BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS GROUP
ENGINEERING MANAGEMENT, NEW DELHI

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BHEL Document No.	Rev.		Prepared by	Checked by	Approved by
TB-xxx-316-141	05	Name			
Type of Document STANDARD SPECIFICATION		Sign	—Sd—	—Sd—	—Sd—
Title CABLE TRAY MATERIAL		Date			
		Group	TBEM		
		W.O. No			
Customer / Consultant					
Tender					

CONTENTS

Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS
05	15.04.15	15-4-15		Rakesh 15/4/15	Documents updated and Tray Cover Included
04	10.05.13	—Sd—	—Sd—	—Sd—	Tray Bends have been included.
03	10.11.10	—Sd—	—Sd—	—Sd—	Thickness of tray has been revised from 2.5 mm to (2.0 to 3.0 mm)
02	08.07.09	—Sd—	—Sd—	—Sd—	Documents updated
01	10.08.07	—Sd—	—Sd—	—Sd—	Different types of tray added and technical specification revised as per project requirement.

Distribution	To					
	Copies					

SECTION-1

SCOPE, SPECIFIC TECHNICAL REQUIREMENTS AND QUANTITIES

1.0 SCOPE

This technical specification covers the requirements of design, manufacture, testing at works, packing and dispatch of Cable Tray Material complete with accessories as listed below.

This section covers the general technical requirements of Cable Tray Material. In case of any discrepancies between the requirements mentioned in this section and those specified in other sections of this specification, *the requirement of this section* shall prevail and shall be treated as binding requirements.

1.1 TECHNICAL PARAMETERS

Type of cable trays:	**Ladder Type**	**Perforated Type**
Thickness of sheet metal for trays & fittings etc.	**2.0 to 3.0 mm**	**2.0 to 3.0 mm**
Accessories with Trays:	2 Nos. side plate along with 8 **Nos.**, M8 bolts with nuts and 2nos washers with each bolts.	2 Nos. side plate along with 8 **Nos.**, M8 bolts with nuts and 2nos washers with each bolts.
Tray Cover		
Thickness of sheet metal for Tray Cover	***1.5 to 3.0 mm***	***1.5 to 3.0 mm***
Accessories with Tray Cover:	*3 Nos. Clamps along with 6 **Nos.**, M8 bolts with nuts and washers with Hardware for Fixing Cover over the Trays.*	*3 Nos. Clamps along with 6 **Nos.**, M8 bolts with nuts and washers with Hardware for Fixing Cover over the Tray.*

1.2 BILL OF QUANTITIES (TYPICAL)

S. No.	**Item**	**Quantity (Domestic) in MT**	**Quantity (Export) in MT**
1.	Ladder Type Trays: 150 -750mm wide, 100mm high, 2.5 ***to 3*** M ***Long*** Galvanised Iron Ladder Type Cable Trays along with 2 nos. side coupler plate & hardware (Clause no. 1.1)	--	--
2.	Perforated Type Trays: 100-150mm wide x50mm high, 200-750mm wide x100mm high, 2.5 ***to 3***M Long Galvanised Iron Perforated Type Cable Trays along with 2 nos. side coupler plate & hardware (Clause no. 1.1)	--	--
3.	150-750 mm wide, 100mm high Galvanized iron ladder type 90° Cable tray BENDS/ELBOW (Horizontal/vertical/outside/inside), Tee bends, Cross, reducer along with 2 nos. side coupler plate & hardware (Clause no. 1.1)	--	--

4.	100-750 mm wide, 100mm high Galvanized iron perforated type 90° Cable tray BENDS/ELBOW (Horizontal/vertical/outside/inside), Tee bends, Cross, reducer along with 2 nos. side coupler plate & hardware (Clause no. 1.1)	--	--
5.	M8/*M10* Bolts/ ***J Bolts, 50x25x3 GI Cleates*** along with Nut and 2 nos. plain washers (Refer Note-4)	--	--
6.	Tray Cover of 2 to 3mm thick Galvanised Iron sheet with fixing Accessories	--	--

Notes:

1. Quantity shall be as per Indent.
2. Quantity may vary by ±30%.
3. 10% extra hardware shall be supplied along with the item no. 1 to 4 above.
4. M8 bolts along with nuts & washers as per clause no. 1.1 are deemed to be included with respective trays/bends (item no. 1 to 4). M8/ ***M10*** bolts mentioned at serial no. 5 are for **additional use** of fixing tray with racks and if required shall be separate in project wise indented BOQ.
5. ***Weight of Trays shall be final weight after punching the holes and galvanising.***

1.3 SEAWORTHY PACKING FOR EXPORT PROJECT:

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.

Minimum requirement for seaworthy packing are as follows:

i. Individual item shall be wrapped using polyethylene sheets and further lots shall be wrapped in Bitumen coated hessian cloth.

ii. Markings shall be provided on the boxes/wrapped polyethylene sheet indicating position of boxes for handling, storage and nature of consignment. The ink used for this purpose as well as for marking dispatch instruction shall be indelible/non-washable marking ink

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

iv. 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 anodized aluminium plate shall be provided on one side of the boxes.

v. 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.

1.4 TECHNICAL SPECIFICATION FOR QUALIFYING REQUIREMENT:

1. Bidder shall be Manufacturer of Trench Material.
2. Bidder should have Galvanising facility at their works.
3. Manufacturer should have manufactured and supplied at least 2MT each of Cable Racks and Cable Tray material in India in any one year during last five years from the date of Technical Bid Opening.

1.5 QUALITY PLAN:

BHEL Standard manufacturing quality plan shall be followed.

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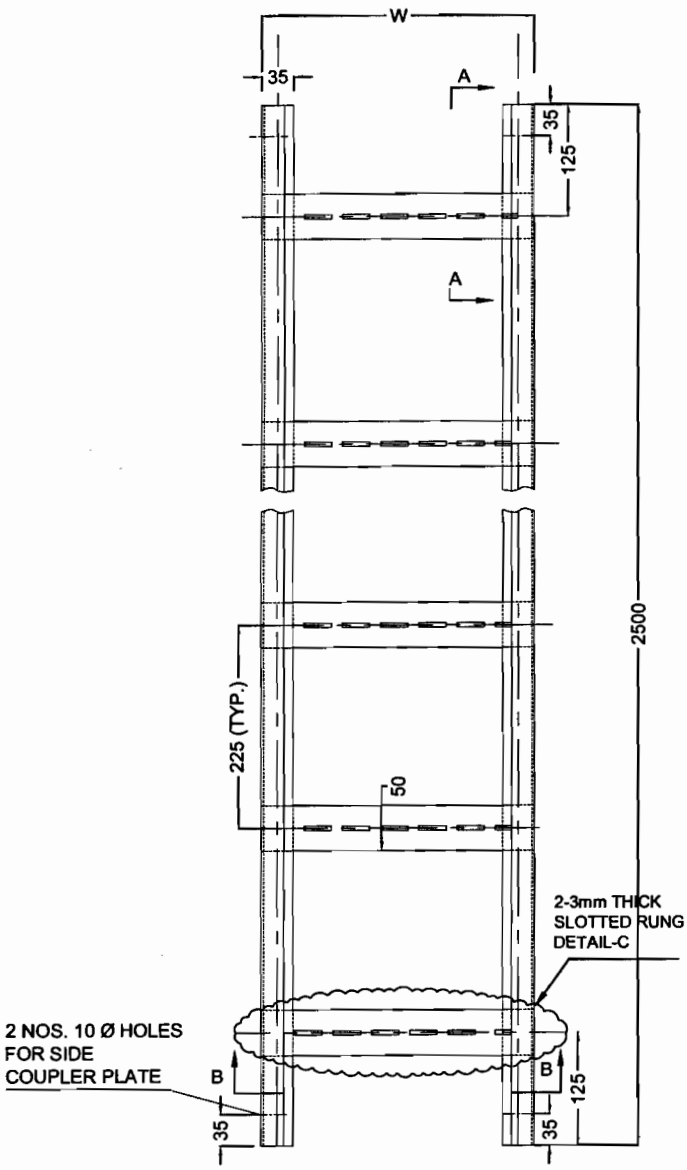
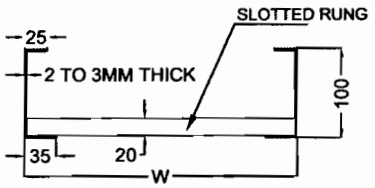
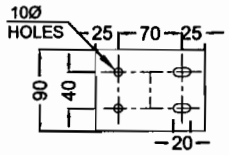
ANNEXURE-1



