BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION PROJECTS ENGINEERING MANAGEMENT

DOCUMENT No.	TB-xxx-316-055	Rev no.-00	Prepared	Checked	Approved
TYPE OF DOC.	TECHNICAL SPECIFICATION	NAME	MLK	SKS	RS
TITLE		SIGN			
RATE CONTRACT FOR ALUMINIUM TUBE		DATE	22/09/14	22/09/14	23/9/14
		GROUP	TBEM	W.O. No	
CUSTOMER/ CONSULTANT					
PROJECT					

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Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS

Distribution	To Copies				TBQM	TBCM
					-	-

QUALITY PLAN

ITEM : ALUMINUM TUBE [RIGID CONDUCTOR]						QP NO :TBQM-STD-ALT REV:02 DATE : 11.11.14 Page 1 of 2		PROJECT : RATE CONTRACT PACKAGE /CONTRACT : **CONTRACTOR : BHEL**					
S.NO.	COMPONENT / OPERATION	CHARACTERISTIC CHECKED	CATEGORY	TYPE OF CHECK	EXTENT OF CHECK	REFERNCE DOCUMENT	ACCEPTANC-E. NORM	FORMAT OF RECORD		AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	D	10	11	12	13
I	CHEMICAL COMPOSITION	Chemical composition	Critical	Spectrometric test	One sample Per cast	IS: 5082	IS: 5082	Laboratory Test / JIR	V	M	C,N	C,N	Review of Test record during final sample testing
II	Process of manufacture: It shall be produced by extruding hot billet in press through port hole die. The port hole die consists of a die aperture & mandrel & the tube is formed by squeezing the hot metal through annular space formed between mandrel & die aperture. Due to high pressure generated during the operation then tube has no weak joints. Heat treatment after extrusion shall be done.												
III	DIMENSIONS												
		a) Outer Diameter	Critical	Physical measurement	10%	Approved GTP& drg./ IS 5082/ IS 2673	Approved GTP& drg./ IS 5082/ IS 2673	JIR	V	M	C,N	C,N	In case of rejection during sample testing sample size to increased to 20%. On subsequent rejection, 100% inspection to be carried out based on random check by inspector.
		b) Ovality	-Do-	-Do-	-Do-	-Do-	-Do-	-Do-	V	M	C,N	C,N	
		c) Straightness	-Do-	-Do-	-Do-	-Do-	-Do-	-Do-	V	M	C,N	C,N	
		d) Length	-Do-	-Do-	-Do-	-Do-	-Do-	-Do-	V	M	C,N	C,N	
		e) Wall thickness	-Do-	-do-	-Do-	-Do-	-Do-	-Do-	V	M	C,N	C,N	
IV	MECHANIICAL PROPERTIES	a) Ultimate Tensile Strength	Critical	Mech.	As per IS:5082-(Range 2)	As per IS:5082-(Range 2)	IS:5082 (Range 2)		V	M	C,N	C,N	
		b) 0.2% Proof Stress	-Do-	-Do-	-Do-	-Do-	-Do-	-Do-	V	M	C,N	C,N	
		c) % Elongation on 50.0 mm specimen	-Do-	-Do-	-Do-	-Do-	-Do-	-Do-	V	M	C,N	C,N	

Released for Rate Contract

Diptojit

दिप्तोजित सेनगुप्ता / DIPTOJIT SENGUPTA
अभियंता (गुणवत्ता) / Engineer (Quality)
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5th Floor, Advant Navis IT Business Park
Sector-142, Expressway Noida-201305
SIGN & SEAL

LEGEND :
M – SUPPLIER / SUB SUPPLIER
C - BHEL / NOMINATED INSPECTION AGENCY
N – CUSTOMER /CUSTOMER NOMINATED AGENCY
CHP- CUSTOMER HOLD POINT TC – TEST CERTIFICATE IR- INSPECTION REPORT
JIR – JOINT INSPECTION REPORT
P – PERFORMED BY
W – WITNESSED BY
V – VERIFICATION BY

Avinash

अविनाश कुमार / AVINASH KUMAR
वरिष्ठ अभियंता (गुणवत्ता) / Sr. Engineer (Quality)
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QUALITY PLAN

ITEM : ALUMINUM TUBE [RIGID CONDUCTOR]	QP NO :TBQM-STD-ALT REV:02 DATE : 11.11.14 Page 2 of 2	PROJECT : RATE CONTRACT PACKAGE /CONTRACT : **CONTRACTOR : BHEL**

S.NO.	COMPONENT / OPERATION	CHARACTERISTIC CHECKED	CATEGORY	TYPE OF CHECK	EXTENT OF CHECK	REFERNCE DOCUMENT	ACCEPTANC-E. NORM	FORMAT OF RECORD		AGENCY			REMARKS
										P	W	V	
1	2	3	4	5	6	7	8	9	D	10	11	12	13
		d) Special test [eg. Bend test etc.]	-Do-	-Do-	5 samples per lot per size	Approved Drg /GTP/ Tech spec.	Approved Drg /GTP/ Tech spec	-Do-	V	M	C,N	C,N	Applicable as specified in approved drg/GTP/ technical specification.
V	ELECTRICAL PROPERTIES	Conductivity	Critical	Electrical	-Do-	-Do-	-Do-	-Do-	V	M	C,N	C,N	
VI	SURFACE FINISH & VERIFICATION OF CUTLENGTHS	Surface defects	Major	Visual Check	10%	IS:5082 Manufacturer standard	IS:5082 / Manufacturer standard /Material to be sound & free from harmful defects	JIR	V	M	C,N	C,N	Review of test record during final inspection by BHEL

Note :

1..Supplier shall directly submit & obtain SMQP approval from PGCIL ,QA & I deptt. & the same shall be applicable for PGCIL projects.

2. For NTPC, NPCIL & similar customers [where Supplier MQP is required], supplier shall submit to BHEL & approval of Customer shall be obtained.

3. For all other projects where the item is classified under Inspection Cat-B of approved inspection category list , this QP shall be applicable.

Diptoji

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BHEL
SIGN & SEAL

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APPENDIX

EXPORT WORTHY PACKING FOR EXPORT JOBS

1.0 SCOPE:

For export jobs, export worthy (air/sea worthy) packing capable of performing all necessary functions like prevention of damage to the contents, sufficient to support frequent handling and lengthy periods of outdoor storage in adverse weather conditions are required. Workmanship and material used shall meet the technical requirements and be in accordance with best commercial export packing practices. Vendor shall be responsible for the packing, however, it shall meet the minimum requirements specified herein. Equivalent or better packing methods may be deployed subject to approval of the purchaser. Vendor shall submit the packing procedure for its equipment for purchaser's approval during detailed engineering.

2.0 TECHNICAL SPECIFICATION OF WOOD:

The wood shall be Fir, Chir, Silver Oak (Grevillea Robusta) or chemically treated mango with moisture content not exceeding 50 %. The wood shall have flextural & compressive strength, stiffness, shock absorption and nail retention properties. The wood shall be free from common defects such as warp, bone, twist, knot, cracks, splits, end splits, bend, visible sign of infection and any kind of decay caused by insects, fungus etc. Surface cracks with a maximum depth of 3 mm are permissible. A continuous crack of any depth all along the length is not allowed.

The wood shall be chemically treated to provide protection against deterioration due to fungi and attack by termites, borers, marine organism and any other kind of infection. It shall be treated only after final processing like cutting, planing, joint grooving etc.

3.0 TYPE, DESIGN & DIMENSION OF WOODEN PACKING CASES:

3.1 PACKING OF EQUIPMENTS:

Various mechanical, electrical and C&I equipment e.g. pumps, motors, equipment skids, heat exchangers, control panels, switch gears, transformers etc. shall be wrapped in weather proof packing and then secured in wooden packing cases. The construction of wooden packing cases shall be as per details given below and also in figures 1 to 11.

3.1.1 BOTTOM FRAME:

The construction of bottom frame shall be as per fig. 2. The number of slides/runners for bottom frames shall be selected depending upon the weight and overall dimension of the load to be carried. The equipment shall be secured by fixing their base frame/plate with the help of bolt & nuts etc to the bottom frame of the wooden packing cases. The equipment not provided with the base frame/plate like cylindrical vessels etc. to be secured to the bottom frame of the wooden case with 'C' clamps fabricated from steel channels/angle irons.

3.1.2 TOP FRAME:

The construction of top frame shall be as per fig. 3.

3.1.3 END PANELS:

The dimensions of the end and lateral panels shall be calculated according to overall dimensions of the items to be packed.

Diagonal braces shall be used for packing cases having height exceeding 500 mm. Detail of bracing shall be as per figure 5 to 8.

3.1.4 SLING PLATE:

To facilitate lifting of cases, longitudnal under slide boards shall be fixed. To avoid damage to the

box while lifting sling plates shall be provided. Refer fig. 11.

3.1.5 ANGLE IRON CLEATS :

Angle iron cleats shall be used for strengthening the joints as indicated in fig. 10.

