOD)

PERFORMANCE BANK GUARANTEE

In accordance of M/s. Bharat Heavy Electricals Limited (A Government of India undertaking, a company incorporated under the Companies Act 1956 having its Registered Office at "BHEL House", SIRI Fort, New Delhi 110 049) through its High Pressure Boiler Plant Division located at Tiruverumbur, Tiruchirapalli- 620 014 (hereinafter called 'the Company') having entered into a contract withhereinafter called ' the said contractor ' which term includes 'suppliers' for the purpose of this Bond and under the terms and conditions of the contract No..... Dt Between BHEL, Trichy and as per the contract, the contractor / supplier is to furnish a performance Bank guarantee for Rs. for the due performance of the equipment to be supplied under the above referred contract and for the fulfillment of all the terms and conditions of the contract, We(indicate the name of the bank) (herein after referred to as the bank) at the request of (Contractor(s)) do here by undertake to pay the company an amount not exceeding Rs.....against any loss or damage caused to or suffered or would be caused to or suffered by the company by reason of any breach by the said contractor (s) of any of the terms and conditions contained in the said agreement.

2. We(indicate the name of the bank with full address), do hereby undertake to pay the amounts due and payable under this guarantee without any demur, merely on a demand from the Company stating that the amount claimed is due by way of loss or damage caused to or would be caused to or suffered by the Company by reason of breach by the said Contractor(s) of any of the terms and conditions contained in the said Agreement or by the reason of the contractor(s) 'failure to perform' the said agreement. Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. _____.

3. We undertake to pay unconditionally to the Company any money so demanded notwithstanding any dispute(s) raised by the Contractor in any suit, or proceedings pending before any Court or Tribunal or Arbitration or before any other authority relating thereto our liability under this present being absolute and unequivocal. The payment under this guarantee would not wait till the disputes have been decided by any Court or Tribunal or in the arbitration proceedings or by any other authority. The payment so made by us under this Bond shall be a valid discharge of liability for payment thereunder and the Contractor(s) shall have no claim against us for making such payment.

4. We.....(indicate the name of Bank), further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Agreement and that it shall continue to be enforceable till all the dues of the Company under or by virtue of the said Agreement have been fully paid and its claims satisfied or discharged or till _____ Office / Department/ Divison of the Company certifies that the terms and conditions of the said Agreement have been fully and properly carried out by the said Contractor(s) and accordingly discharges this guarantee.

[Handwritten signature]

5. (I) Unless a demand or claim under this guarantee is made on us in writing on or before the _____ we shall be discharged from all the liability under this guarantee thereafter. But where such claim or demand has been preferred by the Company with the Bank before the expiry of the said date, the claim shall be enforceable notwithstanding the fact that the said enforcement is effected after the said date.

(ii) For the purpose of this clause, any letter making demand on the Bank by M/s. BHEL dispatched by Registered Post with Ack.Due or by Telegram or by any Electronic media addressed to the above mentioned address of the Bank shall be deemed to be the claim / demand in writing referred to above irrespective of the fact as to whether and when the said letter reaches the Bank, as also any letter containing the said demand or claim is lodged with the bank personally.

6. We(indicate the name of Bank), further agree with the company that the Company shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said agreement or to extend time of performance by the said Contractor (s) from time to time or to postpone for any time or from time to time any of the powers exercisable by the Company against the said Contractor(s) and to forbear or enforce any of the terms and conditions relating to the said Agreement and we shall not be relieved from our liability by any reason of any such variation or extension being granted to the said Contractor(s) or for any forbearance, act or omission on the part of the company or any indulgence by the company to the said Contractor(s) or by any such matter or thing whatsoever which under the law relating would, but for this provision, have effect of not so relieving us.

7. This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor(s).

8. It shall not be necessary for the company to proceed against the contractor before proceeding against the guarantor-bank and the guarantee herein contained shall be enforceable against them notwithstanding any security, which the company may have obtained or obtain from the Contractor shall, at the time when proceedings are taken against the guarantor hereunder be outstanding or unrealised.

9. Any claim or dispute arising under the terms of this document shall only be enforced or settled in the Courts at Tiruchirapalli.

10. The guarantor hereby declare that it has power to execute this guarantee and the executant has full powers to do so on its behalf under the proper authorities granted to him/them by the guarantor.

11. We(indicate the name of Bank) lastly undertake not to revoke this guarantee during its currency except with the previous consent of the company in writing.