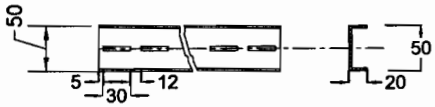


SEC-BB

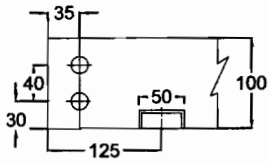
STRAIGHTLADDER TRAY



SIDE COUPLER PLATE 3mm THK



DETAIL-C



SEC-AA

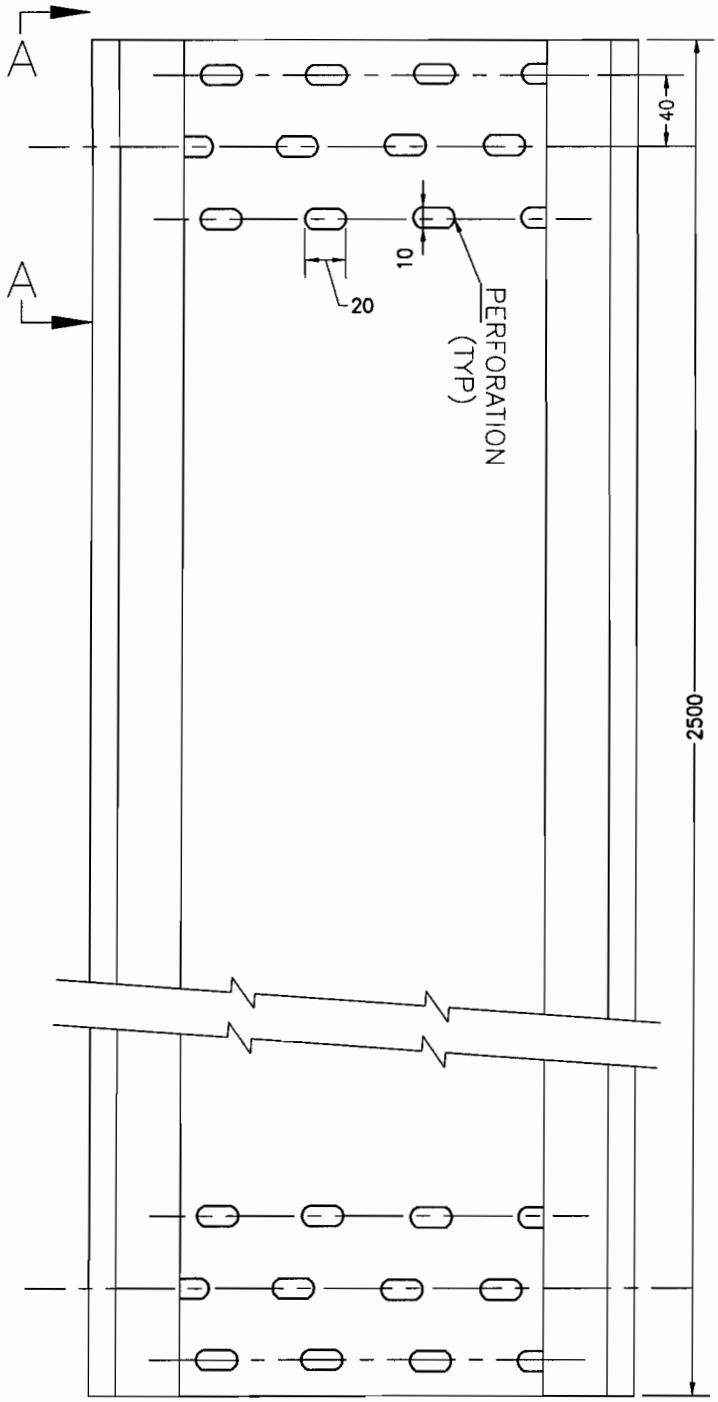
NOTES:

1. WIDTH 'W' MAY VARY BETWEEN 150 MM TO 750 MM.
2. WIDTH 'A' SHALL VARY ACCORDING TO TRAY WIDTH.
3. THE ABOVE DRAWING IS INDICATIVE ONLY. DIMENSION DETAIL MAY CHANGE AS PER INDIVIDUAL PROJECT REQUIREMENTS.
4. BIDDER WILL HAVE TO SUBMIT THE ACTUAL DRAWINGS FOR EACH INDIVIDUAL PROJECT BASED ON THE INPUT FROM BHEL FOR CUSTOMER APPROVAL.
5. WEIGHT OF ZINC COATING SHALL BE 460gm/sq.m