3.1.6 OTHER REQUIREMENTS:

The thickness of planks for top, bottom, side and end panels shall be atleast 25 mm. Planks used for this purpose shall be joined with each other by tongue & groove joint. The groove dimension shall be such that tongue fits tightly into groove to make good joint.

Runners/slides, traverse bars etc. shall be of single length i.e. without any joint. Planks for sheathing, diagonal bracing etc shall also be of single length upto 2400 mm. For sizes larger than 2400 mm, proper jointing is permitted for planks for sheathing and diagonal bracing.

Each equipment to be individually covered with double polyethylene petticoat. Sheet thickness of polyethylene sheet shall not be less than 0.175 mm (175 microns). The sealing shall be such so as not to allow moisture inside.

The inner surface of 4 sides of shooks shall be nailed with bituminised water proof kraft paper. Whereever 2 pieces of kraft paper are used, the joint shall have an overlap of minimum 20mm.

All the inner sides of the box shall be nailed with bitumen coated hessian polyethylene kraft paper. For top frame it shall project on all sides by 100mm and shall be nailed on sides. Wherever 2 pieces of kraft paper are used, the joint shall have an overlap of minimum 20mm.

For delicate equipment like control panels, switchgears etc suitable cushioning material like rubberized coir shall be provided on their bottom support. The thickness of coir shall be 50 mm (minimum) and width 100 mm (minimum).

For control panels and switchgears, the gap between the panel and casing shall be filled with rubberized coir with distance between consecutive supports less than 500 mm (reffig 15). For other equipment suitable support from sides of the casing to be provided.

Switchgear cubicles, control panels and control desks shall be packed and shipped in separate convenient sections. The components e.g. circuit breakers relays and instruments etc. which are removed from panels for shipping purpose shall be separately packed and shipped as per packing instructions in clause 3.2.

Packing case for control panels & switchgear panels shall be finally covered with GI sheet of minimum thickness of 0.4 mm.

Packing cases shall be bound at edges by nailing MS clamps/brackets at sufficient intervals. Further, heavier boxes shall be strapped with 'C' clamps (ref fig 4) fabricated from steel channels/angles and lighter boxes shall be strapped with hoop iron strips.

3.1.7 ALTERNATIVE PACKING CASES FOR CONTROL PANELS AND SWITCHGEARS

If required, for control and switchgear panels, construction of wooden packing cases may be provided as per fig 14 & 15 and as detailed below:

Thickness of planks for all sides, binding and jointing battens shall be atleast 25 mm. Width of planks shall be at least 125mm and that of binding and jointing planks shall be at least 100 mm.

Top frame shall be suitable so that it does not collapse due to sandwitching between slings while lifting. Longitudnal and traverse bars for the bottom wooden pallet to be suitably selected.

Diagonal bracings shall be as per clause 3.1.3 and All other requirements shall be as per clauses 3.1.4 to 3.1.6.

3.2 PACKING OF LOOSE ITEMS:

Loose mechanical, electrical and C&I items eg valves, fittings, pressure/temperature gauges/switches, circuit breakers, relays etc shall be individually wrapped using polyethylene sheets/U foam/thermocole sheets/air bubbled sheets depending upon the item and then packed in wooden boxes. The left out spaces and top of the boxes shall be filled with rubberized coir to get proper cushioning effect. Special attention is to be paid to relays, instruments etc for arresting the movement of their operating mechanisms during transportation.

The construction of wooden packing case shall be as per clause 3.1 retaining its all features concerning strength of box. The construction of wooden packing case for loose electrical and C&I items shall be as per fig. 16.

Inner surface of 6 sides of the box shall be lined with Bitumen coated hessian polyethylene kraft paper. Rubberized coir of min. 25 mm thickness and 100 mm width shall be nailed to inner surfaces of bottom and 4 sides of the box.

Loose items such as Galvanised Steel Structure, Cable support racks, Cable Trays and GI Pipes etc. shall be individually wrapped using polyethylene sheets and further lots may be wrapped in Bitumen coated hessian cloth.

4.0 MOISTURE ABSORBER:

Silica gel is used for this purpose to protect contents over sufficiently long time from corrosion. Silica gel shall be of indicating type conforming to IS-304-1979 packed in cotton bags placed at different positions inside the packing for absorbing moisture and shall not come directly into contact with the equipment / material inside the package. The quantity of silica gel shall be enough for storage period of one (1) year, however, it shall not be less than 4 gms per litre volume of case subject to minimum of 400 gms per case.

5.0 INDICATION MARKS ON THE BOXES:

Markings shall be provided on the boxes indicating position of boxes for handling, storage and nature of consignment. For guidelines refer figure 12. The ink used for this purpose as well as for marking despatch instruction shall be indelible/nonwashable marking ink.

6.0 DESPATCH DETAILS:

External front and rear sides of the boxes to be planed for writing instructions.

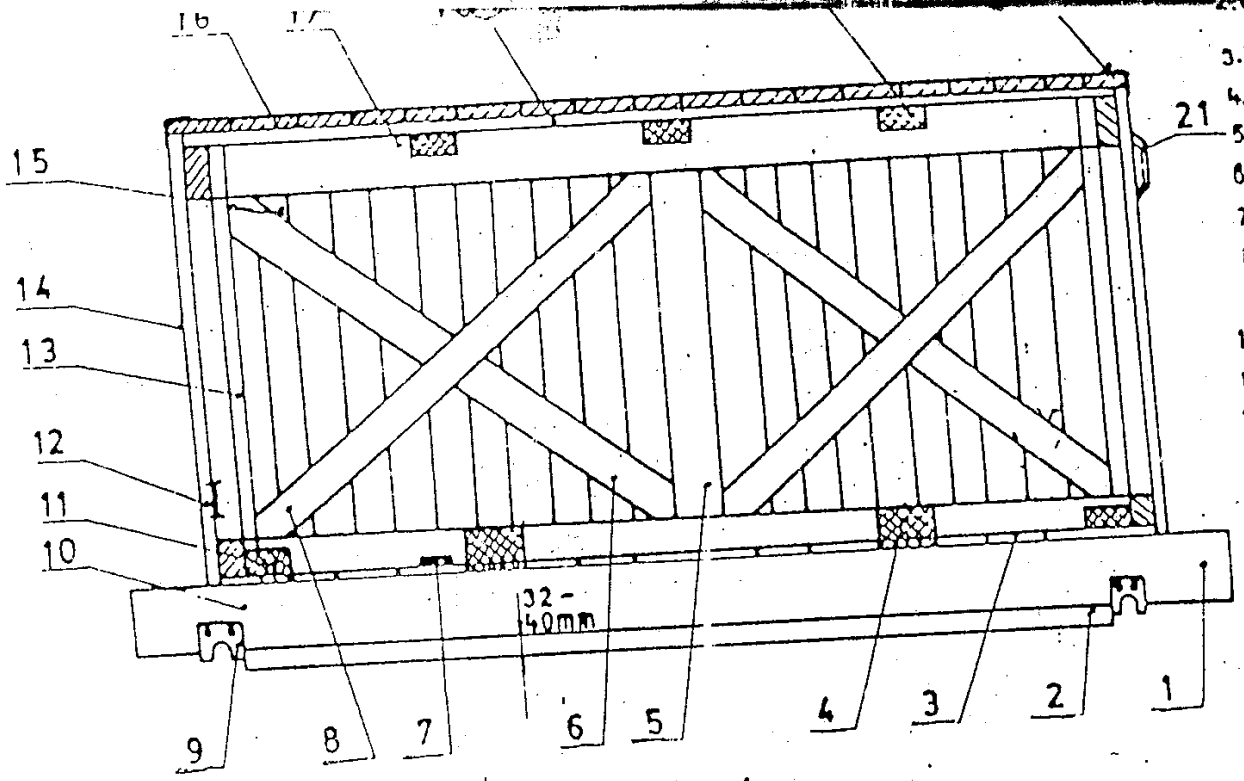
Dispatch details such as consignor/consignee address, contract and case details, country of origin , port of delivery, stacking instructions shall be written on one of the side of boxes. An anodised aluminium plate shall be provided on one side of the boxes.

One copy of packing slip wrapped in polyethylene bag covered with aluminium packing slip holder to be nailed on the external surface of the box. One more copy of the packing slip wrapped in polyethylene bag to be kept inside the box at the prominent place.

7.0 INSPECTION:

There shall be a Customer Hold Point (CHP) for inspection of final assembly of packing. During above inspection, the records for Chemical Treatment shall be reviewed.

- - x x - -



FI -1

2. [illegible] BOARD
3. BOTTOM BOARD
4. CARRIER TRAVERSE BAR
5. INTERMEDIATE VERTICAL SUPPORT
6. DIAGONAL BRACING
7. DRAINAGE HOLES
8. BATTEN
9. SLING PLATE
10. NUT, BOLT, WASHER
11. END TRAVERSE BAR
12. WATER PROOF LINING OF BITUMANISED PAPER
13. VERTICAL SUPPORTS
14. END SHEATING BOARD
15. SIDE SHEATING BOARD
16. TOP SHEATING BOARD
17. LONGITUDINAL SUPPORT
18. TOP HORIZONTAL BEAM
19. TOP TRAVERSE BARS
20. TOP CORNER STRIPS (FOR STRENGTHENING)
21. OUT SIDE DOCUMENTS CONTAINER.

