



BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS GROUP
ENGINEERING MANAGEMENT, NEW DELHI

BHEL Document No.	Rev.	Prepared by	Checked by	Approved by
TB-235-509-125	05	Name		
Type of Document	STANDARD SPECIFICATION	Sign	--sd--	--sd--
Title	GS FLAT & EARTH ELECTRODE FOR EARTHING SYSTEM	Date	17.08.07	17.08.07
		Group	TBEM	
		W.O. No		

Customer / Consultant

Tender

CONTENTS

SECTION	TITLE	PAGE
I.	SCOPE, SPECIFIC TECHNICAL REQUIREMENTS.	1.1 - 1.2
	SKETCH-1 & 2	
II.	STANDARD SPECIFICATION	2.1 - 2.2
III.	PROJECT DETAILS AND GENERAL SPECIFICATION	3.1 - 3.3
IV.	GUARANTEED TECHNICAL PARTICULARS	4.1 - 4.1
V.	CHECK LIST	6.1 - 6.1
VI.	Standard QP	1.0 - 4.0

05. 18.05.15 MS Flat of size 75x12 mm & 50x8 mm added.
Note 4 added in sketch 2.

04	26.11.12	Sd/-	Sd/-	Sd/-	Sd QP included.
03	09.11.12	Sd/-	Sd/-	Sd/-	POWERGRID requirement & Cut Lengths included.
02	10.06.09	Sd/-	Sd/-	Sd/-	Documents updated
01	14.08.07	Sd/-	Sd/-	Sd/-	Revised as per TBMM requirement.

Rev. No.	Date	Altered	Checked	Approved	REVISION DETAILS
Distribution				To	
				Copies	

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SECTION 1

SCOPE AND SPECIAL TECHNICAL REQUIREMENT

1.0 SCOPE

This technical specification covers the requirements of design, manufacture, testing at works, packing and dispatch of Earthing Strips & Earthing Electrodes, complete with accessories.

This section covers the general technical requirements of Earthing Strips & Earthing Electrodes. In case of any discrepancies between the requirements mentioned in this section and those specified in the following sections of this specification, the specifications given herein shall prevail and shall be treated as binding requirements.

1.1 TECHNICAL REQUIREMENTS:

1.1.1 GALVANIZED MILD STEEL FLAT (Power grid Requirement)

- i) Chemical composition & mechanical properties: Grade –A (Item Designation – Fe410W) of IS: 2062.
- ii) Mass of protective zinc coating: 618 gm/sq.m and minimum thickness of coating shall be 85 microns for items thicker than 6 mm. For less than 6 mm, the thickness shall be as per clause 4.0 of IS 4759, 1984.
- iii) Sizes:

Sl. No.	Description	Approx. Weight (kg)
1	Galvanised Steel Flat 75 x 12 mm	7.0663 kg/meter
2	Galvanised Steel Flat 75 x 10 mm	5.8893 kg/meter
3	Galvanised Steel Flat 50 x 6 mm	2.4008 kg/meter
4	Galvanised Steel Flat 25 x 3 mm	0.5894 kg/meter
5	Mild Steel Flat 50 x 6 mm	2.3316 kg/meter

- iv) Length: 4 m to 6 m
- v) Raw Material: Vendor to procure the raw material from Power Grid approved Sources with PG stamp.

1.1.2 GALVANIZED MILD STEEL FLAT (Other then Power grid Requirement)

- i) Chemical composition & mechanical properties: Grade –A (Item Designation – Fe410W) of IS: 2062.
- i) Mass of protective zinc coating: 1) 610 gm/sq.m and minimum thickness of coating shall be 85 microns for items thicker than 6 mm. For

less than 6 mm, the thickness shall be as per clause 4.0 of IS 4759, 1984.

ii) Sizes:

Sl. No.	Description	Weight (kg)
1	Galvanised Iron Flat 75 x 12 mm	7.065 kg/meter
2	Galvanised Iron Flat 75 x 10 mm	5.888 kg/meter
3	Galvanised Iron Flat 75 x 8 mm	4.710 kg/meter
4	Galvanised Iron Flat 65 x 10 mm	5.10 kg/meter
5	Galvanised Iron Flat 65 x 8 mm	4.082 kg/meter
6	Galvanised Iron Flat 50 x 8 mm	3.140 kg/meter
7	Galvanised Iron Flat 50 x 6 mm	2.4 kg/meter
8	Galvanised Iron Flat 25 x 3 mm	0.589 kg/meter
9	Mild Steel Flat 75 x 10 mm	5.7843 kg/meter
10	Mild Steel Flat 50 x 6 mm	2.3316 kg/meter
11	Mild Steel Flat 75 x 12 mm	7.065 kg/meter
12	Mild Steel Flat 50 x 8 mm	3.140 kg/meter

iii) Length: 4 m to 6 m.

1.1.3 EARTH ELECTRODE (Mild Steel iron)

i)	Applicable Standard	IS:1239
ii)	Sizes of Pipe	40 NB
iii)	Grade	Medium
iv)	Thickness of zinc -coating	460 gm/sq.m
v)	Reference Drg.	SKETCH SK-1 (Typical)

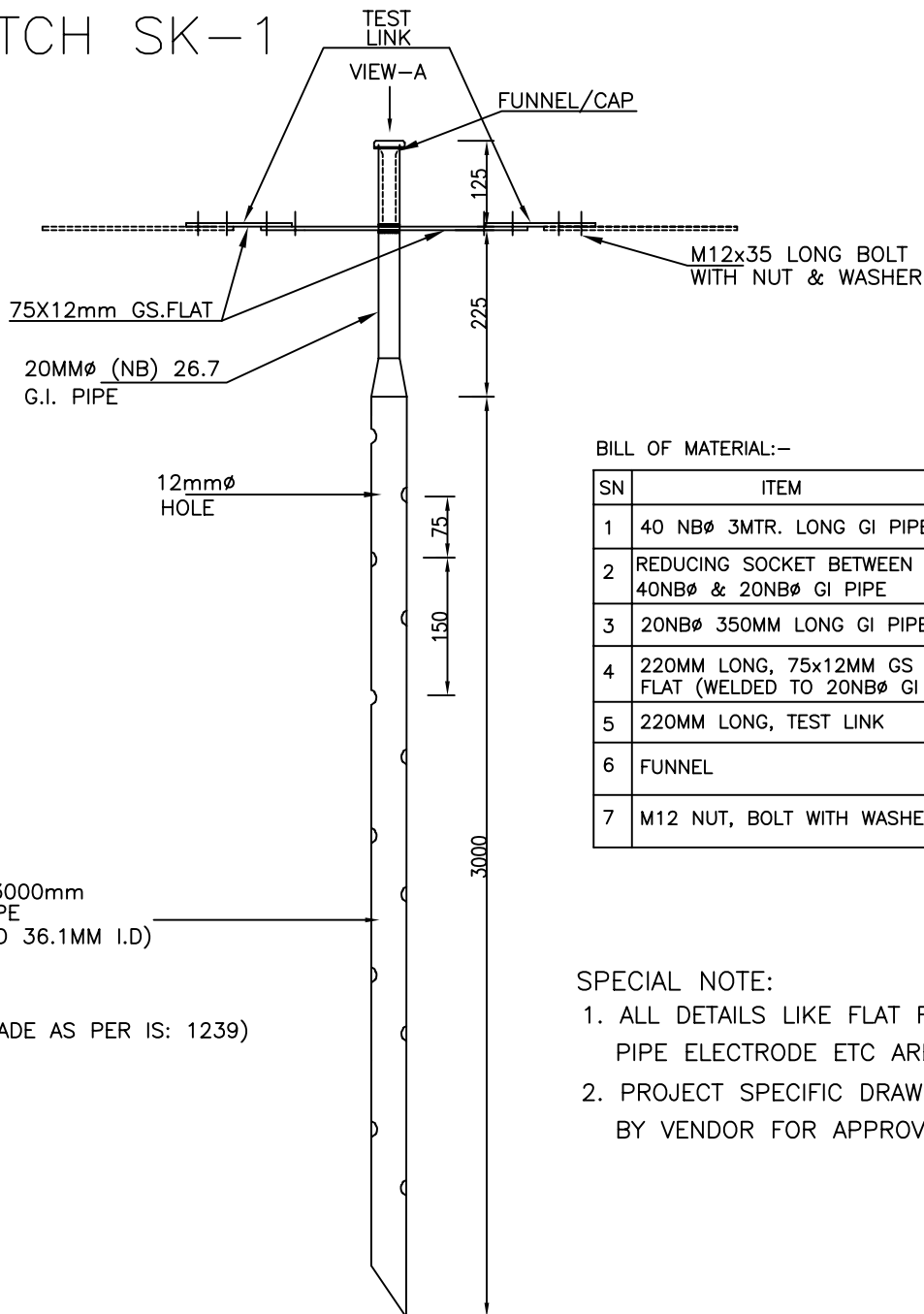
1.1.4 EARTH ELECTRODE (Cast Iron)