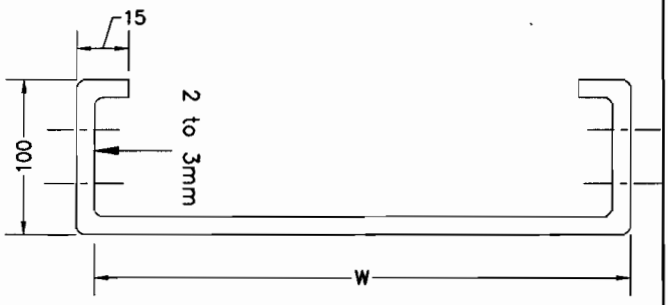
STANDARD GALVANISED STEEL SHEET LADDER TYPE CABLE TRAYS

COMPUTERREF.NO.	DRG.NO	REV.	SHEET NO.
	TB-4-xxx-316-141	00	1 OF 5

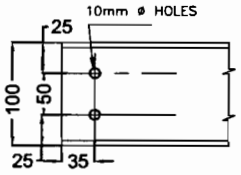
ANNEXURE-1



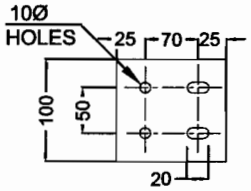
PLAN



END VIEW



SECTION A-A



SIDE COUPLER PLATE 3mm THK

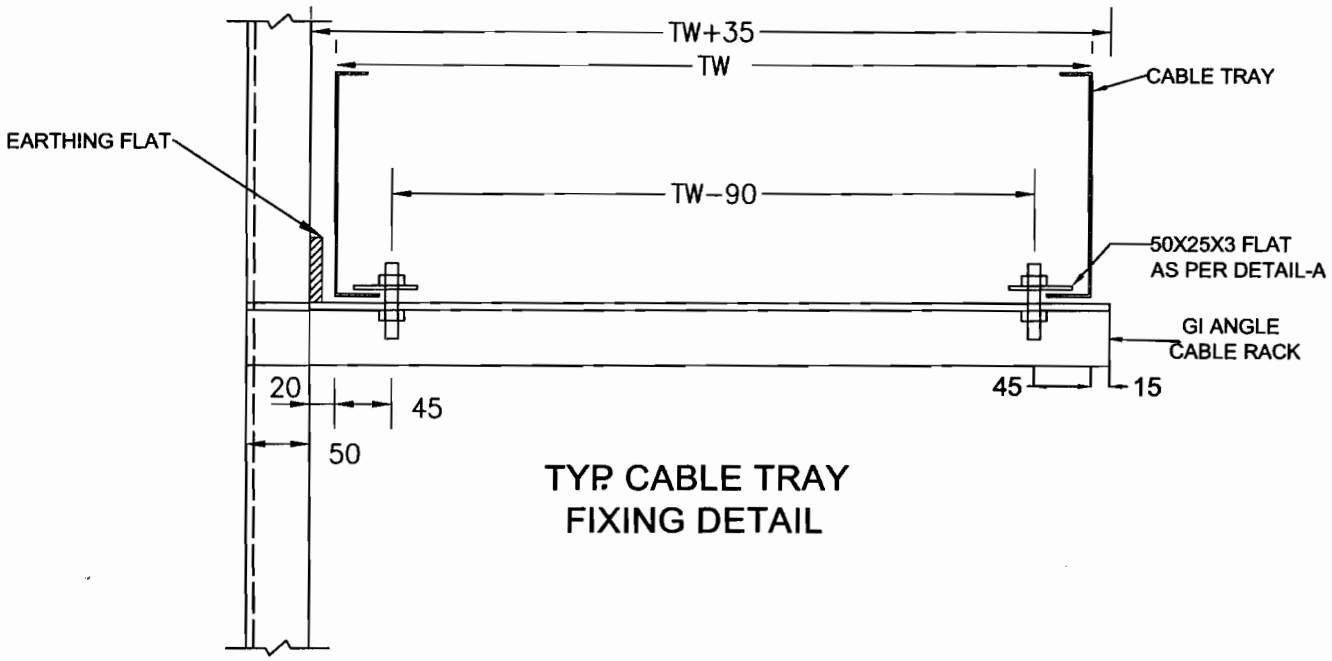
NOTES:

1. WIDTH 'W' MAY VARY BETWEEN 150 MM TO 750 MM.
2. THE ABOVE DRAWING IS INDICATIVE ONLY. DIMENSION DETAIL MAY CHANGE AS PER INDIVIDUAL PROJECT REQUIREMENTS.
3. BIDDER WILL HAVE TO SUBMIT THE ACTUAL DRAWINGS FOR EACH INDIVIDUAL PROJECT BASED ON THE INPUT FROM BHEL FOR CUSTOMER APPROVAL.
4. WEIGHT OF ZINC COATING SHALL BE 460gm/sq.m

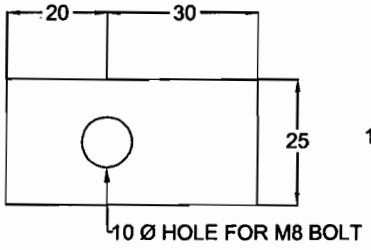
STANDARD GALVANISED STEEL SHEET PERFORATED TYPE CABLE TRAYS

COMPUTERREF.NO.	DRG.NO	REV.	SHEET NO.
	TB-4-xxx-316-141	00	2 OF 5

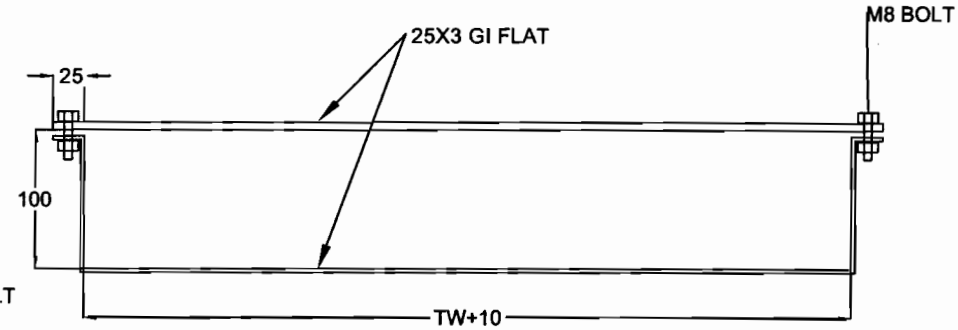
ANNEXURE-1



TYP. CABLE TRAY
FIXING DETAIL



DETAIL-A



TRAY COVER FIXING CLAMP

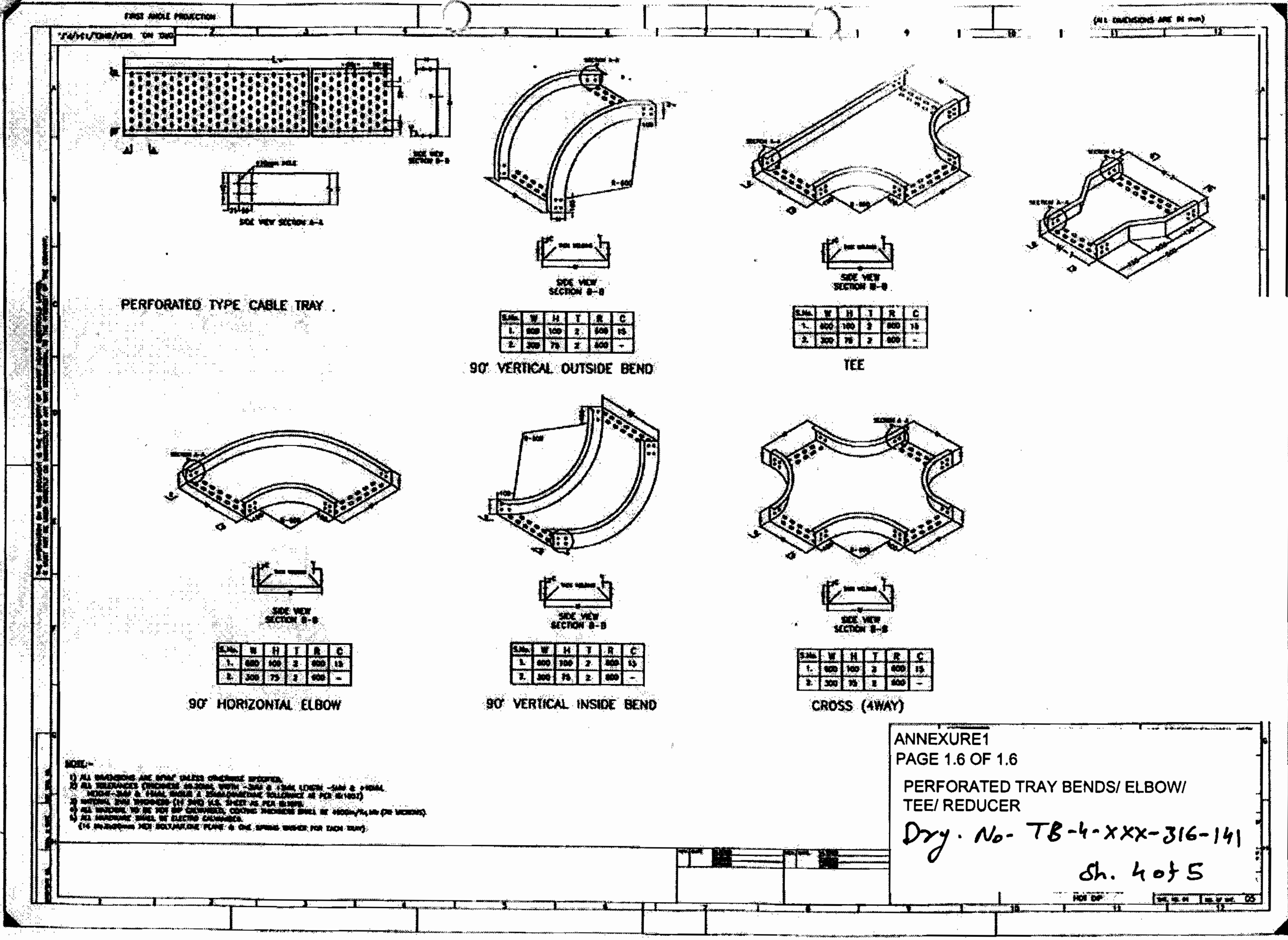
NOTES:

1. TRAY WIDTH 'TW' MAY VARY BETWEEN 150 MM TO 750 MM.
2. THE ABOVE DRAWING IS INDICATIVE ONLY. DIMENSION DETAIL MAY CHANGE AS PER INDIVIDUAL PROJECT REQUIREMENTS.
3. BIDDER WILL HAVE TO SUBMIT THE ACTUAL DRAWINGS FOR EACH INDIVIDUAL PROJECT BASED ON THE INPUT FROM BHEL FOR CUSTOMER APPROVAL.
4. WEIGHT OF ZINC COATING SHALL BE 460gm/sq.m

FIXING DETAILS FOR GI CABLE TRAYS

COMPUTERREF.NO.	DRG.NO	REV.	SHEET NO.
	TB-4-xxx-316-141	00	3 OF 5

Annexure-1



90° VERTICAL OUTSIDE BEND

S.No.	W	H	T	R	C
1.	600	100	2	600	15
2.	300	75	2	600	-

TEE

S.No.	W	H	T	R	C
1.	600	100	2	600	15
2.	300	75	2	600	-

90° HORIZONTAL ELBOW

S.No.	W	H	T	R	C
1.	600	100	2	600	15
2.	300	75	2	600	-

90° VERTICAL INSIDE BEND

S.No.	W	H	T	R	C
1.	600	100	2	600	15
2.	300	75	2	600	-

CROSS (4WAY)

S.No.	W	H	T	R	C
1.	600	100	2	600	15
2.	300	75	2	600	-

ANNEXURE1

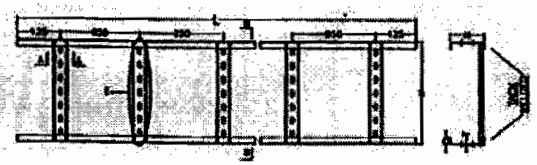
PAGE 1.6 OF 1.6

PERFORATED TRAY BENDS/ ELBOW/
TEE/ REDUCER

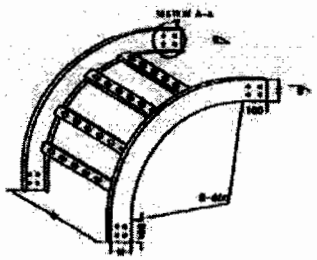
Drg. No- TB-4-XXX-316-141

Sh. 4 of 5

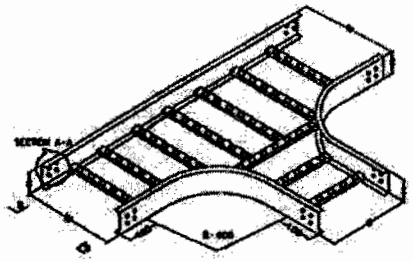
Sheet 4 of 5



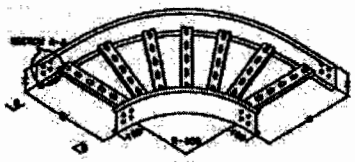
LADDER TYPE CABLE TRAY .



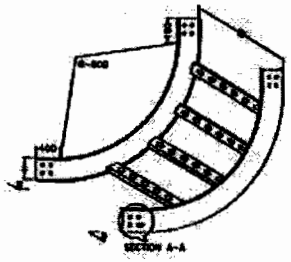
90° VERTICAL OUTSIDE BEND



TEE



90° HORIZONTAL ELBOW



90° VERTICAL INSIDE BEND

ANNEXURE1
PAGE 1.5 OF 1.6
LADDER TRAY BENDS/ ELBOW/
TEE/ REDUCER
Drg. No - TB-4-XXX-316-141
Sh- 5 of 5

Sheet 5 of 5

Annexure-1

SECTION -2

STANDARD SPECIFICATION

2.1 TECHNICAL PARAMETERS

CABLE TRAYS & BENDS

Material of cable trays:	Galvanised
Thickness of sheet metal for trays & fittings etc:	Slotted Rung & Side member- 2.0 to 3.0 mm thick
Whether Ladder type or perforated type:	Ladder/Perforated
Mass of Zinc coating:	460 gm/m^2
Accessories:	Coupler plates and associated hardwares.

2.2 APPLICABLE STANDARDS

The Cable trench material shall conform to the following Indian Standards:

Structural steel (Standard quality)	:	IS:2062
Hot Rolled Carbon Steel Sheets and Strips - Specification	:	IS:1079
Mechanical testing of metals - Tensile Testing	:	IS:1608
Dimensions for steel plates, sheets strips and flats for general engineering purposes	:	IS:1730
Method for tensile testing of steel sheet and strip of thickness 0.5 mm to 3 mm	:	IS:1608
Method for bend test	:	IS:1599
Recommended practice for red oxide and zinc chromate on iron & steel	:	IS:2074
General technical delivery requirements for steel and steel products	:	IS:8910

Methods of chemical analysis of pig iron, cast iron and plain carbon and low alloy steel , Part-I	:	IS:228
Method for testing uniformity of coating on Zinc coated articles	:	IS:2633
Recommended practice for hot dip galvanising on iron & steel	:	IS:2629
Hot dip zinc coating on structural steel and other allied products	:	IS:4759
Method for determination of mass of zinc coating on zinc coated iron and steel articles	:	IS:6745

Latest version of all the standards shall be referred.

2.3 TECHNICAL REQUIREMENTS

2.3.1 The cable trays & bends shall be ladder/perforated type.

2.3.2 The material (Mild Steel) used for the supply shall be in sound condition and of recent manufacture, free from defects, loose mill scale, slag, pitting, rust, etc.

2.3.3 The cable trays shall be hot dip galvanised (zinc coating).

2.3.4 The min. weight of zinc coating shall be 460 gm/m.^{2}

2.3.5 The trays shall not have sharp edges cuts, abrasions etc. and the zinc coating shall be adherent, smooth and reasonably bright, continuous and free from such imperfections as flux, ash, bare and black spot, pimples, lumpiness, rust stains, bulky white deposits and blisters.

2.3.6 All drilling, cutting, bending etc. of fabricated steel work shall be carried out before galvanising. After galvanising, no drilling or welding shall be performed on the galvanized parts of the equipment excepting that nuts may be threaded after galvanizing. Sodium dichromate treatment shall be provided to avoid formation of white rust after hot dip galvanisation.

2.3.7 Bolts and nuts shall be of steel with hexagonal head by approved supplier. All bolts shall be galvanised including threaded portions. The threaded portions of all bolts shall be cleared of smear by spinning / brushing. All washers and nuts shall also be galvanised but threading of nuts shall be oiled / greased.

2.3.8 The *Bidder* shall indicate in his offer the final weight of the tray after punching and galvanising.

2.4 TESTS

Details of tests for Cable Tray Material shall be as follows:

1. Dimensional and visual examination - As per approved drawing.
2. Deflection Test: (Type test)
   A 2.5 m straight section of tray shall be simply supported at two ends. A uniform distributed load of 76 kg/m shall be applied along the length of the tray. The maximum deflection at the mid span shall not exceed 7 mm.
3. Mass of Galvanisation - IS: 6745
4. Uniformity of zinc coating - IS: 2633

SECTION - 3

PROJECT DETAILS AND GENERAL SPECIFICATIONS

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	

3.3 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.