NOMENCLATURE OF PARTS OF PACKING CASES

FIG. -1

BOTTOM FRAME ARRANGEMENTS

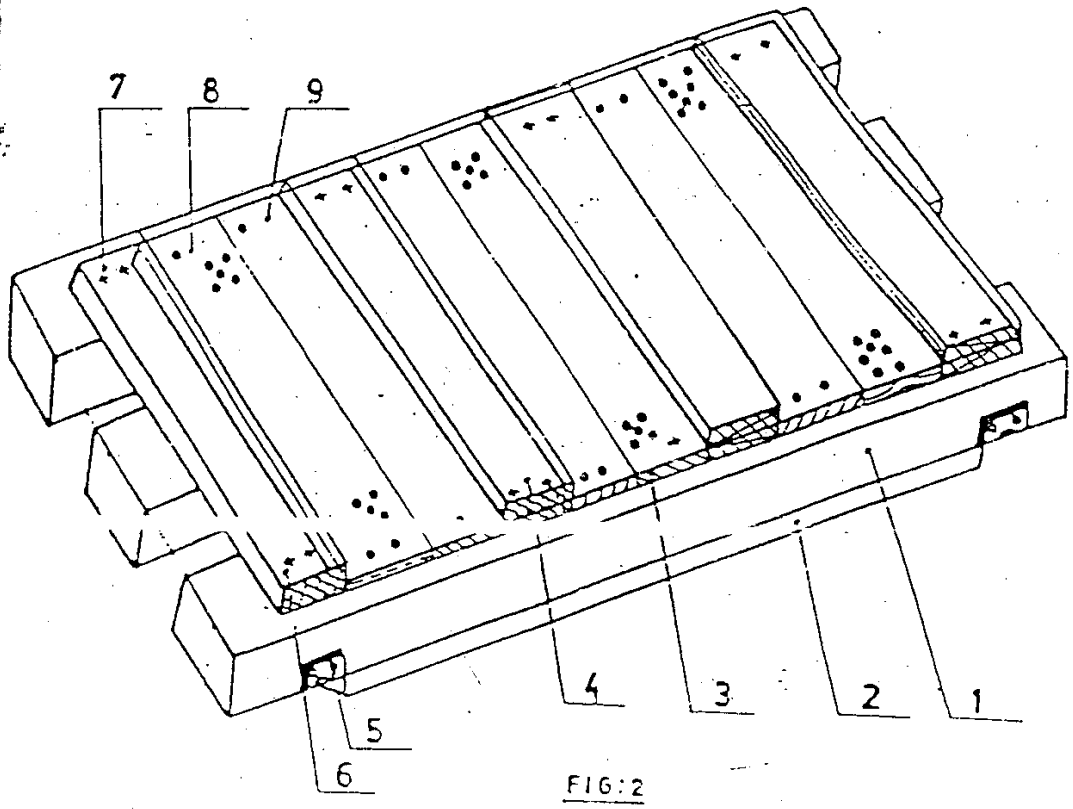


FIG:2

Nos of slides : Minimum 2 Nos.
For length more than 1800 mm or load more than 1000kg, Nos of slides shall be minimum 3 Nos.
For dimensions of slides, refer Table 1
Cross section of end traverse bolt; 100 X 100 mm. (minimum)

1. SLIDE
2. UNDER SLIDE BOARD
3. BOTTOM BOARD
4. CARRIER TAVERSE BAR
5. SLING PLATE
6. TRAVERSE BAR (END)
7. BOLT, NUT & WASHER
8. DRAINAGE HOLES
9. NAILS

TOP FRAME ARRANGEMENT

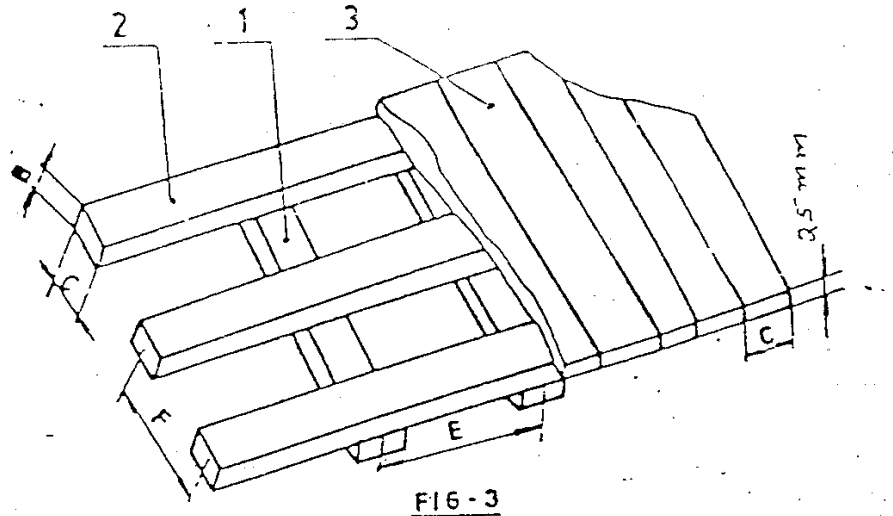
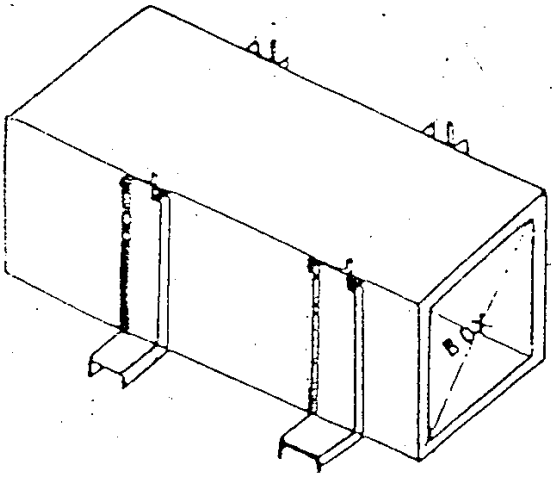


FIG-3

Dim F : 700 t. 1000 mm
Dim E : 500 t 900 mm
B x C : 30 x 100 mm.

1 – Treverse Bars
2 – Horizontal Beams
3 – Top Board

ARRANGEMENT OF C-CLAMPS AROUND CASES



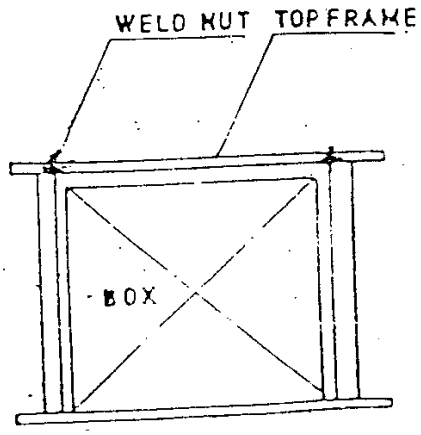


FIG: 4

ARRANGEMENT OF DIAGONAL BRACING AND HORIZONTAL SUPPORT

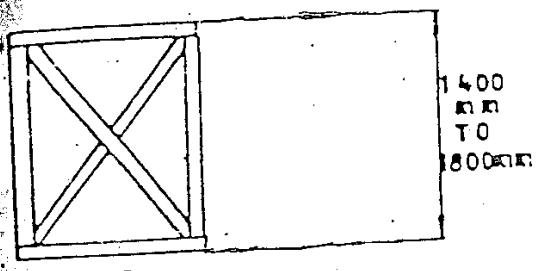


FIG: 6

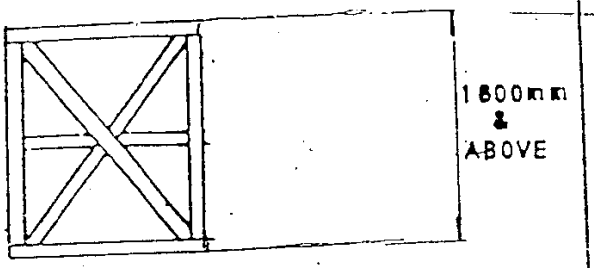


FIG: 8

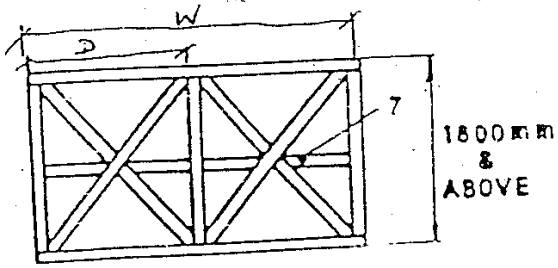


FIG: 9

7- Middle Horizontal Support

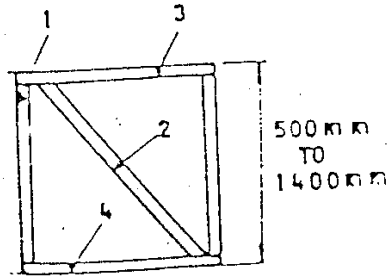


FIG: 5

1- Vertical Support
2- Diagonal Bracing
3- Upper Horizontal Support
4- Lower Horizontal Support