i)	Cast Iron pipe ID (mm)	100/150 mm
ii)	Thickness (mm)	12/10/13 mm
iii)	Reference Drg.	SKETCH SK-2 (Typical)

1.2 Manufacturing quality plan:

- i) Quality plan of GS flat is not required for power grid projects. Therefore, the inspection of GS flat & electrodes for power grid projects will be carried out as per relevant Indian Standards (latest version).
- ii) The QP enclosed with standard specification is to be followed for Non Power Grid projects.

SKETCH SK-1



BILL OF MATERIAL:-

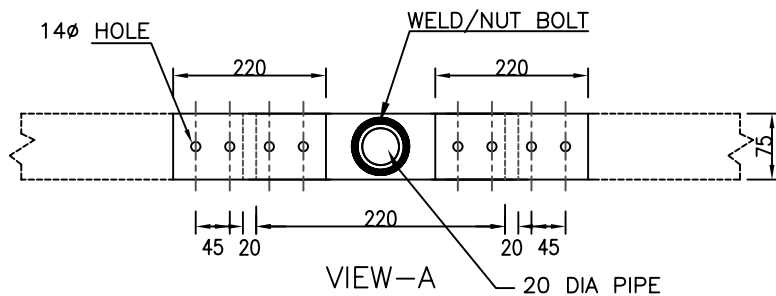
SN	ITEM	UNIT	QTY.
1	40 NB ϕ 3MTR. LONG GI PIPE	NOS.	01
2	REDUCING SOCKET BETWEEN 40NB ϕ & 20NB ϕ GI PIPE	NOS.	01
3	20NB ϕ 350MM LONG GI PIPE	NOS.	01
4	220MM LONG, 75x12MM GS FLAT (WELDED TO 20NB ϕ GI PIPE)	NOS.	01
5	220MM LONG, TEST LINK	NOS.	02
6	FUNNEL	NOS.	01
7	M12 NUT, BOLT WITH WASHERS	SETS	08

SPECIAL NOTE:

1. ALL DETAILS LIKE FLAT FIXING TO GI PIPE ELECTRODE ETC ARE TYPICAL.
2. PROJECT SPECIFIC DRAWING TO BE SUBMITTED BY VENDOR FOR APPROVAL.

NOTE:

1. ALL DIMENSIONS ARE IN MM.
2. STEEL TO CONFORM TO IS:2062, GRADE-A
3. ALL ITEMS TO BE HOT DIP GALVANISED.
4. SUPPLY OF FIXING BOLTS, NUTS, WASHERS FOR GI FLT EARTHING CONDUCTOR IS ALSO PART OF THE SCOPE
5. WASHER TO BE ELECTRO GALVANISED.



EQUIPMENT EARTHING DETAILS
DETAILS OF PIPE ELECTRODE
IN TREATED EARTH PIT

COMPUTERREF.NO.

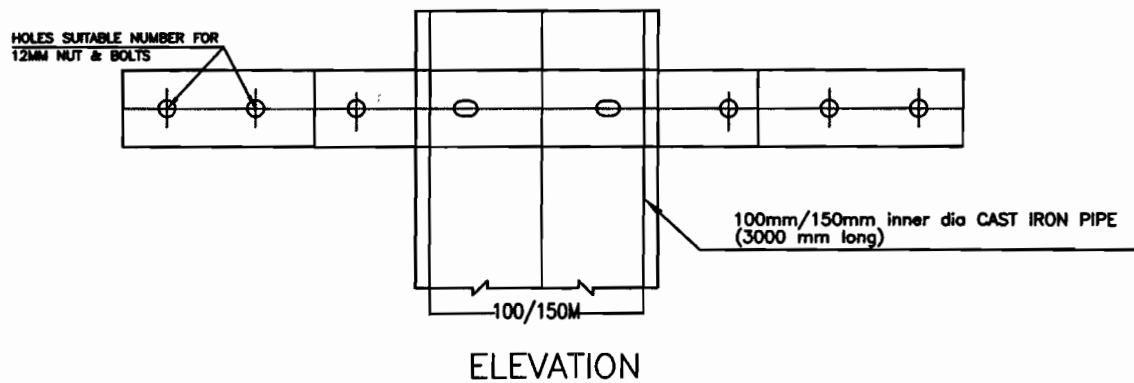
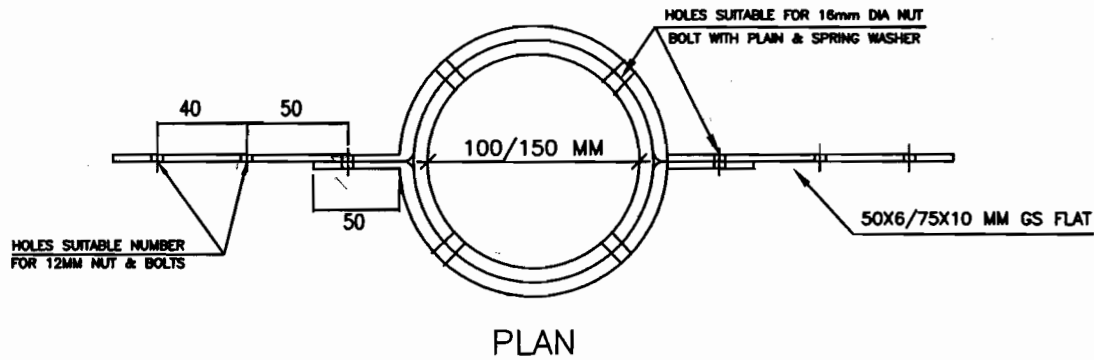
DRG. No.