In witness whereof we....., (indicate the name of Bank) have hereunto setout Bank Seal the _____ day _____ month 200
BANK E-MAIL ID:
BANK PHONE NO.
BANK FAX NO:

List of Consortium Bank	
Nationalised Bank	Nationalised Bank
1 Allahabad bank	19 Vijaya Bank
2 Andhra bank	Public Sector Banks
3 Bank of Baroda	20 IDBI
4 Canara Bank	Foreign bank
5 Corporation bank	21 CITI Bank N.A
6 Central bank	22 Deutsche Bank AG
7 Indian Bank	23 The Hongkong and Shanghai Banking Corporation Limited
8 Indian Oversea Bank	24 Standard Chartered Bank
9 Oriental bank of Commerce	25 The Royal Bank of Scotland N.V.
10 Punjab National Bank	26 J P Morgan
11 Punjab & Sindh Bank	Private bank
12 State Bank of India	27 Axis Bank
13 State Bank of Hyderabad	28 The Federal Bank Limited
14 Syndicate Bank	29 HDFC
15 State Bank of Travancore	30 Kotak Mahindra Bank
16 UCO Bank	31 ICICI
17 Union Bank of India	32 Indusind Bank
18 United Bank of India	33 Yes Bank

INTEGRITY PACT

Between

Bharat Heavy Electricals Ltd. (BHEL), a company registered under the Companies Act 1956 and having its registered office at "BHEL House", Siri Fort, New Delhi - 110049 (India) hereinafter referred to as "The Principal", which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the ONE PART

and

_____, (description of the party along with address), hereinafter referred to as "The Bidder/ Contractor" which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the OTHER PART

Preamble

The Principal intends to award, under laid-down organizational procedures, contract/s for

_____. The Principal values full compliance with all relevant laws of the land, rules and regulations, and the principles of economic use of resources, and of fairness and transparency in its relations with its Bidder(s)/ Contractor(s).

In order to achieve these goals, the Principal will appoint Independent External Monitor(s), who will monitor the tender process and the execution of the contract for compliance with the principles mentioned above.

Section 1 – Commitments of the Principal

- 1.1 The Principal commits itself to take all measures necessary to prevent corruption and to observe the following principles:-
- 1.1.1 No employee of the Principal, personally or through family members, will in connection with the tender for, or the execution of a contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.
- 1.1.2 The Principal will, during the tender process treat all Bidder(s) with equity and reason. The Principal will in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential / additional information through which the Bidder(s) could obtain an advantage in relation to the tender process or the contract execution.
- 1.1.3 The Principal will exclude from the process all known prejudiced persons.
- 1.2 If the Principal obtains information on the conduct of any of its employees which is a penal offence under the Indian Penal Code 1860 and Prevention of Corruption Act 1988 or any other statutory penal enactment, or if there be a substantive suspicion in this regard, the Principal will inform its Vigilance Office and in addition can initiate disciplinary actions.

Section 2 – Commitments of the Bidder(s)/ Contractor(s)

- 2.1 The Bidder(s)/ Contractor(s) commit himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the tender process and during the contract execution.
- 2.1.1 The Bidder(s)/ Contractor(s) will not, directly or through any other person or firm, offer, promise or give to the Principal or to any of the Principal's employees involved

in the tender process or the execution of the contract or to any third person any material, immaterial or any other benefit which he / she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the tender process or during the execution of the contract.

- 2.1.2 The Bidder(s)/ Contractor(s) will not enter with other Bidder(s) into any illegal or undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.
- 2.1.3 The Bidder(s)/ Contractor(s) will not commit any penal offence under the relevant IPC/ PC Act; further the Bidder(s)/ Contractor(s) will not use improperly, for purposes of competition or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.
- 2.1.4 The Bidder(s)/ Contractor(s) will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.
- 2.2 The Bidder(s)/ Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

Section 3 – Disqualification from tender process and exclusion from future contracts

If the Bidder(s)/ Contractor(s), before award or during execution has committed a transgression through a violation of Section 2 above, or acts in any other manner such as to put his reliability or credibility in question, the Principal is entitled to disqualify the Bidder(s)/ Contractor(s) from the tender process or take action as per the separate "Guidelines on Banning of Business dealings with Suppliers/ Contractors". framed by the Principal.

Section 4 – Compensation for Damages

- 4.1 If the Principal has disqualified the Bidder from the tender process prior to the award according to Section 3, the Principal is entitled to demand and recover the damages equivalent Earnest Money Deposit/Bid Security.
- 4.2 If the Principal has terminated the contract according to Section 3, or if the Principal is entitled to terminate the contract according to section 3, the Principal shall be entitled to demand and recover from the Contractor liquidated damages equivalent to 5% of the contract value or the amount equivalent to Security Deposit/Performance Bank Guarantee, whichever is higher.

Section 5 – Previous Transgression

- 5.1 The Bidder declares that no previous transgressions occurred in the last 3 years with any other company in any country conforming to the anti-corruption approach or with any other Public Sector Enterprise in India that could justify his exclusion from the tender process.
- 5.2 If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason.