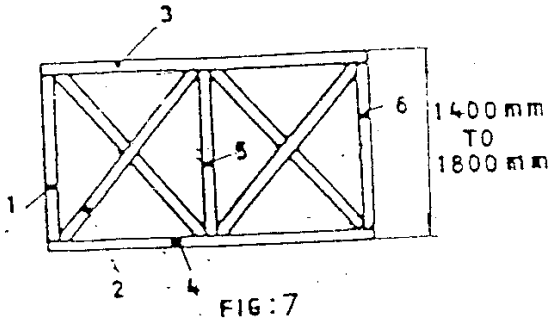
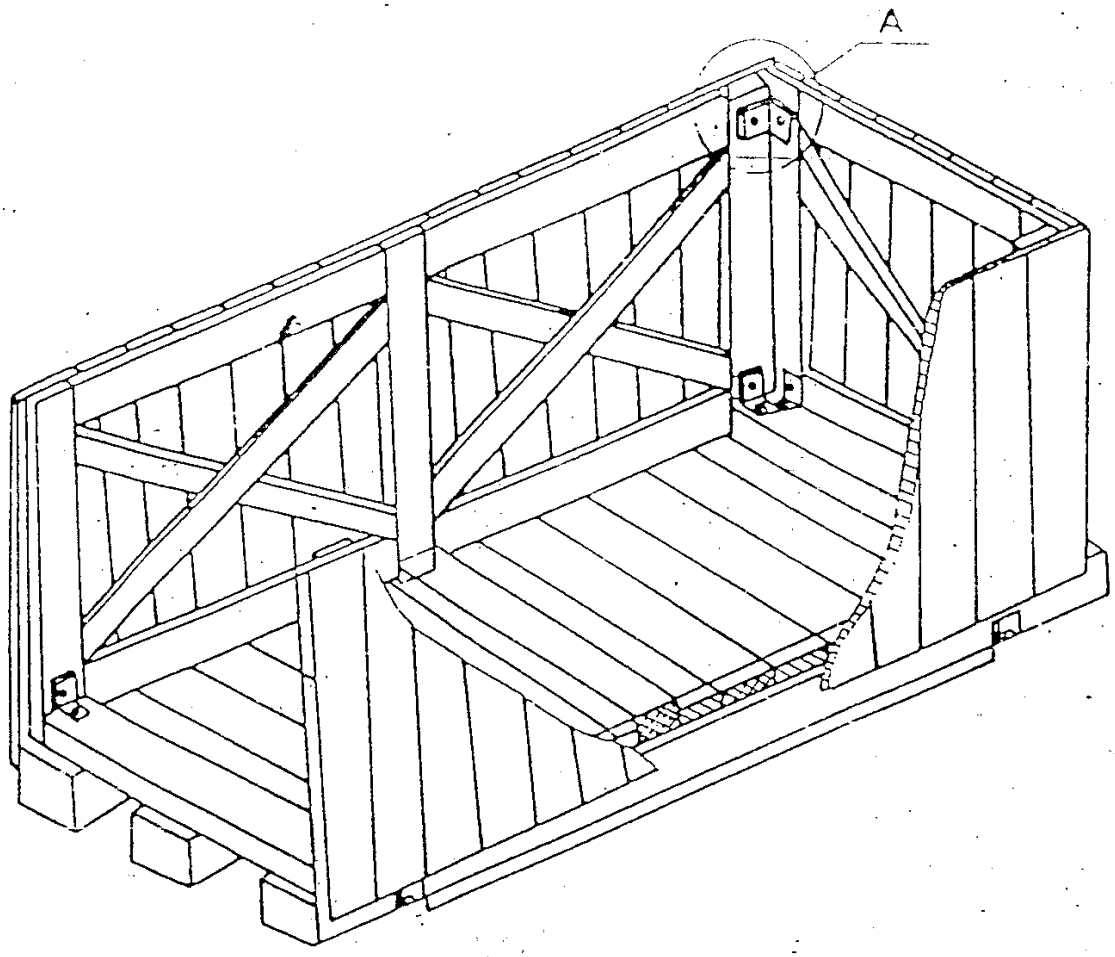


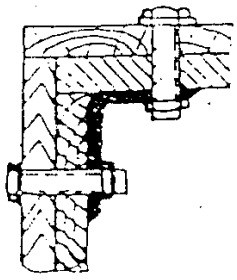
FIG: 7

1, 5, 6 - Vertical Support
2 - Diagonal Bracing
3 - Upper Horizontal Support
4 - Lower Horizontal Support

The dimensions of various items shall be as Table-2

ARRANGEMENT OF PACKING CASE





DETAIL-A

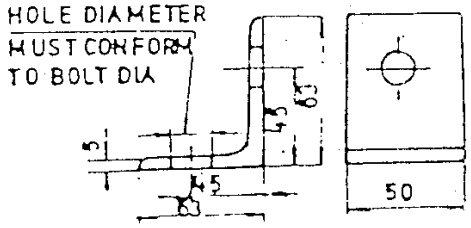


FIG:10

ARRANGEMENT OF SLING - PLATE ON CASES

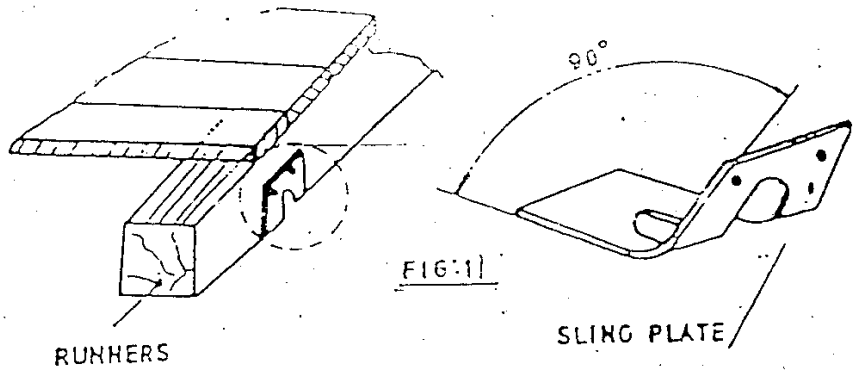


FIG:11

Table

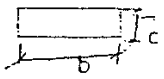
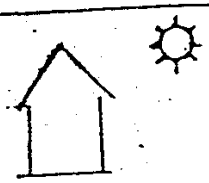
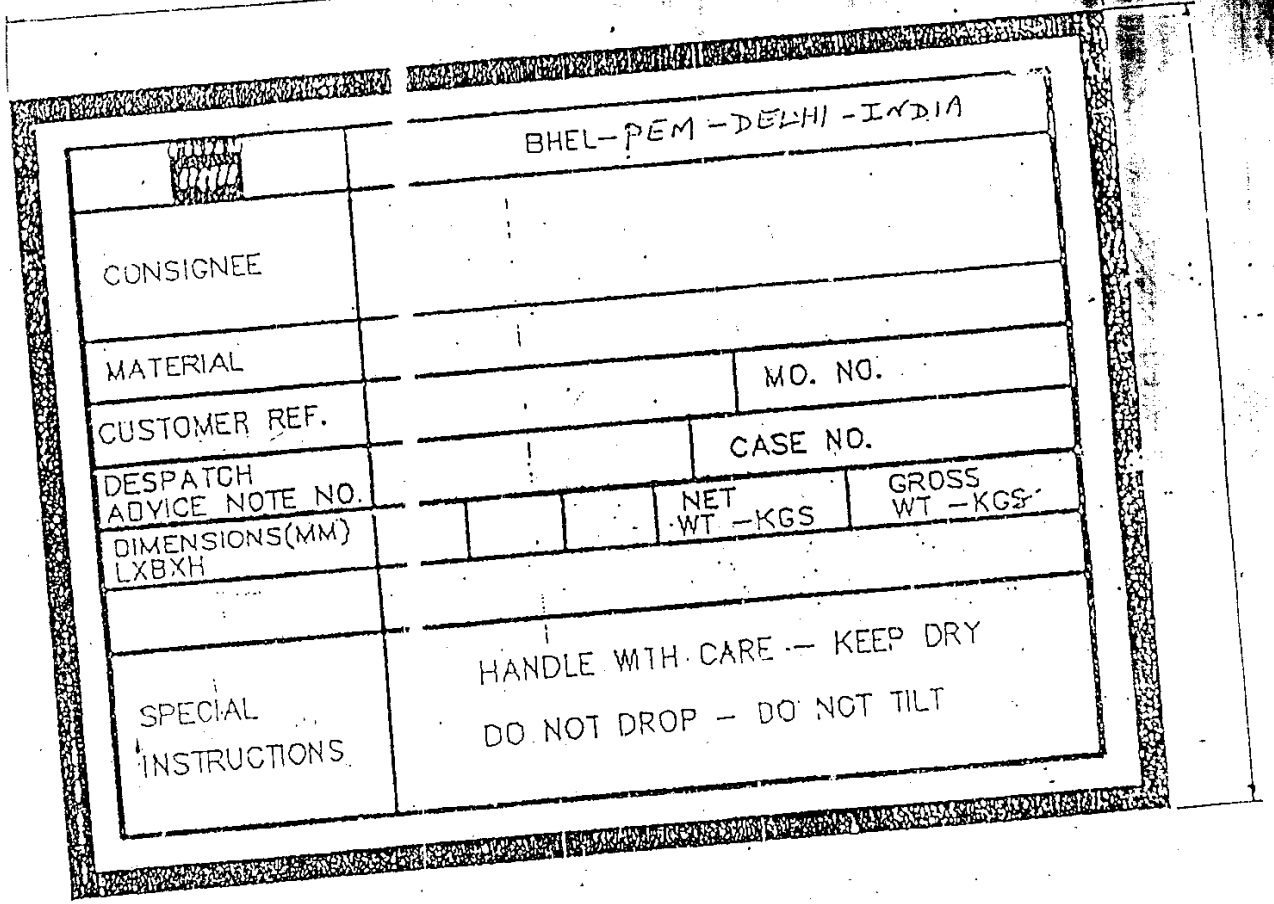
Load	Length of Slides 600	800	1000	1200	1300	1500	2000
	Cross Section b x c 						
500	50 x 100	50 x 100	50 x 100	50 x 100	75 x 100	75 x 100	100 x 100
800	50 x 100	50 x 100	75 x 100	75 x 100	75 x 100	75 x 100	100 x 100
1000	75 x 100	75 x 100	75 x 100	100 x 100	100 x 100	100 x 110	100 x 150
1500	75 x 100	75 x 100	100 x 100	100 x 100	100 x 100	100 x 150	100 x 150
2000	75 x 100	100 x 100	100 x 100	100 x 150	100 x 150	100 x 150	150 x 150
2500	75 x 100	100 x 100	100 x 150	100 x 150	100 x 150	150 x 150	150 x 150
3000	100 x 100	100 x 150	150 x 150	150 x 150	150 x 150	150 x 150	