3.4 DOCUMENTATION

3.4.1 DRAWINGS

All drawings for cable trays etc. shall be prepared in AutoCAD. All dimensions and data shall be in SI metric units.

All items of the equipment should be clearly identified by proper part number in the contract drawings. Such parts which are to be dispatched to site from works in dispatch able units and are re-assembled at site should be marked by proper identification marks at works and indicated in the drawings and quantified. All the items of the shipping list should be identified in the drawings.

The drawings submitted by the subcontractor shall be reviewed by the purchaser as far as practicable within 4 weeks of receipt of drawings and shall be modified by the subcontractor if any modifications and / or corrections are required by the purchaser. The subcontractor shall incorporate such modifications and / or corrections and submit the final drawings within 2 weeks of receipt of commented drawings for approval. Any delay arising out of failure of the subcontractor to rectify the drawings in good to time shall not alter the contract completion date.

Approval of drawings or work by the purchaser/consultant shall not relieve the subcontractor of any of his responsibilities and liabilities under the contract.

In case of any modification that may be necessary during erection or commissioning of the equipment, the subcontractor shall carry out modifications in the original drawing & submit 'As Built' drawings.

The title block of drawings shall contain the following information incorporated in all contract drawings

Title block for _____ project:

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

3.4.2 DOCUMENTS TO BE SUBMITTED ALONGWITH OFFER

1) Guaranteed Technical Particulars

3.4.3 DOCUMENTATION SCHEDULE AT CONTRACT STAGE

A (No. of Copies)	For Approval
6 to 15 (As per Project requirement)	Copies of GA drawings with projects details, dimension, equipment weight, fixing details, tolerances and terminal details etc.
6 to 15	Copies of GTP
6 to 15	Copies of type test reports
6 to 15	Copies of manufacturing quality plan.
B (No. of Copies)	**After Approval and For Information/Distribution.**
6 to 15 (As per Project requirement)	Copies of GA drawings
6 to 15	Copies of GTP
6 to 15	Copies of type, Routine & Acceptances tests.
6 to 15	Copies of manufacturing quality plan.
6 to 15	Copies of shipping list detailing the description & quantities of all items being dispatched separately, with shipping weights, number of cases and dimensions.

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

3.5 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.

3.6 SURFACE TREATMENT

3.6.1 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.

3.7 WELDING

All welding shall be done by a qualified welder.

3.8 PACKING AND MARKING

3.8.1 PACKING

Cable Tray Material 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.

For export project, the packing shall be SEAWORTHY as explained in section1.

3.8.2 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 AND TECHNICAL PARTICULARS

(To be filled and submitted at Contract stage)

1.0	Name of the Project	:
2.0	Bidder's Name and Address	:
3.0	Applicable Standards	:
4.0	Application	:
5.0	Material specification	:
6.0	Thickness of sheet metal for cable trays, fittings etc.	:
7.0	Maximum permissible loading for a 2.5 m. long simply supported at both ends	:
8.0	Corresponding deflection at centre, for the loading as in 8.0 above	:
9.0	Weight of Zinc coating	:
10.0	Length of single cable tray piece	:
11.0	weight of single piece	:

SECTION-5

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.	Equipment	Cable tray		
2.	Thickness of Tray	2.0 to 3.0 mm		
a)	2.0 mm		YES / NO	
b)	2.5 mm		YES / NO	
c)	3.0 mm		YES / NO	
3.	Type of cable-tray	Ladder/Perforated		
a)	Ladder type		YES / NO	
b)	Perforated type		YES / NO	
4.	Material certificate	As per Relevant Standard (cl.2.2)	YES / NO	
5.	Weight of zinc coating	460gm/m^2	YES / NO	
6.	Maximum permissible deflection at centre of 2.5m long tray simply supported at both ends after applying the uniformly distributed uniform distributed load of 76 kg/M shall be applied.	≤ 7mm	YES / NO	
7.	Required accessories (as per cl. 1.1 of Section-1)	Included	YES / NO	
8.	Conformance to the Applicable standard	As specified in clause 2.2 , Section -2 of the specification	YES / NO	
9.	90° Horizontal Bend	Included	YES / NO	
10.	90° Vertical Bend	Included	YES / NO	
11.	90° Horizontal elbow	Included	YES / NO	
12.	Tee	Included	YES / NO	
13.	Reducer	Included	YES / NO	
14.	***Tray Cover***	***Included***	***YES / NO***	
15.	***Weight of Trays shall be considered as per clause no. 2.3.8 of Section-2***	***Agreed***	***YES / NO***	

BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS GROUP
ENGINEERING MANAGEMENT, NEW DELHI

BHEL Document No.	Rev.		Prepared by	Checked by	Approved by
TB-xxx-316-143	03	Name			
Type of Document STANDARD SPECIFICATION		Sign	--sd---	--sd--	--sd--
Title CABLE RACK & HANGER ASSEMBLY		Date			
		Group	TBEM		
		W.O. No			
Customer / Consultant					
Tender					

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CONTENTS

Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS
03	15.04.15				Documents updated
02	10.05.13				Assembly drawings revised.
01	17.06.09	Sd/-	Sd/	Sd/-	Documents updated

Distribution	To					
	Copies					

SECTION -1

SCOPE, BILL OF QUANTITIES AND SPECIFIC TECHNICAL REQUIREMENTS

1.0 SCOPE

This technical specification covers fabricating, painting / galvanising, testing, manufacturing, testing at works, packing and despatch of Cable rack/Hanger assembly complete with accessories as listed below.

The detailed scope of work is fabrication, galvanizing and supply of all Cable Racks / Hanger Assembly made of MS channels, beams, angles, Flats etc.,

This section covers the general technical requirements of Cable Trench Material. In case of any discrepancies between the requirements mentioned in this section and those specified in other sections of this specification, the requirement of this section shall prevail and shall be treated as binding requirements.

1.1 SPECIFIC TECHNICAL REQUIREMENTS

A. Rack assembly

Material of cable racks	:	Mild Steel
Sections used in Cable Rack assemblies:	:	Standard MS Angle sections, Channels, Beams & flats as per individual project requirement.
Whether Galvanised or Painted	:	Galvanized *or Painted* as per requirement.
Mass of Zinc coating	:	610 gm/m^2 minimum, Unless specified otherwise.

B. Hanger Assembly

Material of Hanger Assembly	:	Mild Steel
Sections used in hanger assemblies:	:	Standard MS Angle sections, Channels, Beams & flats as per individual project requirement.
Whether Galvanised or Painted	:	Galvanized *or Painted* as per requirement.
Mass of Zinc coating	:	610 gm/m^2 minimum, Unless specified otherwise.

1.2 BILL OF QUANTITIES

Sl. No.	Description	Quantity (Domestic)	Quantity (Export)
1	Galvanised Cable Rack / Hanger assemblies (Zinc coating 610 gms/sqm)	-- MT	-- MT
2	Painted Cable Rack/ Hanger assemblies	-- MT	-- MT
3.	MS (Black) Cable Rack/ Hanger assemblies	-- MT	-- MT
4.	Charges for Add extra on above for providing additional zinc coating of 100gms/sqm each or part thereof.	-- MT	-- MT
5.	*Zinc Rich Paint*	-- Litre	-- Litre

Notes:

1. Quantity shall be as per Indent.
2. Quantity may vary by ±30%.
3. Item no. 4 shall also be considered for evaluation.
4. ***Calculation of weight of shall be as per clause no. 2.1.3 of section-2. No deduction in weight shall be made for holes***.

1.3 SEAWORTHY PACKING FOR EXPORT PROJECT:

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.