SKETCH SK-1

REV. 01

SHEET No.

SKETCH SK-2



BILL OF MATERIAL:-

SN	ITEM	UNIT	QTY.
1	100/150MM INNER DIA CI PIPE CONFORMING TO IS :1536-1960	NO.	01
2	16MM NUT, BOLT INCLUDING 1 NO. PLAN WASHERS AND 1 NO. SPRING WASHER	SETS.	06
3	12MM NUT, BOLT INCLUDING 1 NO. PLAN WASHERS AND 1 NO. SPRING WASHER	SETS.	04
4	50X6 OR 75X10 MM GS FLAT (HALF RING)	PAIR	01

SPECIAL NOTE:

1. ALL DETAILS ARE TYPICAL.
2. PROJECT SPECIFIC DRAWING TO BE SUBMITTED BY VENDOR FOR APPROVAL.

NOTE:-

1. ALL DIMENSIONS ARE IN MM
2. ALL NUT AND BOLTS ARE HOT DIP GALVANIZED.
3. WASHERS SHALL BE ELECTRO-GALVANIZED.
4. Cast iron pipe shall be supplied with GS flat suitably wrapped and connected through welding/bolting to minimize contact resistance.



COMPUTERREF.NO.

DRG. No.

SKETCH SK-2

REV. 03

SHEET No.

SECTION - 2

STANDARD SPECIFICATION

2.1 APPLICABLE STANDARDS

The materials shall strictly conform to the following Indian Standards, as appropriate:

The materials shall confirm to the latest editions of the following Indian Standards:

- IS 2062: 2011 Steel for general structural purposes
- IS 1730: 1998 Dimensions for steel plate, sheets, strips and flats for general engineering Purposes.
- IS 1731: 1971 Dimensions for steel flats for structural and general engineering purposes.
- IS 2629: 1985 Recommended practices for Hot-dip galvanizing on iron & Steel
- IS 2633: 1986 Methods for testing uniformity of coating of zinc- coated articles.
- IS 1852: 1985 Rolling & Cutting Tolerance for hot rolled steel products.
- IS 1239 (Part 1): 1990 Specification for mild steel tubes, tubular and other wrought steel fittings (Mild Steel tubes)
- IS 1239 (Part 2): 1992 Specification for Mild steel tubes, tubular and other wrought steel fittings (Mild Steel Sockets)
- IS 4826 – 1979 Hot-dipped zinc coatings on mild steel tubes
- IS 4759: 1984 Hot Dip Coatings on Structural Steel and other allied Products
- IS 6745: 1972 Determination of mass of Zinc Coating on Zinc Coated Iron and Steel Articles
- IS 1536: 1993 Cast Iron Pressure Pipe -Specification

2.2 CONSTRUCTIONAL FEATURES

2.2.1 MILD STEEL FLATS

All steel required for earthing material shall confirm to Grade –A (Item Designation – Fe410W) of IS:2062: 2011.

2.2.2 EARTH ELECTRODES

- (1) The earth electrodes (Galvanised Iron) shall be perforated and fabricated out mild steel pipes and shall conform strictly to IS 1239 – 2004.
- (2) The earth electrodes (Cast Iron) shall be perforated and fabricated out cast iron pipes and shall conform strictly relevant IS: 3043-2006.

Note: Latest revisions shall be followed for all mentioned standard.

SECTION - 3

GENERAL SPECIFICATIONS

3.1 INSPECTION AND TESTING

All tests and inspection of the equipment specified shall be performed to the extent and in the manner as stipulated in the relevant standards and in this specification. All type test/routine tests/acceptance tests as specified shall be conducted as per the details mentioned in the Purchase order for this equipment.

3.2 DOCUMENTATION SCHEDULE AT CONTRACT STAGE: (DOCUMENTATION REQUIREMENT SHALL BE SPECIFIED BY PROJECT PPE AT CONTRACT STAGE AND SHALL VARY FROM PROJECT TO PROJECT).

A (No. of Copies)	For Approval
	Copies of GA drawings with projects details, dimension, equipment weight, fixing details, tolerances and terminal details etc.
	Copies of GTP
	Copies of type test reports
	Copies of manufacturing quality plan.
B (No. of Copies)	After Approval and For Information/Distribution.
	Copies of GA drawings
	Copies of GTP
	Copies of type, Routine & Acceptances tests.
	Copies of manufacturing quality plan.
	Copies of shipping list detailing the description & quantities of all items being dispatched separately, with shipping weights, number of cases and dimensions.

3.3 Material shall not be dispatched without the approval of test certificates by purchasers.

3.4 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.

In general, screw threads shall be standard metric threads. The use of other thread from will be used only after prior approval. The supplier shall furnish locking devices for threaded fasteners, which will lock them in such a manner so as to prevent them from coming loose in transport and in service.

All joints and fastening shall be so designed, constructed and registered that the component part may be accurately positioned and restrained to fulfill their required function. The heads of all bolts shall register flush on the surface, which they fasten.

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.

Whenever possible, all similar parts of the works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall be interchangeable with, and shall be made of the same materials and workmanship as the corresponding parts of the equipment supplied under the specification. Where feasible, common component units shall be employed in different pieces of equipment in order to minimize spare parts stocking requirements. All equipment of the same type and rating shall be physically and electrically interchangeable.

The supplier shall apply all lubricants used for installation and operation of the equipment. All consumable required for one-year operation shall be in the scope of supplier.

All components exposed to rain shall be designed with sloped upper surface to avoid water pools.

3.5 SURFACE TREATMENT

- 3.5.1** All metal surfaces shall be treated to provide anti-corrosion protection. All ferrous surfaces for external use shall be hot-dip galvanized after fabrication. High Tensile steel nuts and bolts and spring washers shall be electro-galvanized to service condition .

36 WELDING

All welding shall be done by a qualified welder.

3.7 PACKING AND MARKING

3.7.1 PACKING

GI Flat may be supplied in open condition. However, while stacking the materials for transportation it should be ensured that, similar items are grouped and tied with steel wires /

strips for convenient handling and shall be done in such away to avoid damage during transits.

3.7.2 MARKINGS

The following details shall be marked on the packing:

- i) Name and address of the consignee
- ii) Purchase Order No:
- iii) Name of supplier
- iv) Description of material
- v) Tare weight
- vi) Gross weight

SECTION - 4

GUARANTEED TECHNICAL PARTICULARS for ELECTRODES

1.0 EARTH ELECTRODE (Galvanized iron)

- 2.1 Mild Steel pipe OD (mm)
- 2.2 Mild Steel ID (mm)
- 2.3 Thickness of zinc –coating
- 2.4 Weight of zinc coating
- 2.5 Applicable standards

2.0 EARTH ELECTRODE (Cast Iron)

- 3.1 Cast Iron Pipe OD (mm)
- 3.2 Cast Iron Pipe ID (mm)
- 3.3 Applicable standards

CHECK LIST FOR INFORMATION TO BE FURNISHED WITH OFFER
RETURN THIS CHECKLIST AS PART OF THE OFFER DULY SIGNED

The offer may not be considered if the following information and this Checklist are not enclosed with the Offer.