Table 2

End and side Panels	Width of the panel W	Distance between longitudinal support DIM 'D'						
		600	800	1000	1200	1400	1600	1800
		Cross Section (b : c) Item 1 to 7						
Fig 5	600 to 1200	30 x 100	30 x 100	30 x 100	30 x 130	30 x 130	30 x 130	30 x 130
	1201 to 1600	30 x 130	30 x 130	30 x 130	30 x 130	30 x 130	30 x 130	30 x 130
to	1601 to 2000	30 x 130	30 x 130	30 x 130	30 x 130	30 x 130	30 x 130	30 x 130
Fig 9	2001 to 3000	30 x 130	30 x 130	30 x 130	30 x 130	30 x 130	30 x 130	40 x 150
	3001 to 4000	30 x 130	30 x 130	40 x 150	40 x 150	40 x 150	40 x 150	40 x 150

INDICATION MARKS ON CASES

SL NO	INDICATION MARK	MEANING
1		TOP SIDE
2		KEEP AWAY FROM HEAT
3		SLINGING POSITION
4		FRAGILE MATERIAL TO BE HANDLED WITH CARE
5		CENTRE OF GRAVITY
6		KEEP DRY



	BHEL-PEM-DELHI-INDIA
CONSIGNEE	
MATERIAL	MO. NO.
CUSTOMER REF.	CASE NO.
DESPATCH ADVICE NOTE NO.	NET WT -KGS / GROSS WT -KGS
DIMENSIONS(MM) LXBXH	
SPECIAL INSTRUCTIONS	HANDLE WITH CARE — KEEP DRY DO NOT DROP — DO NOT TILT

FIG-13: MARKING PLATE

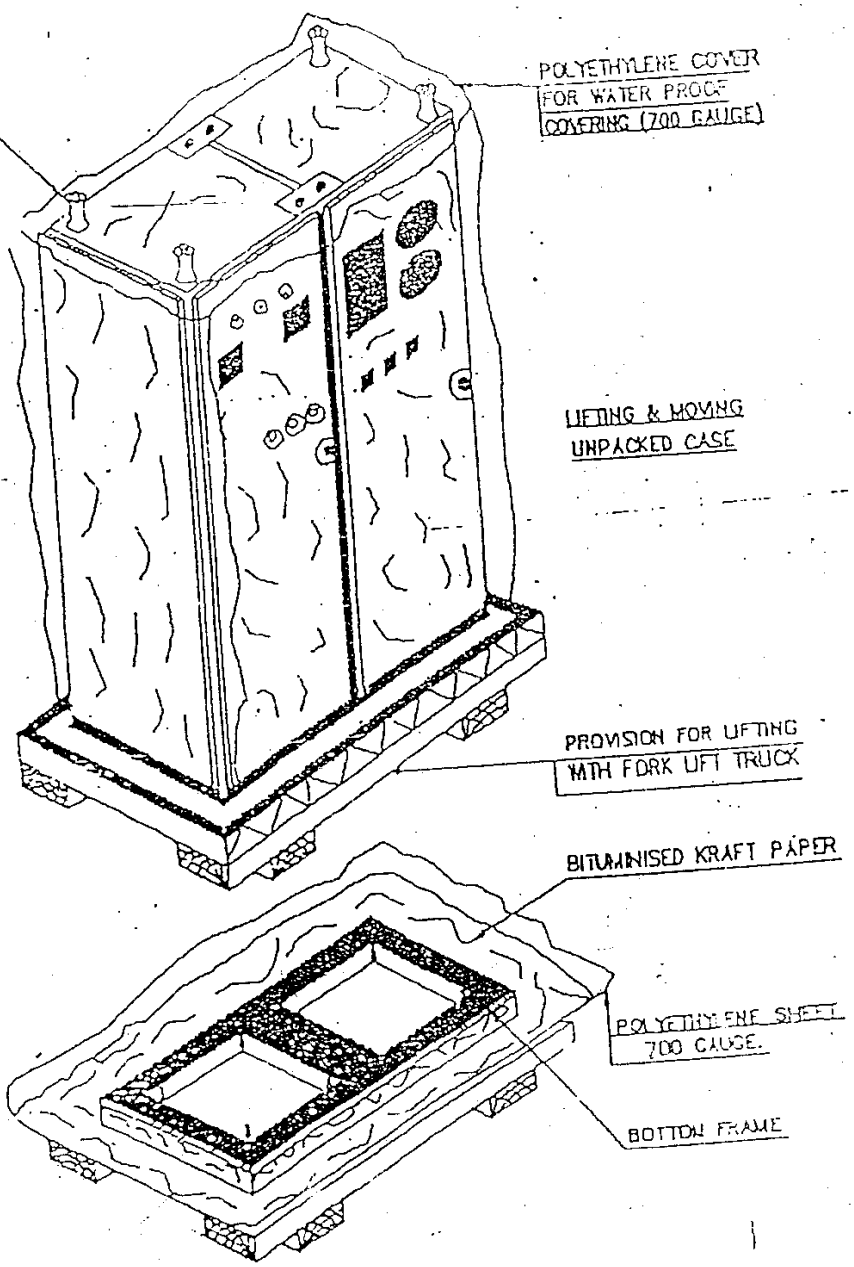

EYE BOLT
POLYETHYLENE COVER FOR WATER PROOF COVERING (700 GAUGE)
LIFTING & MOVING UNPACKED CASE
PROVISION FOR LIFTING WITH FORK LIFT TRUCK
BITUMINISED KRAFT PAPER
POLYETHYLENE SHEET 700 GAUGE.
BOTTOM FRAME