Minimum requirement for seaworthy packing are as follows:

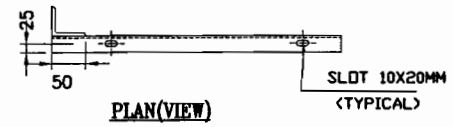
i. Individual item shall be wrapped using polyethylene sheets and further lots shall be wrapped in Bitumen coated hessian cloth.
ii. Markings shall be provided on the boxes/wrapped polyethylene sheet indicating position of boxes for handling, storage and nature of consignment. The ink used for this purpose as well as for marking dispatch instruction shall be indelible/non-washable marking ink
iii. External front and rear sides of the boxes to be planed for writing instructions.
iv. 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 anodized aluminium plate shall be provided on one side of the boxes.
v. 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.

1.4 Technical Specification for Qualifying Requirement:

1. Bidder shall be Manufacturer of Trench Material.
2. Bidder should have Galvanising facility at their works.
3. Manufacturer should have manufactured and supplied at least 2MT each of Cable Racks and Cable Tray material in India in any one year during last five years from the date of Technical Bid Opening.

1.5 QUALITY PLAN:

BHEL Standard manufacturing quality plan shall be followed.



PLAN(VIEW)

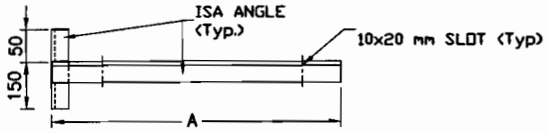


FIG-1: SINGLE TIER

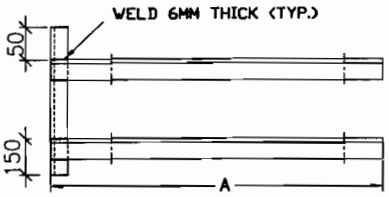


FIG-2: TWO TIER

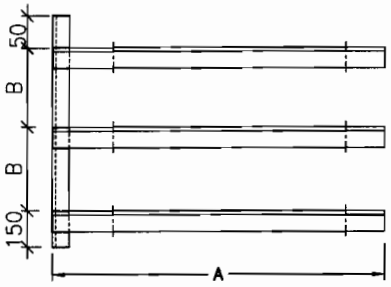


FIG-3: THREE TIER

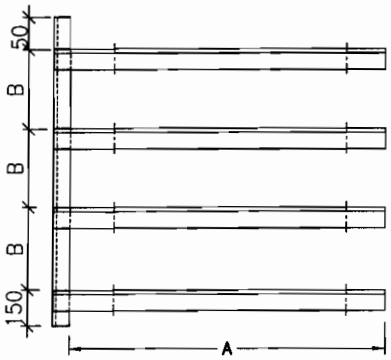


FIG-4: FOUR TIER

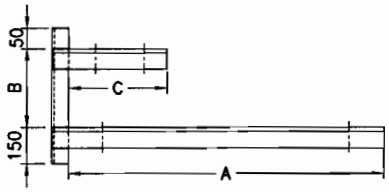


FIG-5: TWO TIER

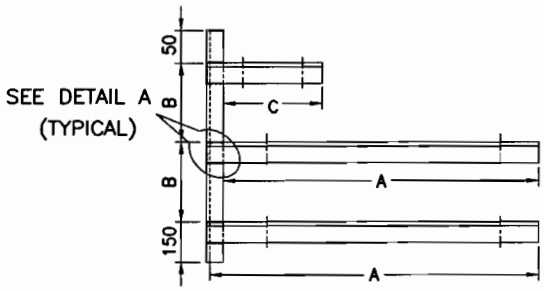
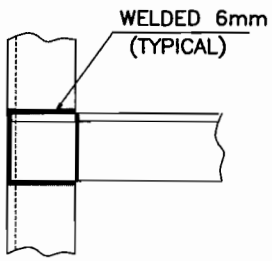


FIG-6: THREE TIER



DETAIL-A

NOTES:

1) RACKS MAY BE WITH/WITHOUT STOPPERS. IF STOPPERS HAVE BEEN ASKED, SLOTS WILL NOT BE REQUIRED.
2) 'A' MAY VARY BETWEEN 150 TO 750 MM.
3) 'B' MAY VARY BETWEEN 200 TO 300 MM.
4) 'C' MAY VARY BETWEEN 150 TO 450 MM.
5) OFFER SHALL BE ON THE BASIS OF WEIGHT OF ASSEMBLY.
6) THE ABOVE DRAWING IS INDICATIVE ONLY. BIDDER WILL HAVE TO SUBMIT THE ACTUAL DRAWINGS FOR EACH INDIVIDUAL PROJECT BASED ON THE INPUT FROM BHEL FOR CUSTOMER APPROVAL.
7) TYPE AND SIZE OF ASSEMBLY SHALL VARY AS PER INDIVIDUAL PROJECT REQUIREMENT.

ANNEXURE-2

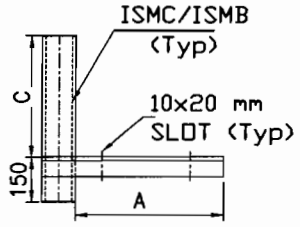


FIG-7: SINGLE TIER, ONE SIDED

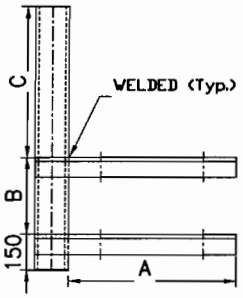


FIG-8: TWO TIERS, ONE SIDED

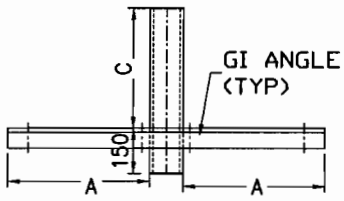


FIG-10: SINGLE TIER, BOTH SIDED

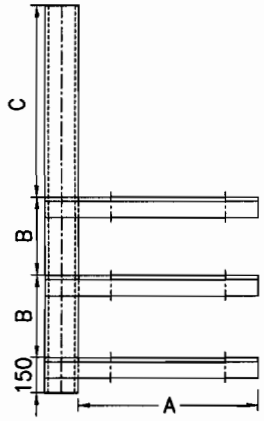


FIG-9: THREE TIERS, ONE SIDED

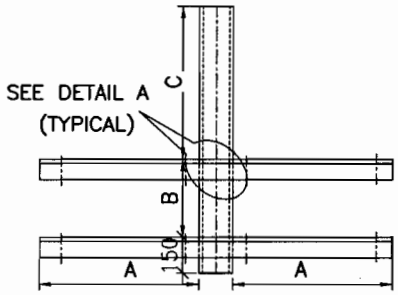
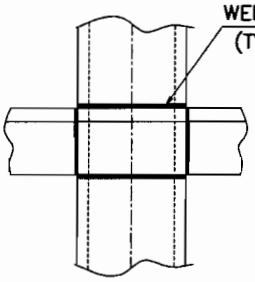
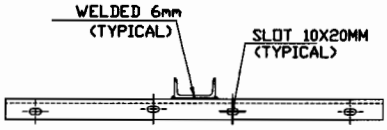


FIG-11: TWO TIERS, BOTH SIDED



DETAIL-A



PLAN VIEW OF BOTH SIDED HANGER

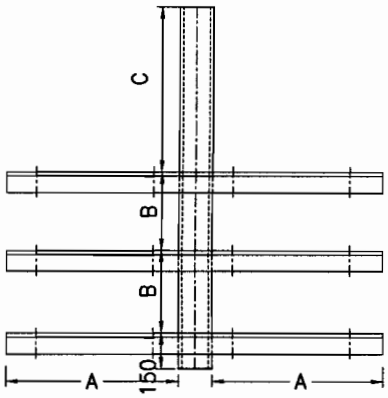


FIG-12: THREE TIERS, BOTH SIDED

NOTES:

1) HANGERS MAY BE WITH/WITHOUT STOPPERS. IF STOPPERS HAVE BEEN ASKED, SLOTS WILL NOT BE REQUIRED.
2) 'A' MAY VARY BETWEEN 200 TO 750 MM.
3) 'B' MAY VARY BETWEEN 200 TO 300 MM.
4) 'C' MAY VARY BETWEEN 250 TO 850 MM.
5) OFFER SHALL BE ON THE BASIS OF WEIGHT OF HANGER ASSEMBLY.
6) THE ABOVE ARE TYPICAL ASSEMBLIES. ORDER CAN BE PLACED FOR QUADRUPLE TIERS ALSO.
7) THE ABOVE DRAWING IS INDICATIVE ONLY. BIDDER WILL HAVE TO SUBMIT THE ACTUAL DRAWINGS FOR EACH INDIVIDUAL PROJECT BASED ON THE INPUT FROM BHEL FOR CUSTOMER APPROVAL.
8) TYPE AND SIZE OF ASSEMBLY SHALL VARY AS PER INDIVIDUAL PROJECT REQUIREMENT.

SECTION - 2
STANDARD TECHNICAL SPECIFICATION

2.0 GENERAL

This section covers the standard technical specification for ***Cable Rack and Hanger Assemblies.***

2.1 STEEL MATERIAL

Steel materials shall conform to IS: 2062-latest revision and all other relevant IS codes.

2.1.1 STRUCTURAL STEEL SECTIONS:

For designing/supply of *Cable Racks / Hanger Assembly*, preferably rationalized steel sections have been used.

Steel shall not be pitted and should be free from scales and rust. If the rolled section and plates are bent or distorted, bend or distortion shall normally be removed by the cold treatment. Straightening under hot stage shall be resorted to only under specific permission from BHEL. If any rolling defects viz., laminations, cracks etc. are discovered in the steel during the processing, it is to be rejected.

2.1.2 TOLERANCE:

The dimensional and weight tolerances for rolled shapes shall be in accordance with IS: 1852-latest revision.

No rolled or fabricated member shall deviate from straightness by more than 1/1000 of the axial length or 10mm which ever is smaller.

2.1.3 ***WEIGHT*** *:*

The calculated weight of the Cable Rack and Hanger Assembly shall be considered for supply and payment purpose based on unit weight as per IS 808 for Standards Angle, Channel and Beams. For Calculation of weight of flats, plates, rods, square sections etc, density of steel i.e. 7850kg/ m^3 will be considered.
The standard steel sections unit weight shall conform to IS 808 with tolerance in size as per IS 1852.
For fabricated Racks and hanger assemblies' unit weight shall be worked out considering theoretical dimensions & density of steel as 7850 kg/cum.
Weight of cleats, brackets, packing pieces, bolts nuts, washers, pieces, separators, gussets, etc. shall be added to the weight of Cable Racks. No deduction shall be made for holes.
Weight of welding material, paint, zinc coating, galvanising etc., shall not be added in the weight of members for payment and nothing extra shall be paid for making and filling holes.

2.2 FABRICATION

GENERAL:

All the workmanship and finish shall be of the best quality and shall conform to the best approved method of fabrication. All materials shall be finished straight and shall be machined true and square where so specified. All holes and edges shall be free of burrs. Shearing and

chipping shall be neatly and accurately done and all portions of work exposed to view shall be neatly finished. Material at the shops shall be kept clean and protected from weather.

The fabrication of *Cable Racks / Hanger Assembly* shall be carried out generally in accordance with IS:800. All materials shall be completely shop fabricated.

The use of filler in the connections shall be avoided as far as possible. The diagonal members in tension may be connected entirely to the gusset plate where necessary to avoid the use of fillers. Each diagonal shall be in one piece without splices or center gussets, and it shall be connected at the point of intersection by one or more bolts.

STRAIGHTENING:

For rolled steel material, if straightening or flattening is necessary, it shall be done by methods that will not injure the materials.

CUTTING:

Cutting may be affected by chopping, cropping, sawing or machine flame cutting. Sheared or cropped edges shall be dressed to a neat workmanlike finish and shall be free from distortion and burrs.

PUNCHING AND DRILLING:

Holes in members may be punched full size through material not over 12mm thick. Holes must be cleaned of burrs and ragged edges. Drilled holes shall be preferred. Holes made by drilling shall also be cleaned of burrs and ragged edges. Where several parts are to be drilled, they shall be first assembled, tightly clamped together and drilled through.

Punched holes must be square with plates and the walls of the holes shall be parallel. The following maximum allowance in accuracy of punched holes is permissible:

i) Holes must be perfectly circular and no tolerance in this respect is permissible.

ii) The maximum allowable difference in diameter of the holes on the two sides of plates or angle is 0.8 mm, i.e. the allowable taper in punched holes should not exceed 0.8 mm in diameter.

iii) Holes must be square with the plates. Holes at angle or slant shall not be permitted.

WELDING:

The work shall be done as per approved fabrication drawings, qualified welding procedure specifications (WPS) and by qualified welders. Procedure qualification records (PQR) shall be maintained. Electrodes for shielded arc manual welds shall comply with the requirements of IS:814 – latest revision. All welds shall be free from defects like blow holes, slag inclusions, lack of penetration, under cutting, cracks etc. All welds shall be cleaned of all slag or flux before galvanizing.

MARKING OF MEMBERS FOR IDENTIFICATION.

All members shall be marked for identification during erection. This mark shall correspond to distinguishing marks on approved erection drawings and shall be legibly painted and stamped on. The erection mark / identification mark shall be stamped with a metal dye with figures at least 16 mm high and to such optimum depth as to be clearly visible, even after a member is galvanized or painted. All erection marks shall be on outer surface of all sections and near one end, but clear of bolt holes. Marking shall be so stamped that they are easily discernible when sorting out Racks / Hanger assemblies.

Erection marks on like Racks / Hangers shall be in identical locations.

2.3 GALVANISING:

All steel works of *galvanized rack / hanger* assembly shall be hot dip galvanized after fabrication. Galvanizing of each assembly shall be carried out in one complete immersion and double dipping shall not be permitted.

Zinc required for galvanizing will have to be arranged for by the Contractor. Purity of zinc to be used for galvanizing shall be 99.5% as per IS:209-latest revision.

All burrs and irregular edges shall be ground smooth before galvanizing.

After all shop work is complete, all structural *assemblies* shall be punched with the Erection Mark and be hot dip galvanized. Before galvanizing the steel section shall thoroughly be cleaned of any paint, grease, rust, scale, acid/ alkali or such other foreign matters as are likely to interfere with the galvanizing process or with the quality and durability of the zinc coating. Pickling shall be carefully done and shall be proper.

Minimum weight of zinc coating shall be 610gms/sqm. However, higher coating may be provided as per requirement.

The galvanized surface shall consist of a continuous and uniformly thick coating of zinc, firmly adhering to the surface of steel. The finished surface shall be clean and smooth and shall be free from defects like discolored patches, bare spots, unevenness of coating, spelter which is loosely attached to the steel, globules, spiky deposits, blistered surface flaking or peeling off, etc. The presence of any of these defects noticed on visual or microscopic inspection shall render the material liable to rejection.

There shall be no flaking or loosening when struck squarely with a chisel faced hammer. The galvanized steel member shall withstand minimum four one minute dips in copper sulphate solution as per IS: 2633 – latest revision.

When the steel section is removed from the galvanizing kettle excess spelter shall be removed by 'bumping'. The processes known as 'wiping' or 'scrapping' shall not be used for this purpose.