BHEL ENQUIRY. NO:
BIDDER OFFER REFERENCE:

(1)	(2)	(3)	(4)	(5)
S.No.	Parameter	Requirement	Yes / No	Remarks in case reply in Col (4) is NO
1.0	Weight of Zinc coating	Weight of zinc coating shall be as per clause 2.4 of Section-2		
2.0	Tolerance in the flat size	Tolerance in the flat size shall be as per IS:1852-1985		
3.0	Chemical composition of flat/CI Pipe/GI Pipe	Certified copy of the chemical composition of the material as per the relevant standards shall be supplied before the dispatch of the material.		
4.0	Earth electrode	Electrode arrangement shall be provided as per sketch no. SKTECH SK-1 / SKETCH SK-2		
5.0	PG stamp	Raw material shall be inspected at source by Powergrid/BHEL.		
6.0	Length	4 to 6 mtrs		
7.0	Conformance	With enclosed QP		

Date:

Signature of the authorized representative of Bidder

Company Seal



QUALITY PLAN

ITEM: CI PIPE ELECTRODE

OP NO: TBQM-STD-CIE
REV: 00
DATE: 15-01-11
Page 1 of 2

PROJECT:

PACKAGE/CONTRACT:

CONTRACTOR: BHEL

FORMAT OF RECORD

AGENCY

REMARKS

S.NO.	COMPONENT / OPERATION	CHARACTERISTIC CHECKED	CATEGORY	TYPE OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	9	10	11	12	13
1	2	3	4	5	6	7	8	D				

1.0	INCOMING MATERIALS:											
1.1	MS FLATS	Freedom from defects	Major	Visual	100%	IS 2062	IS 2062	Internal Logbook	M		C	a) MS Flat to be taken from BHEL approved Sources.
		Dimensions		Measure ments	10 %	IS 1852	IS 1852		M		C	b) Correlation of Material Test Certificates to be maintained.
		Mech. Properties		Mech	As per IS 2062	IS 2062	IS 2062	Lab Report / Mfr. TC	Y	M	C	
		A. Yield Strength										
		B) Tensile Strength										
		C) % Elongation										
		D) Bend Test										
		4) Chem. Composition		Chem.	As per IS 2062	IS 2062	IS 2062	Lab Report / Mfr. TC	Y	M	C	
1.2	CI PIPES	Freedom from defects	Major	Visual	100%	IS 1536	IS 1536	Internal Logbook	M		C	a) CI Pipe to be taken from BIS licensees Manufacturer and a copy of valid licensees to be submit along with Test Report.
		Dimensions		Measure ments	10 %				M		C	
		Mech. Properties		Mech	As per IS 1536			Lab Report / Mfr. TC	Y	M	C	b) Co-relation of Material Test Certificates to be maintained.
		c) Hydrostatic Test	-do-	Mechani cal	As per IS 1536	IS 1536	IS 1536	"	M		C	
		4) Chem. Composition		Chem.	IS 1536	IS 1536	IS 1536	"	Y	M	C	
1.3	Hardware (Nuts, Bolts, Plane Washer &	Mechanical, Chemical and Galvanizing test	-do-	Review	IS 1367 - F-17	IS 1367 - P-17, IS 1363, IS 3063 & IS 2016	IS 1367 - P-17, IS 1367, IS 1363, IS 3063 & IS 2016	Lab Report / Mfr. TC	Y	M	C	Hardware to be taken from BHEL approved Sources.
BHEL SIGN & SEAL		LEGEND:		M - MANUFACTURER / SUB CONTRACTOR		P - PERFORMED BY		NAME & SIGN OF				
				C - BHEL / NOMINATED INSPECTOR AGENCY		W - WITNESSED BY						
				N - CUSTOMER / CUSTOMER NOMINATED AGENCY		V - VERIFICATION BY						

Signature of the Quality Engineer (TBQM)

Signature of the Business Group



QUALITY PLAN

ITEM : GI FLAT / GI PIPE ELECTRODE

QIP NO : TBQM-STD-QIP
REV: 01
DATE : 12-01-11
Page 3 of 4

PROJECT :

PACKAGE / CONTRACT :

CONTRACTOR : BHEL

FORMAT OF RECORD

AGENCY

REMARKS

S.NO.	COMPONENT / OPERATION	CHARACTERISTIC CHECKED	CATEGORY	TYPE OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS	
									P	W	V		
1	2	3	4	5	6	7	8	9	D	10	11	12	13

d)	Rinsing	visual	-do-	Visual	100 %	IS 2629-1985	IS 2629-1985	"	M	C		
e)	Preluxing	Chem.	-do-	Sp. Gr.	One sample for per shift	IS 2629-1985	IS 2629-1985	"	M	C		
f)	Drying	Visual	-do-	Visual	100 %	Value 1.1-1.3	Value 1.1-1.3	"	M	C		
g)	Hot Dip Galvanizing Zinc Temp.	Visual	-do-	Measure ment	Hourly Reading	IS 2629-1985 450-460 deg C	IS 2629-1985 450-460 deg C	"	M	C		
3.2	Dipping in zinc	"	-do-	Visual	100%	IS 2629-1985 450 to 460 deg C	IS 2629-1985 450 to 460 deg C	"	M	C		
a)	Quenching	"	-do-	"	"	IS 2629-1985 450 to 460 deg C	IS 2629-1985 450 to 460 deg C	"	M	C		
b)	Passivation	Chem.	-do-	"	"	IS 2629-1985 450 to 460 deg C	IS 2629-1985 450 to 460 deg C	"	M	C		
3.3	GALVANISING TESTS:											
a)	Surface finish no black/dare spots, ash flux, inclusions lumps, pimples and runs etc. (except small & suitable for patching)	-do-	Visual	100%	IS 2629-1985	IS 2629-1985	IS 2629-1985	Internal Logbook	M	C		
b)	Adhesion Test	-do-	Hammer Test	3 samples per shift	IS 2629-1985	IS 2629-1985	IS 2629-1985	"	M	C		
c)	Thk of coating	-do-	Physical	"	IS 2629-1985	IS 2629-1985	IS 2629-1985	"	M	C		
d)	Wt. Of zinc	-do-	Measure ment	"	IS 6745-1972	IS 6745-1972	IS 6745-1972	"	M	C		
e)	Preece Test	-do-	Chem.	"	IS 2633-1985	IS 2633-1985	IS 2633-1985	IS-4759	M	C		

BHEL
SIGN & SEAL

LEGEND:
M - MANUFACTURER / SUB CONTRACTOR
C - BHEL / NOMINATED INSPECTOR AGENCY
N - CUSTOMER / CUSTOMER NOMINATED AGENCY
P - PERFORMED BY
W - WITNESSED BY
V - VERIFICATION BY

BY
FOR
DEPUTY MANAGER
QUALITY CONTROL
BHEL
Bhilai
Jharkhand
India



QUALITY PLAN

ITEM : GI FLAT / GI PIPE ELECTRODE

OP NO : TBQM-STD-01F
REV: 01
DATE : 12-01-11
Page 4 of 4

PROJECT :