FIGURE-14

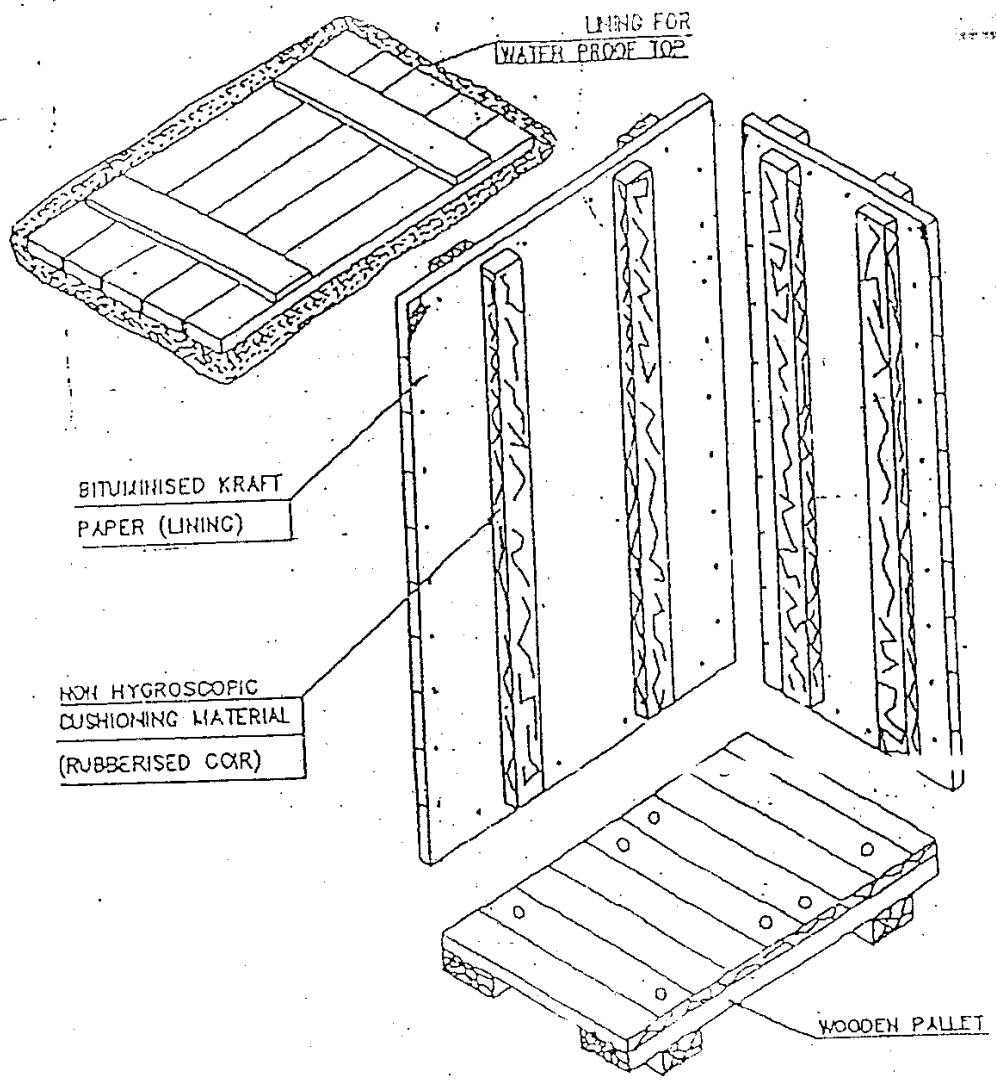

LINING FOR
WATER PROOF TOP
BITUMINISED KRAFT
PAPER (LINING)
NON HYGROSCOPIC
CUSHIONING MATERIAL
(RUBBERISED COIR)
WOODEN PALLET

FIGURE-15

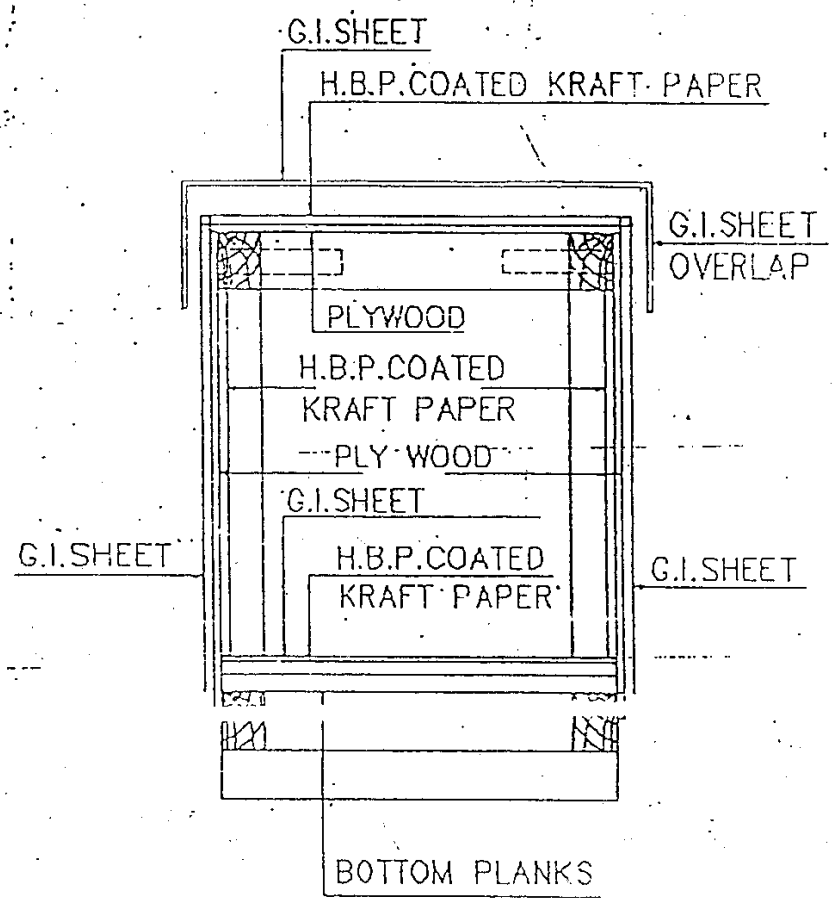


FIG-16 : CLOSED PACKING CASE WITH G.I.SHEET SHOWING LAYERS OF PACKING MATERIALS.

SECTION – I

SCOPE, SPECIFIC TECHNICAL REQUIREMENT AND QUANTITIES

1.0 SCOPE

This technical specification covers the requirements of design, manufacture, testing at works, packing and dispatch of ALUMINIUM TUBE.

The equipment is required for the following project.

Name of the customer :

Name of the Project :

The specification comprise of following sections:

Section-1 Scope, Specific Technical Requirements & quantities.

Section-2 Equipment Specification

Section-3 Project Details & General Specifications

Section-4 Guaranteed & Technical Particulars.

Section-5 Checklist (to be filled during tender stage)

Section-6 Quality Plan

In case of any conflict between various sections, order of precedence shall be in the same order as listed above.

1.1 (A) BILL OF QUANTITY

Sl. No.	Description	Quantity
1.	ALUMINUM TUBE 3" IPS (EH type)	21 MT
2.	ALUMINUM TUBE 4" IPS (EH type)	310 MT
3.	ALUMINUM TUBE 4.5" IPS (EH type)	132 MT
4.	Type test charges (RIV & Corona Inception/Extinction Tests) for 3 inch Al. Tube.	1 Lot
5.	Type test charges (RIV & Corona Inception/Extinction Tests) for 4 inch Al. Tube.	1 Lot
6.	Type test charges (RIV & Corona Inception/Extinction Tests) for 4.5 inch Al. Tube.	1 Lot
7.	EXPORT-WORTHY PACKING CHARGES	1 MT

Note:- **5%** of the above mentioned quantities of every type & size of Aluminum Tube shall be considered for Export Projects. Export-worthy packing for the Export Projects has to be provided by the vendor.

1.2 (B) TECHNICAL SPECIFICATION REQUIREMENT FOR PRE-QUALIFICATION CRITERIA

1) The manufacturer should have manufactured & supplied at least 60MT of Aluminium Tube of **3 inch or higher size** in India in any one year during the last five years from the date of technical bid opening.

2) The manufacturer should have manufactured and supplied Al. tube upto 4.5" size.

3) Bidder shall be manufacturer of Aluminium Tube.

1.3 (C) TYPE TEST CHARGES (OPTIONAL)

The bidder has to quote type test charges for the following type tests. Conduction of these type test is optional and shall be as per the requirement of particular contract. If required, then these should have been conducted in NABL accredited Laboratory. The sample used for type testing shall be in the scope of bidder.

1) RIV Test.
2) Corona Inception/Extinction Test.

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SECTION – II

EQUIPMENT SPECIFICATION

TECHNICAL SPECIFICATIONS FOR ALUMINIUM TUBE

1.0 TECHNICAL DATA OF ALUMINIUM TUBE

S. No.	PARTICULARS	DATA
1	Applicable Grade & Standard	Grade 63401 WP (Range 2) as per IS 5082: 1981
2	Manufacturing Process	a) Hot extrusion process through die and mandrel (Solid billet process). Heat treatment shall be done after hot extrusion of the tube; or b) Bridge extrusion process and then cold drawn. Heat treatment shall be done after hot extrusion of the tube.
3	Chemical Composition	Copper- 0.05% Max Magnesium- 0.4 to 0.9% Silicon- 0.3 to 0.7% Iron- 0.5% Max Manganese- 0.03 Max. Aluminium - Balance
4	Min. 0.2% proof Stress	170 MPa
5	Min. UTS	200 MPa
6	Min. Elongation on 50 mm	10%
7	Max. Electrical Resistivity at 20°C	0.03135 Ω-mm/ mm^2
8	Min. Electrical Conductivity	55% of IACS
9	Temp. Coefficient of resistance	0.00364/°C
10	Temp. Coefficient of Linear Expansion over 20°C to 200°C	0.000023/°C
11	Thermal Conductivity at 100°C	0.43 Cal/s/mm^2/cm/°C

12	Nominal Size, IPS (EH type)	3 Inch	4 Inch	4.5 Inch
13	Minimum Outside Diameter in mm (*no negative tolerance permitted*)	88.90 +2.2	114.2 +2.2	120 +1.5
14	Modulus of elasticity (kg/mm2)	6700	6700	6700
15	Minimum Thickness in mm *(no negative tolerance permitted)*	7.62 +2.2	8.51 +2.2	12 +1.0
16	Nominal Cross Section Area, in Sqmm	1946	2826	4071.5
17	Nominal Weight, kg/m (Maximum positive tolerance allowed is 8%, no negative tolerance is allowed.)	5.25	7.7	10.993
18	Packing	HDPE covering		
19	**Required Length**	As per individual PI.		