Section 6 – Equal treatment of all Bidders/ Contractors/ Sub-contractors

- 6.1 The Bidder(s)/ Contractor(s) undertake(s) to obtain from all subcontractors a commitment consistent with this Integrity Pact and report Compliance to the Principal. This commitment shall be taken only from those sub-contractors whose contract value is more than 20 % of Bidder's/ Contractor's contract value with the Principal. The Bidder(s)/ Contractor(s) shall continue to remain responsible for any default by his Sub-contractor(s).
- 6.2 The Principal will enter into agreements with identical conditions as this one with all Bidders and Contractors.
- 6.3 The Principal will disqualify from the tender process all bidders who do not sign this pact or violate its provisions.

Section 7 – Criminal Charges against violating Bidders/ Contractors /Sub-contractors

If the Principal obtains knowledge of conduct of a Bidder, Contractor or Subcontractor, or of an employee or a representative or an associate of a Bidder, Contractor or Subcontractor which constitutes corruption, or if the Principal has substantive suspicion in this regard, the Principal will inform the Vigilance Office.

Section 8 –Independent External Monitor(s)

- 8.1 The Principal appoints competent and credible Independent External Monitor for this Pact. The task of the Monitor is to review independently and objectively, whether and to what extent the parties comply with the obligations under this agreement.

- 8.2 The Monitor is not subject to instructions by the representatives of the parties and performs his functions neutrally and independently. He reports to the CMD, BHEL.
- 8.3 The Bidder(s)/ Contractor(s) accepts that the Monitor has the right to access without restriction to all contract documentation of the Principal including that provided by the Bidder(s)/ Contractor(s). The Bidder(s)/ Contractor(s) will grant the monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his contract documentation. The same is applicable to Sub-contractor(s). The Monitor is under contractual obligation to treat the information and documents of the Bidder(s)/ Contractor(s) / Sub-contractor(s) with confidentiality.
- 8.4 The Principal will provide to the Monitor sufficient information about all meetings among the parties related to the contract provided such meetings could have an impact on the contractual relations between the Principal and the Contractor. The parties offer to the Monitor the option to participate in such meetings.
- 8.5 As soon as the Monitor notices, or believes to notice, a violation of this agreement, he will so inform the Management of the Principal and request the Management to discontinue or take corrective action, or heal the situation, or to take other relevant action. The Monitor can in this regard submit non-binding recommendations. Beyond this, the Monitor has no right to demand from the parties that they act in a specific manner, refrain from action or tolerate action.
- 8.6 The Monitor will submit a written report to the CMD, BHEL within 8 to 10 weeks from the date of reference or intimation to him by the Principal and, should the occasion arise, submit proposals for correcting problematic situations.
- 8.7 The CMD, BHEL shall decide the compensation to be paid to the Monitor and its terms and conditions.
- 8.8 If the Monitor has reported to the CMD, BHEL, a substantiated suspicion of an offence under relevant IPC / PC Act, and the CMD, BHEL has not, within reasonable time, taken visible action to proceed against such offence or reported it to the Vigilance Office, the

Monitor may also transmit this information directly to the Central Vigilance Commissioner, Government of India.

8.9 The number of Independent External Monitor(s) shall be decided by the CMD, BHEL.

8.10 The word 'Monitor' would include both singular and plural.

Section 9 – Pact Duration

9.1 This Pact begins and shall be binding on and from the submission of bid(s) by bidder(s). It expires for the Contractor 12 months after the last payment under the respective contract and for all other Bidders 6 months after the contract has been awarded.

9.2 If any claim is made / lodged during this time, the same shall be binding and continue to be valid despite the lapse of this pact as specified as above, unless it is discharged/ determined by the CMD, BHEL.

Section 10 – Other Provisions

10.1 This agreement is subject to Indian Laws and jurisdiction shall be registered office of the Principal, i.e. New Delhi.

10.2 Changes and supplements as well as termination notices need to be made in writing. Side agreements have not been made.

10.3 If the Contractor is a partnership or a consortium, this agreement must be signed by all partners or consortium members.

10.4 Should one or several provisions of this agreement turn out to be invalid, the remainder of this agreement remains valid. In this case, the parties will strive to come to an agreement to their original intentions.

10.5 Only those bidders/ contractors who have entered into this agreement with the Principal would be competent to participate in the bidding. In other words, entering into this agreement would be a preliminary qualification.

For & On behalf of the Principal

For & On behalf of the Bidder/ Contractor

(Office Seal)

(Office Seal)

Place-----

Date-----

Witness: _____

Witness: _____

(Name & Address) _____

(Name & Address) _____