PACKAGE / CONTRACT :

CONTRACTOR : BHEL

S.NO.	COMPONENT / OPERATION	CHARACTERISTIC CHECKED	CATEGORY	TYPE OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	REMARKS
1	2	3	4	5	6	7	8	9	D 10 11 12	13

4.0	FINAL INSPECTION							1984					
4.1	Calibration of measuring and testing eqpt..	Calibration	Major	Visual	100%	Periodicity of calibration not to exceed 12 months	Periodicity of calibration not to exceed 12 months	Calibration records	M		C		Calibration should have been done in reputed laboratory
4.2		a) Visual & Dimensions	-do-	Visual	100%	IS 2629/802-10985-1978	IS 2629/802-10985-1978	Inspection report	M		C		
				Measurement	as per IS 2500-1992 level S4	Appd. Drgs.	Appd. Drgs.		M		C		Final inspection by BHEL
		b) Mech. And Chem. Test as indicate in Cl. 1.1 & 1.2	-do-	Mechanical & Chemical	As indicated in cl. 1.1 & 1.2	As listed in 1.1 & 1.2	As listed in 1.1 & 1.2		M		C		Final inspection is a CHP
		c) Galvanizing. Tests as indicated in 3.3	-do-	Mechanical & Chemical	SS/lot offered	IS 6745-1972	IS 6745-1972		M		C		
5.0	Hardware (Nuts, Bolts, Plane Washer & Spring Washer)	Mechanical, Chemical and Galvanizing test	-do-	Review	IS 1367 - P-17	IS 1367 - P-17 IS 1367, IS 1363, IS 2053 & IS 2016	IS 1367 - P-17 IS 1367, IS 1363, IS 2053 & IS 2016	Lab Report / Mfr. TC	Y	M		C	Hardware to be taken from BHEL, approved Sources.
6.0	PACKING	Material, Sturdiness, marking, checking with Packing list	-do-	Visual	100%	BHEL Spec.	BHEL Spec.	Subcontract certificate	M				

BHEL

SIGN & SEAL

LEGEND:

M - MANUFACTURER / SUB CONTRACTOR

C - BHEL / NOMINATED INSPECTION AGENCY

N - CUSTOMER / CUSTOMER NOMINATED AGENCY

P - PERFORMED BY

W - WITNESSED BY

V - VERIFICATION BY

Signature of Mr. P. S. SINGH

Signature of Mr. P. S. SINGH

Signature of Mr. P. S. SINGH

Signature of Mr. P. S. SINGH

Signature of Mr. P. S. SINGH

SEA WORTHY PACKING FOR EXPORT JOBS

1.0 SCOPE:

For export jobs, 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 flexural & 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, longitudinal under slide boards shall be fixed. To avoid damage to the box while lifting sling plates shall be provided. Refer fig. 11.

1/16

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. Wherever 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 sandwiching 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/thermocol 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.

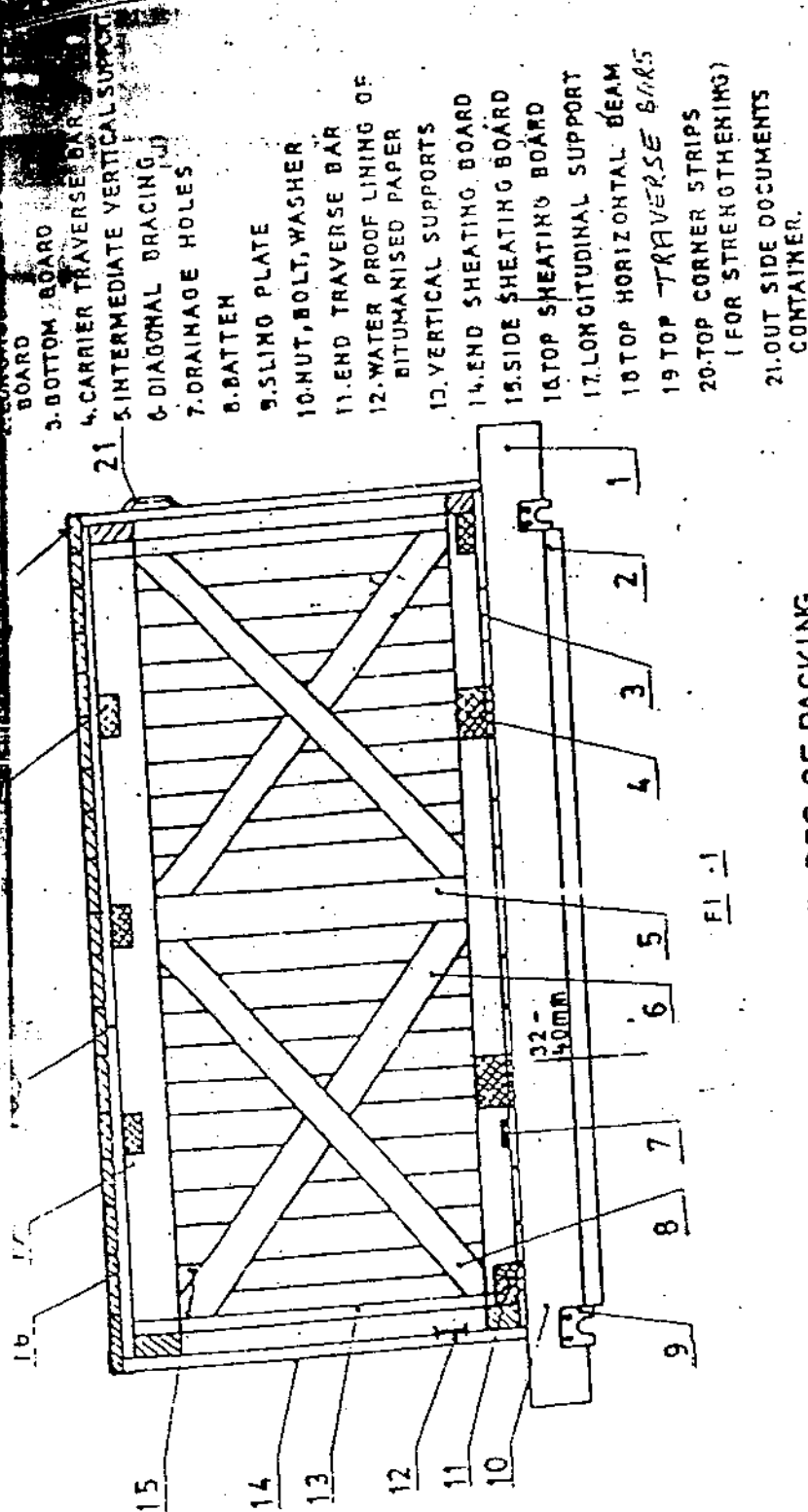
Dispatch details such as consignor/consignee address, contract and case details, country of origin , port of delivery, stacking instructions shall be written on one of the side of boxes. An anodised aluminium plate shall be provided on one side of the boxes.