No deviation on above-indicated parameters shall be accepted. The indicated quantity of individual type of Aluminum Tubes as mentioned in Section-I may vary by up to ± 30%.However overall quantity may vary by ± 20%. The tube shall be supplied in cut lengths minimum of 4m & maximum of 7m respectively. The negative/positive tolerance on the length of the section shall not exceed 10 mm. The maximum positive tolerance allowed on nominal weight (Kg/m) is 8%, however during tender stage, if the vendor exceeds the tolerance as a deviation, then the additional prices shall be loaded on the offer of bidder.

a) All tubes shall be supplied straightened & reasonably free from twist.

b) The surface of the Aluminium tubes shall have a bright smooth finish, free from seams,cracks & other imperfections. Special attention shall be given to avoid formation of corona. The finished tubes shall be perfectly straight.

c) The ingot to be used for producing the Aluminium tubular busbars of grade 63401 W.P (Range 2), shall comply with the requirements specified in Table1 (Clause 6.1) of IS:5082 when analysed in accordance with IS:504 or any other standard instrumental method of analysis.

d) Aluminium Tube should be suitable for bending at site as per switchyard layout requirement.

2.0 TESTS:

In addition to routine tests on the aluminium tubes as per IS 5082, Test Reports for following tests shall also be submitted:

i) Measurement of the outside diameter, wall thickness and ovality of the tube.
0.2% proof tests both on the parent metal and aluminium tube as per standards, as appropriate.

ii) Tensile Strength Test.

iii) Percentage Elongation Test.

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SECTION – 3

PROJECT DETAILS AND GENERAL SPECIFICATIONS

3.0 GENERAL

This section stipulates the General Technical Requirements under the contract and will form an integral part of the Technical Specification.

The provisions under this section are intended to supplement general requirements for the materials, equipment and services covered under other sections and is not exclusive. However in case of conflict between the requirements specified in this section and requirements specified under other sections, the requirements specified under respective sections shall hold good.

3.1 SITE INFORMATION

SL.NO.	DESCRIPTION	
3.1	**PROJECT INFORMATION**	
	a) Customer	
	b) Project	
	c) Project location	
	d) Transport facilities Nearest Railway Station/Gauge Distance from Railway Station	
	e) Access roads	
3.2	**SITE CONDITIONS**	
3.2.1	Ambient Temp.	
	a) Maximum Design Ambient air temp. (max.) °C	
	b) Minimum Design Ambient air temp. (max.) °C	
3.2.2	Relative humidity	
3.2.3	Height above mean sea level	
3.2.4	Pollution Severity	
3.2.5	Earth quake data	
	a) Seismic zone as per IS 1893:84	
	b) Seismic acceleration	
3.2.6	Wind data	
	a) Wind velocity m/sec.	
3.2.7	Average annual rainfall	

3.2 INSTRUCTION TO BIDDERS

The bidders shall submit the technical requirements, data and information as per the technical data sheets, provided in Section-4.

The bidders shall furnish catalogues, engineering data, technical information, design documents, drawings etc fully in conformity with the technical specification.

It is recognised that the Manufacturer may have standardised on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered provided such proposals meet the specified designs, standard and performance requirements and are acceptable to the Purchaser. Unless brought out clearly, the Bidder shall be deemed to conform to this specification scrupulously.

3.3 STANDARDS

The works covered by the specification shall be designed, engineered, manufactured, built, tested and commissioned in accordance with the Acts, Rules, Laws and Regulations of India.

The equipment to be furnished under this specification shall conform to latest issue (with all amendments) of specified standards.

In addition to meeting the specific requirement called for in Sections 1 and 2 of the Technical Specification, the equipment shall also conform to the general requirement of the applicable standards, which shall form an integral part of the specification.

The Bidder shall note that standards mentioned in the specification are not mutually exclusive or complete in themselves, but intended to complement each other.

When the specific requirements stipulated in the specifications exceed or differ from those required by the applicable standards, the stipulation of the specification shall take precedence.

Other internationally accepted standards, which ensure equivalent or better performance than that specified in the standards referred, shall also be accepted. The bidder shall submit copies of such standards.

In case governing standard for the equipment is different from IS or IEC, the salient points of difference shall be clearly brought out in the offer along with English language version of standard or relevant extract of the same. The equipment conforming to standards other than IS/IEC shall be subject to Purchaser's / owner's approval.

The bidder shall clearly indicate in his bid the specific standards in accordance with which the works will be carried out.

3.4 SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED

All equipment shall also perform satisfactorily under various other electrical, electromechanical and meteorological conditions of the site of installation All equipment shall be able to withstand all external and internal mechanical, thermal and electromechanical forces due to various factors like wind load, temperature variation, ice & snow, (wherever applicable) short circuit etc for the equipment.

3.5 ENGINEERING DATA

3.5.1 Drawings

The contactor shall necessarily submit all the drawings/ documents unless anything is waived. The contactor shall submit 6 (six) sets of drawings/ design documents/ data/ test reports as may be required for the approval of the purchaser. All drawings submitted by the Manufacturer including those submitted at the time of bid shall be in sufficient detail to indicate the type, size, arrangement, material description, Bill of Materials, weight of each component, break-up for packing and shipment, the external connections, fixing arrangement required. the dimensions required for installation and interconnections with other equipment and materials, clearances and spaces required for installation and i nterconnections between various portions of equipment and any other information specifically requested in the specifications.

Each drawing submitted by the Manufacturer shall be clearly marked with the name of the Purchaser, the unit designation, the specifications title, the specification number and the name of the Project. If standard catalogue pages are submitted, the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

Further work by the Manufacturer shall be in strict accordance with these drawings and no deviation shall be permitted without the written approval of the Purchaser, if so required.

The review of these data by the Owner will cover only general conformance of the data to the specifications and documents, interfaces with the equipment provided under the specifications, external connections and of the dimensions which might affect substation layout. Owner may not indicate a thorough review of all dimensions, quantities and details of the equipment, material, any devices or items indicated or the accuracy of the information submitted. This review and /or approval by the Owner shall not be considered by the Manufacturer, as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications and documents.

All manufacturing and fabrication work in connection with the equipment prior to the

approval of the drawings shall be at the Manufacturer's risk. The Manufacturer may make any changes in the design which are necessary to make the equipment conform to the provisions and intent of the Contract and such changes will again be subject to approval by the Purchaser. Approval of Manufacturer's drawing or work by the Purchaser shall not relieve the manufacturer of any of his responsibilities and liabilities under the Contract All engineering data submitted by the Manufacturer after final process including review and approval by the Owner shall form part of the Contract Document and the entire work performed under these specifications shall be performed in strict conformity, unless otherwise expressly requested by the Owner in Writing.
The title block of drawings shall contain the following information incorporated in all contract drawings

Title block for _____ project:

1. Customer :
2. Consultant :
3. Project :
4. Contract No./LOA No. :
5. Main Contractor : Bharat Heavy Electricals Limited
6. BHEL Order No. & Date :

3.5.2 Approval Procedure

The scheduled dates for the submission of these as well as for, any data/information to be furnished by the Purchaser would be discussed and finalised at the time of award. The following schedule shall be followed generally for approval.

	Stage	No. of copies	Submission Schedule /Remarks
i)	Initial Submission Drawings, Data sheets, Type test Reports	6	As per agreed schedule
ii)	Resubmission, if required	6	Within 3 (three) weeks from date of comments including both ways posta time
iii)	Approval or comments Within	3	(three) weeks of receipt of resubmission.
iv)	Furnishing of distribution copies of drawings in bound volume	8	2 Weeks from the date of final approval Five (6) copies for each substation plus two (2) copies for corporate centre.
v)	Furnishing of distribution copies of type test reports in bound volumes	3	2 Weeks from the date of final approval One (1) copies for each substation plus two (2)

			copies for corporate centre.
vi)	Furnishing of distribution copies of Routine test reports	2	2 Weeks from the date of final approval One (2) copies for each substation
vii)	CD-ROM/ Optical Disc of all documents	3	One (1) set for each substation plus two (2) set for corporate centre.

NOTES:

a) The manufacturer may note that all re-submissions must incorporate all comments given in the prior submission by the Purchaser. Adequate justification for not incorporating the same must be submitted, failing which the submitted documents may be returned.