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 --



NOMENCLATURE OF PARTS OF PACKING

CASIS

FIG. -1

EC 009

BOTTOM FRAME ARRANGEMENTS

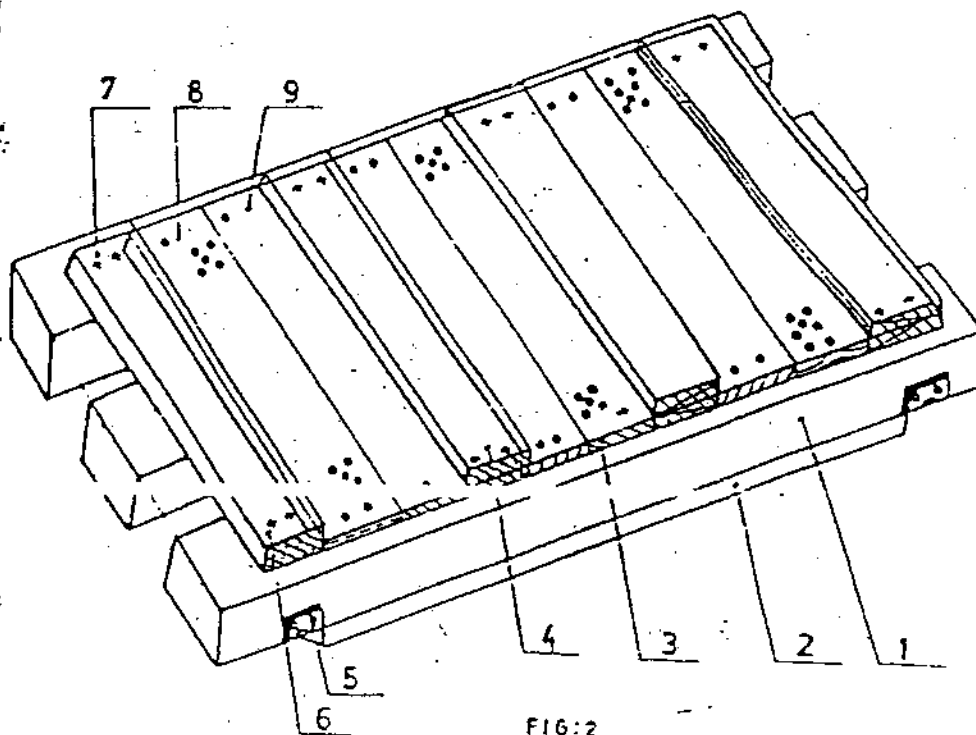


FIG:2

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 I

Cross section of end traverse bar: 100x100 mm
(minimum)

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

TOP FRAME ARRANGEMENT

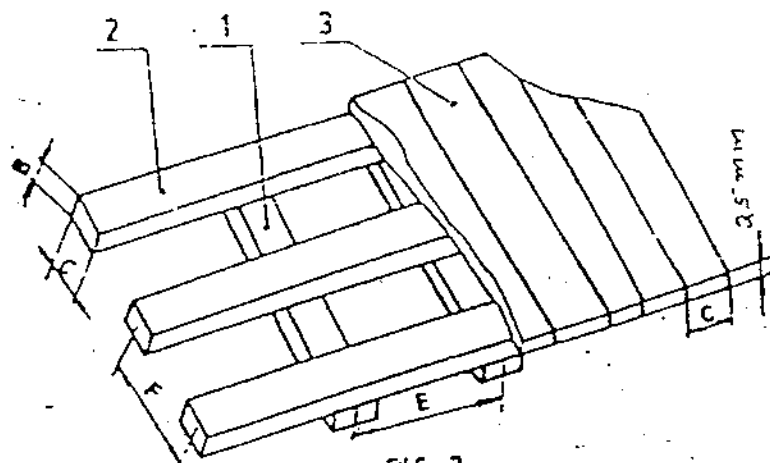


FIG-3

Dim F : 700 to 1000 mm
 Dim E : 500 to 900 mm
 BXC : 30x100 mm.

- 1 - Traverse Bars
- 2 - Horizontal Soaps
- 3 - Top Board

ARRANGEMENT OF C-CLAMPS AROUND CASES

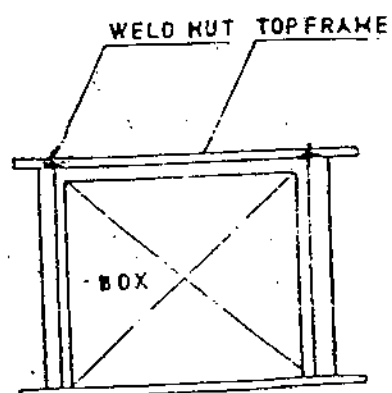
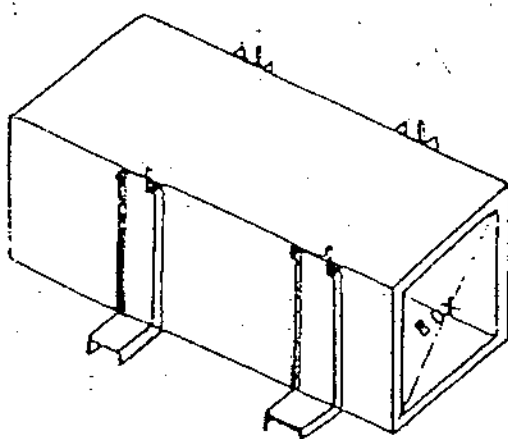