3.6 QUALITY ASSURANCE PROGRAMME

To ensure that the equipment and services under the scope of this Contract, whether manufactured or performed within the Manufacturer's Works or at his Sub-manufacturer's premises or at the Purchaser's site or at any other place of Work, are in accordance with the specifications, the Manufacturer shall adopt a suitable quality assurance programme to control such activities at all points, as necessary. Such programme shall be outlined by the Manufacturer and shall be finally accepted by the Purchaser after discussions before the award of Contract. A quality assurance programme of the manufacturer shall generally cover the following:

(a) Manufacturer's organisation structure for the management and implementation of the proposed quality assurance programme:
(b) Documentation control system;
(c) Qualification data of bidder's key personnel;
(d) The procedure for purchases of materials, parts components and selection of sub-Manufacturer's services including vendor analysis, source inspection, incoming raw material inspection, verification of material purchases etc.
(e) System for shop manufacturing and site erection controls including process controls and fabrication and assembly control;
(f) Control of non-conforming items and system for corrective actions;
(g) Inspection and test procedure both for manufacture and field activities;
(h) Control of calibration and testing of measuring instruments and field activities;
(i) System for indication and appraisal of inspection status;
(j) System for quality audits;
(k) System for authorising release of manufactured product to the Purchaser
(l) System for maintenance of records;
(m) System for handling storage and delivery; and
(n) A quality plan detailing out the specific quality control measures and Procedures adopted for controlling the quality characteristics relevant to each item of equipment furnished and/or services rendered.

The Purchaser or his duly authorised representative reserves the right to carry out quality audit and quality surveillance of the system and Procedure of the Manufacturer/'his vendors quality management and control activities.

3.7 Quality Assurance Documents

The Manufacturer shall be required to submit all Quality Assurance Documents as stipulated in the quality plan at the time of purchasers inspection of equipment/ material.

3.8 TYPE TESTING, INSPECTION, TESTING & INSPECTION CERTIFICATE

All equipment being supplied shall conform to type tests and shall be subject to routine and acceptance tests in accordance with requirements stipulated under respective sections. Purchaser reserves the right to witness any or all the tests. The Manufacturer shall intimate the Purchaser the detailed programme about the tests at least three (3) weeks in advance in case of domestic supplies & six (6) weeks in advance in case of foreign supplies. Purchaser reserves the option for getting any or all the type tests repeated on the equipment. The Manufacturer shall also submit type test procedure for approval of the Purchaser.

In the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/manufacturing changes (including substitution of components) or due to non-compliance with the requirement stipulated in the technical specification or any/all additional type tests not carried out without any additional cost implication to the Purchaser.

The price of conducting all tests and additional type tests is deemed to be included in Bid price. In case any bidder indicates that he shall not carry out a particular test, his offer shall be considered incomplete and shall be liable to be rejected.

The Purchaser, his duly authorised representative and/or outside inspection agency acting on behalf of the Purchaser shall have at all reasonable times free access to the Contractors premises or Works and shall have the power, at all reasonable times to inspect and examine the materials and workmanship of the Works during its manufacture or erection if pert of the Works is being manufactured or assembled at other premises or works, the Manufacturer shall obtain for the Engineer and for his duly authorized representative permission to inspect as if the works were manufactured or assembled on the Manufacturer's own premises or works. Inspection may be made at any stage of manufacture, dispatch or at site at the option of the Purchaser and the equipment if found unsatisfactory due to bad workmanship or quality, material is liable to be rejected.

The Manufacturer shall give the Purchaser/inspector thirty (30) days written notice of any material being ready for testing. Such tests shall be to the Manufacturer's account except for the expenses of the inspector. Unless witnessing of the tests is virtually waived, the Purchaser/ inspector will attend such tests within thirty (30) days of the date of which the equipment is notified as being ready for test/ inspection, failing which the Manufacturer may proceed with the test which shall be deemed to have been made in the Inspector's presence and the Manufacturer shall forthwith forward duly certified copies of test reports in triplicate to the Inspector.

The Purchaser or Inspector shall, within fifteen (15) days from the date of inspection as defined herein, give notice in writing to the Manufacturer, of any objection to any drawings and all or any equipment and workmanship which in his opinion is not in accordance with the Contract. The Manufacturer shall give due consideration to such objections and shall either make the modifications that may be necessary to meet the said objections or shall confirm in writing to the Purchaser/ inspector giving reasons therein, that no modifications are necessary to comply with the Contract.

When the factory tests have been completed at the Manufacturer's works, the Purchaser/ inspector shall issue a certificate to this effect within fifteen (15) days after completion of tests but if the tests are not witnessed by the Purchaser/inspector, the certificate shall be issued within fifteen (15) days of receipt of the Manufacturer's Test certificate by the Engineer/ Inspector. Failure of the Purchaser/inspector to issue such a certificate shall not prevent the Manufacturer from proceeding with the Works. The completion of these tests or the issue of the certificate shall not bind the Purchaser to accept the equipment should it, on further tests/ after erection, be found not to comply with the Contract. The equipment shall be dispatched to site only after approval of test reports and issuance of MICC by the Purchaser.

In all cases where the Contract provides for tests whether at the premises or at the works of the Manufacturer or of any Sub-Contractor, the Manufacturer except where otherwise specified shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Purchaser /Inspector or his authorised representative to carry out effectively such tests of the equipment in accordance with the Contract and shall give facilities to the Purchaser Inspector or to his authorised representative to accomplish testing.

The inspection by Purchaser and issue of Inspection Certificate thereon shall in no waylimit the liabilities and responsibilities of the Manufacturer in respect of the agreed quality assurance programme forming a part of the Contract.

The Purchaser will have the right of having at his own expenses any other test(s) of reasonable nature carded out at Manufacturer's premises or at site or in any other place in addition of aforesaid type and routine tests, to satisfy that the material comply with the specification.

The Purchaser reserves the right for getting any field tests not specified in respective sections of the technical specification conducted on the completely assembled equipment at site. The testing equipment for these tests shall be provided by the Purchaser

3.9 MATERIALS AND WORKMANSHIP

Equipment materials and components shall be new, of high grade and good quality and be to the latest engineering practice. The material and workmanship throughout shall be in accordance with the purpose for which they are intended. Each component shall be designed to be consistent with its duty.

All the information concerning materials or components to be used in manufacturing, machinery, equipment, materials and components supplied, installed or used shall be submitted for approval. Without such approval the supplier shall run risk of subsequent rejection. The cost as well as time delay associated with such rejection shall be borne by the supplier.

3.10 PACKING AND STORAGE

All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection. On request of the purchaser, the manufacturer shall also submit packing details/associated drawing for any equipment/ material at a later ate, in case the need arises. While packing all the materials, the limitation from the point of view of availability of Railway wagon sizes in India should be taken into account. The manufacturer shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. Any demurrage, wharf age and other such charges claimed by the transporters, railways etc shall be to the account of the manufacturer. Purchaser takes no responsibility of the availability of the wagons.

All coated surfaces shall be protected against abrasions, impact, discolouration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device.

Supplier shall ensure that equipment shall be properly packed, blocked, padded, coated and protected so that it is not damaged due to possible mishandling. Storage requirements shall be clearly defined by the supplier. Packing shall be such that if required, long time storage at site should not deteriorate the performance of the equipment.

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SECTION – IV

GUARANTEED AND TECHNICAL PARTICULARS OF STRANDED ALUMINIUM TUBE (SEPARATE GTP TO BE FILLED FOR EACH TYPE OF TUBE)

S. No.	PARTICULARS	DATA			
1)	Applicable Grade & Standard				
2)	Manufacturing Process				
3)	Chemical Composition				
4)	Min. 0.2% proof Stress				
5)	Min. UTS				
6)	Min. Elongation on 50 mm				
7)	Max. Electrical Resistivity at 20°C				
8)	Min. Electrical Conductivity				
9)	Temp. Coefficient of resistance				
10)	Temp. Coefficient of Linear Expansion over 20°C to 200°C				
11)	Thermal Conductivity at 100°C				
12)	Modulus of Elasticity				
13)	Nominal Size, IPS (EH type)				
14)	Minimum Outside Diameter in mm *(no negative tolerance permitted)*				
15)	Minimum Thickness in mm *(no negative tolerance permitted)*				
16)	Nominal Cross Section Area, in Sqmm				
17)	Nominal Weight, kg/m				
18)	Packing				
19)	**Required Length**				

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SECTION – V

CHECK LIST

Put a tick mark (√) in "YES/NO' Column if the specified requirement is met, or put a (X) mark, if the specified requirement is not met and give comments in the "Remarks" column.

1. TECHNICAL REQUIREMENTS (FOR ALUMINIUM TUBE)

S.NO	PARTICULARS	DATA	Yes/No	Remarks
1.	Applicable Grade & Standard	Grade 63401 WP (Range 2) as per IS 5082: 1981		
2.	Type Test Charges	a) RIV Test b) Corona Inception/Extinction Test		
3.	No Negative Tolerance permitted	a) on Overall Diameter b) on Thickness		
4.	Maximum cut length of Al. Tube	7 Meter		
5.	Negative/Positive Tolerance on Length	10 mm		
6.	Maximum Positive Tolerance on Nominal Weight (Kg/m)	8%		
7.	Routine Test	As per clause 2 of Section-II		

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SECTION – VI

QUALITY PLAN

Bidder shall follow standard BHEL QAP doc. No. TBQM-STD-ALUMINIUM TUBE.

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