FIG-4

ARRANGEMENT OF DIAGONAL BRACING AND HORIZONTAL SUPPORT

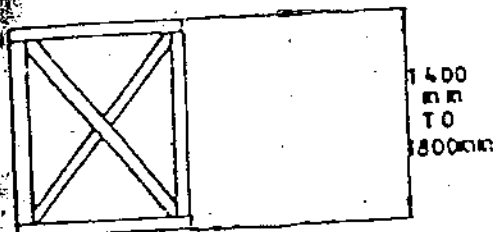


FIG: 6

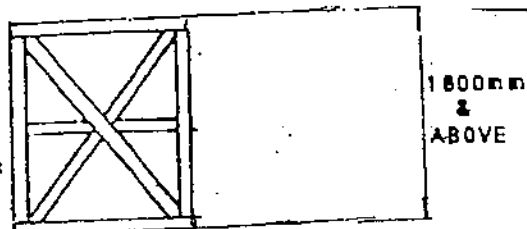


FIG: 8

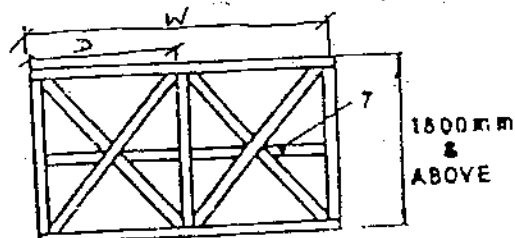


FIG: 9

7- Middle Horizontal Support

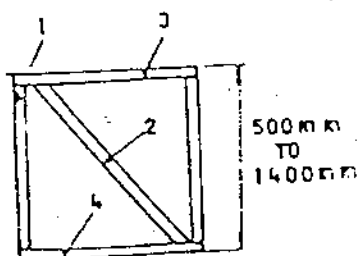


FIG: 5

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

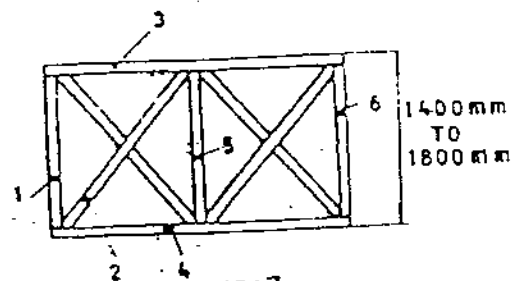
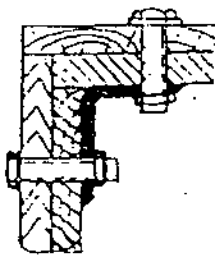
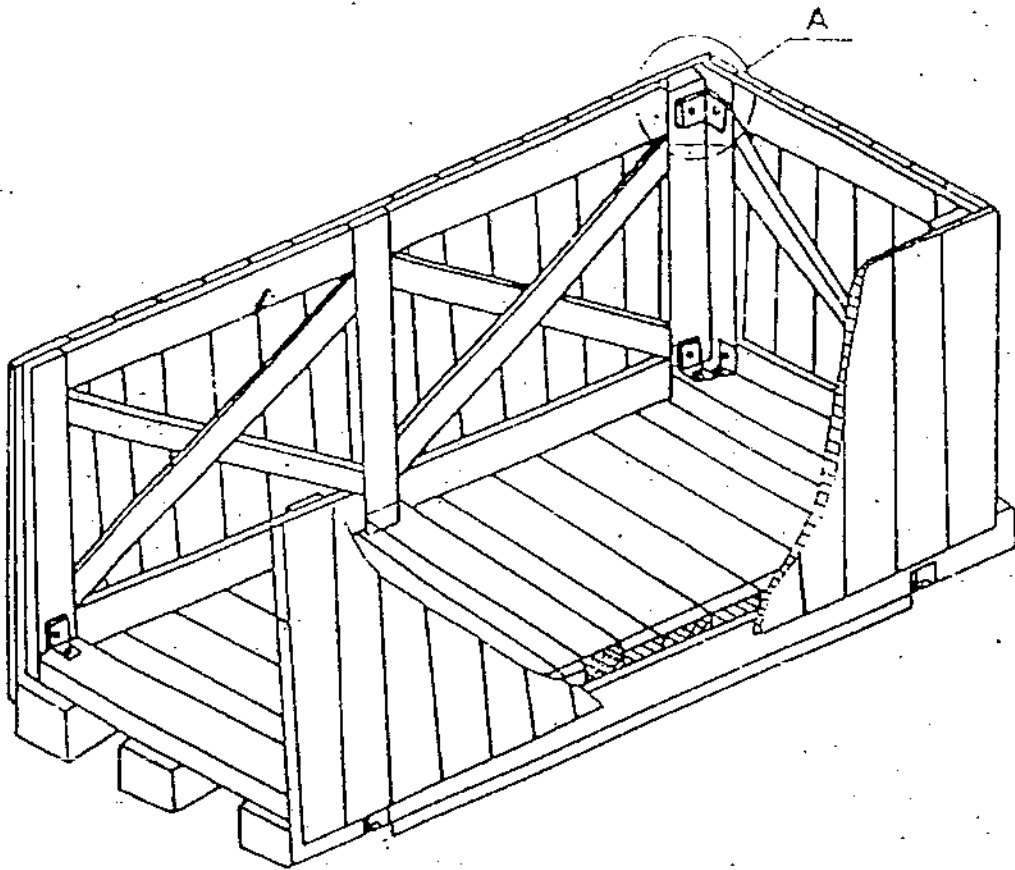


FIG: 7

- 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

HOLE DIAMETER
MUST CONFORM
TO BOLT DIA

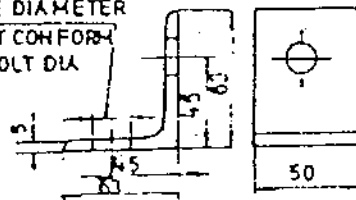


FIG:10

25

ARRANGEMENT OF SLING - PLATE ON
CASES

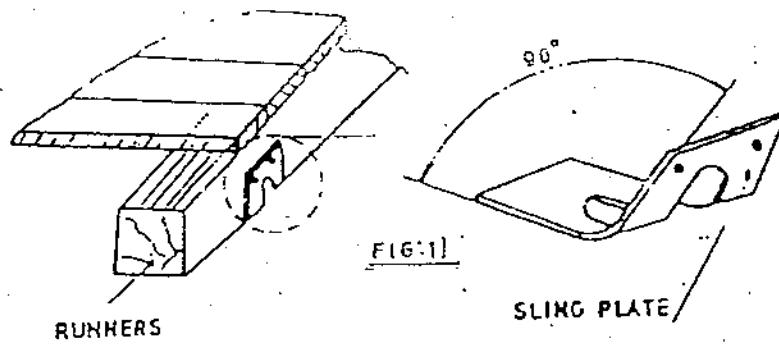


Table 1

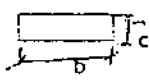
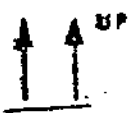
load	Length of Slides						
	600	800	1000	1200	1300	1500	2000
	Cross Section b x c						
							
500	50 x 100	50 x 100	50 x 100	50 x 100	75 x 100	75 x 100	100 x 100
500	50 x 100	50 x 100	75 x 100	75 x 100	75 x 100	75 x 100	100 x 100
1000	75 x 100	75 x 100	75 x 100	100 x 100	100 x 100	100 x 110	100 x 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)						
Fig 5 to Fig 9	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
	1601 to 2000	30 x 130	30 x 130	30 x 130	30 x 130	30 x 130	30 x 130	30 x 130
	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

(20)

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

116/12

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.

31

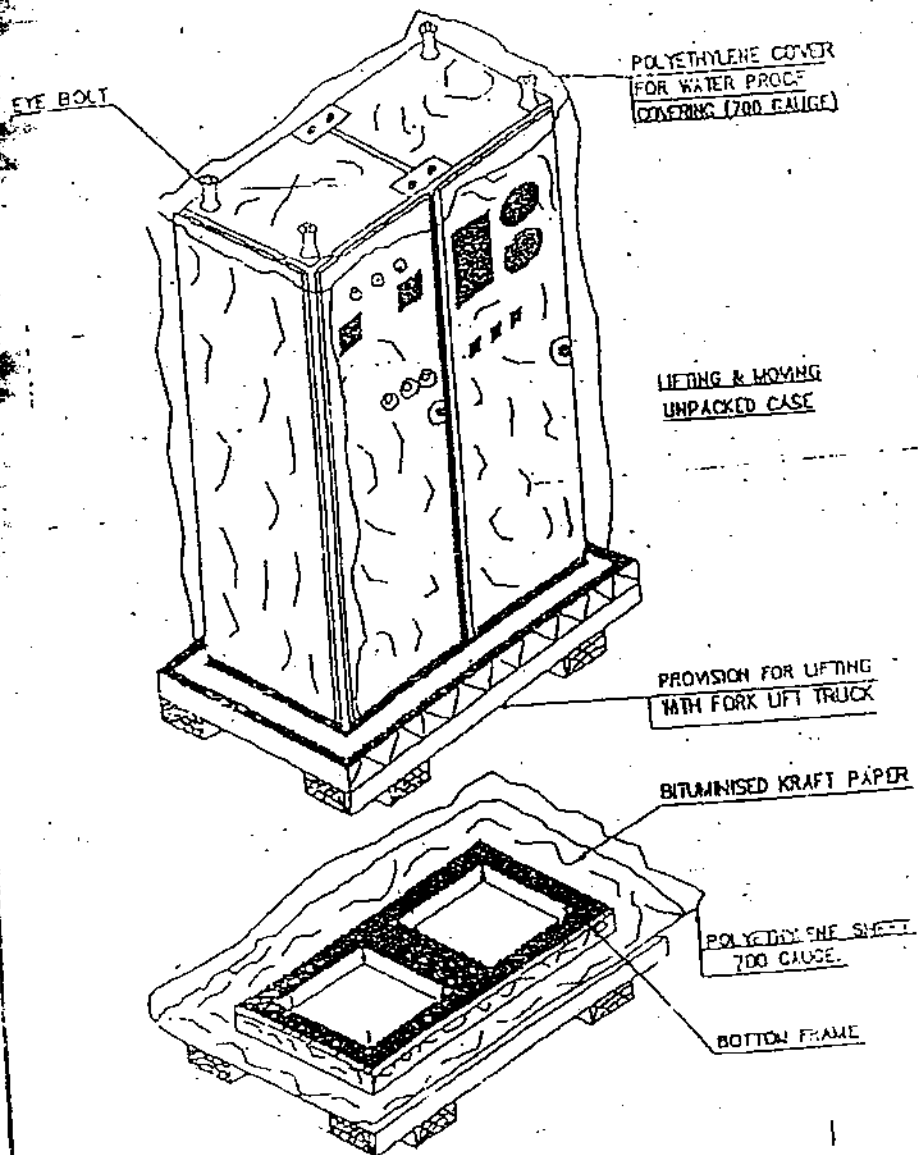


FIGURE-14

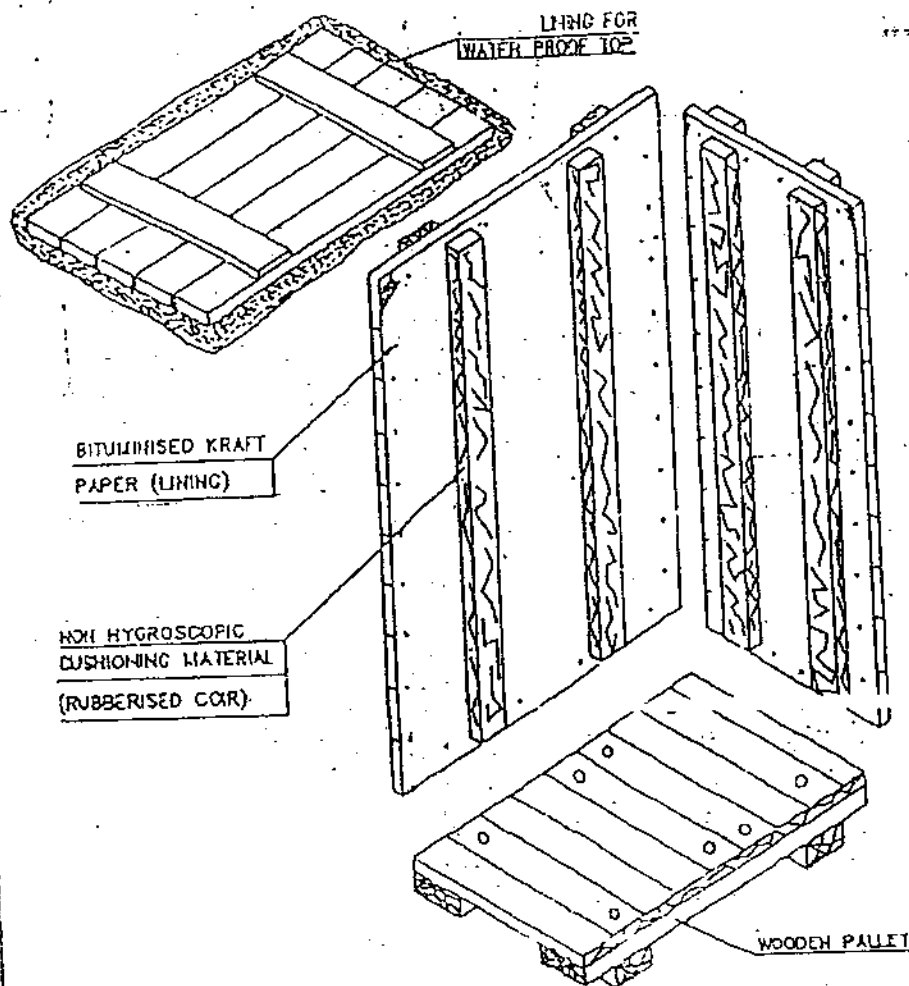


FIGURE-15

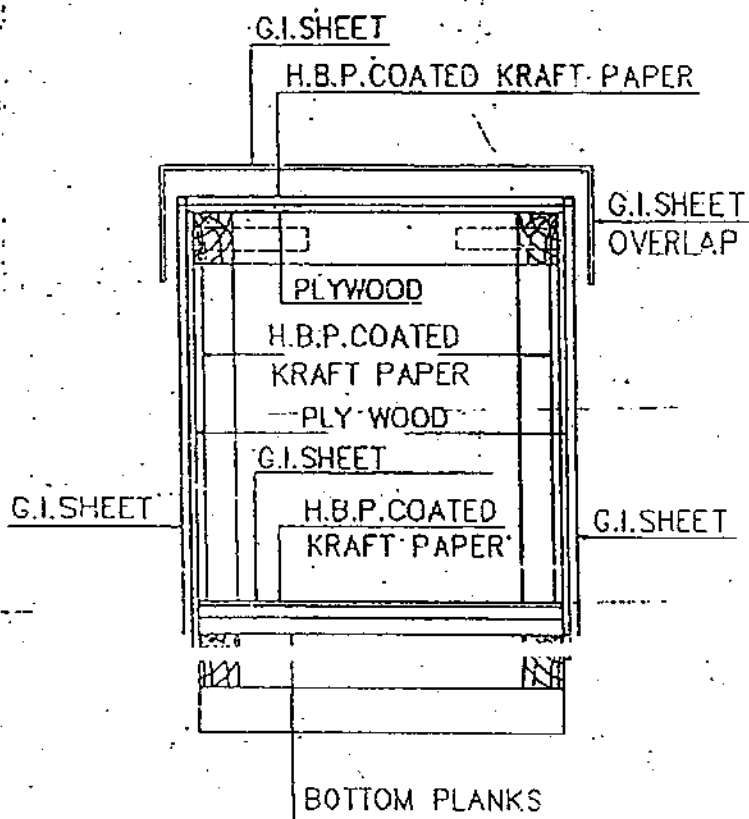


FIG-16 : CLOSED PACKING CASE WITH G.I. SHEET
SHOWING LAYERS OF PACKING MATERIALS.