Defects in certain members indicating presence of impurities in the galvanizing bath in quantities larger than that permitted by the specification, or lack of quality control in any manner in the galvanizing plant shall render the entire production in the relevant shift liable to rejection.

All the galvanized structural steel assemblies and accessories shall be treated with sodium dichromate or an approved equivalent solution after galvanizing, so as to prevent white storage stains.

If the galvanizing of any assembly is damaged, BHEL shall be shown of the extent of damage and if so directed the galvanizing may have to be redone in the similar manner as stated above at no extra cost.

Contractor shall also supply *2litre of Zinc Rich Paint with each MT quantity of Galvanised Assemblies* free of cost, for repairing galvanized surfaces damaged in transit, and minor modifications done at site during erection.

Galvanizing tests *at works* shall be made from time to time on as many samples as may be considered necessary. The supplier shall supply all samples and equipment and carry out the tests without any extra cost.

2.4 PAINTING

The painted rack and Hanger assembly shall be painted as following with approved color, shade & brand as per approved drawing and documents by BHEL/ customer

1. Sand Blasting shall be done before application of primer.
2. Supplier shall furnish painting procedure for approval indicating curing time between each coat and final paint. Painting to be carried out in separate area away from fabrication and sand blasting and ensure no ingress of foreign particles on the painted surface.
3. Epoxy zinc phosphate primer of min 50micron thickness.
4. Minimum two coats of Epoxy finish paint with thickness of 30 micron to 35micron
5. Total DFT (Dry Film Thickness) 80 micron minimum.

2.5 INSPECTION OF MATERIALS

GENERAL:

Contractor shall give notice to BHEL in advance for inspection of materials. All rejected material shall be promptly removed from the shop and replaced with new material for BHEL approval/ inspection. The fact that certain material has been accepted at Contractor's shop shall not invalidate final rejection at site by BHEL if it fails to be in proper condition or has fabrication inaccuracies which prevent proper assembly. No materials shall be painted, galvanized or dispatched to site without the inspection and approval by BHEL unless such inspection is waived off in writing by BHEL.

Shop inspection by BHEL, for submission of test certificates and acceptance there of by BHEL shall not relieve contractor from the responsibility of furnishing material conforming to the requirements of these specifications, nor shall it invalidate any claim which BHEL may make because of defective or unsatisfactory material and workmanship.

Contractor shall provide all the testing and inspection services and facilities for shop work. For fabrication work carried out in the field the standard of supervision and quality control shall be maintained as in shop fabricated work. The inspection and testing shall be conducted in a manner satisfactory to BHEL.

SECTION - 2
STANDARD TECHNICAL SPECIFICATION

2.0 GENERAL

This section covers the standard technical specification for ***Cable Rack and Hanger Assemblies.***

2.1 STEEL MATERIAL

Steel materials shall conform to IS: 2062-latest revision and all other relevant IS codes.

2.1.1 STRUCTURAL STEEL SECTIONS:

For designing/supply of *Cable Racks / Hanger Assembly*, preferably rationalized steel sections have been used.

Steel shall not be pitted and should be free from scales and rust. If the rolled section and plates are bent or distorted, bend or distortion shall normally be removed by the cold treatment. Straightening under hot stage shall be resorted to only under specific permission from BHEL. If any rolling defects viz., laminations, cracks etc. are discovered in the steel during the processing, it is to be rejected.

2.1.2 TOLERANCE:

The dimensional and weight tolerances for rolled shapes shall be in accordance with IS: 1852-latest revision.

No rolled or fabricated member shall deviate from straightness by more than 1/1000 of the axial length or 10mm which ever is smaller.

2.1.3 ***WEIGHT*** *:*

The calculated weight of the Cable Rack and Hanger Assembly shall be considered for supply and payment purpose based on unit weight as per IS 808 for Standards Angle, Channel and Beams. For Calculation of weight of flats, plates, rods, square sections etc, density of steel i.e. 7850kg/ m^3 will be considered.
The standard steel sections unit weight shall conform to IS 808 with tolerance in size as per IS 1852.
For fabricated Racks and hanger assemblies' unit weight shall be worked out considering theoretical dimensions & density of steel as 7850 kg/cum.
Weight of cleats, brackets, packing pieces, bolts nuts, washers, pieces, separators, gussets, etc. shall be added to the weight of Cable Racks. No deduction shall be made for holes.
Weight of welding material, paint, zinc coating, galvanising etc., shall not be added in the weight of members for payment and nothing extra shall be paid for making and filling holes.

2.2 FABRICATION

GENERAL:

All the workmanship and finish shall be of the best quality and shall conform to the best approved method of fabrication. All materials shall be finished straight and shall be machined true and square where so specified. All holes and edges shall be free of burrs. Shearing and

chipping shall be neatly and accurately done and all portions of work exposed to view shall be neatly finished. Material at the shops shall be kept clean and protected from weather.

The fabrication of *Cable Racks / Hanger Assembly* shall be carried out generally in accordance with IS:800. All materials shall be completely shop fabricated.

The use of filler in the connections shall be avoided as far as possible. The diagonal members in tension may be connected entirely to the gusset plate where necessary to avoid the use of fillers. Each diagonal shall be in one piece without splices or center gussets, and it shall be connected at the point of intersection by one or more bolts.

STRAIGHTENING:

For rolled steel material, if straightening or flattening is necessary, it shall be done by methods that will not injure the materials.

CUTTING:

Cutting may be affected by chopping, cropping, sawing or machine flame cutting. Sheared or cropped edges shall be dressed to a neat workmanlike finish and shall be free from distortion and burrs.

PUNCHING AND DRILLING:

Holes in members may be punched full size through material not over 12mm thick. Holes must be cleaned of burrs and ragged edges. Drilled holes shall be preferred. Holes made by drilling shall also be cleaned of burrs and ragged edges. Where several parts are to be drilled, they shall be first assembled, tightly clamped together and drilled through.

Punched holes must be square with plates and the walls of the holes shall be parallel. The following maximum allowance in accuracy of punched holes is permissible:

i) Holes must be perfectly circular and no tolerance in this respect is permissible.

ii) The maximum allowable difference in diameter of the holes on the two sides of plates or angle is 0.8 mm, i.e. the allowable taper in punched holes should not exceed 0.8 mm in diameter.

iii) Holes must be square with the plates. Holes at angle or slant shall not be permitted.

WELDING:

The work shall be done as per approved fabrication drawings, qualified welding procedure specifications (WPS) and by qualified welders. Procedure qualification records (PQR) shall be maintained. Electrodes for shielded arc manual welds shall comply with the requirements of IS:814 – latest revision. All welds shall be free from defects like blow holes, slag inclusions, lack of penetration, under cutting, cracks etc. All welds shall be cleaned of all slag or flux before galvanizing.

MARKING OF MEMBERS FOR IDENTIFICATION.

All members shall be marked for identification during erection. This mark shall correspond to distinguishing marks on approved erection drawings and shall be legibly painted and stamped on. The erection mark / identification mark shall be stamped with a metal dye with figures at least 16 mm high and to such optimum depth as to be clearly visible, even after a member is galvanized or painted. All erection marks shall be on outer surface of all sections and near one end, but clear of bolt holes. Marking shall be so stamped that they are easily discernible when sorting out Racks / Hanger assemblies.

Erection marks on like Racks / Hangers shall be in identical locations.

2.3 GALVANISING:

All steel works of *galvanized rack / hanger* assembly shall be hot dip galvanized after fabrication. Galvanizing of each assembly shall be carried out in one complete immersion and double dipping shall not be permitted.

Zinc required for galvanizing will have to be arranged for by the Contractor. Purity of zinc to be used for galvanizing shall be 99.5% as per IS:209-latest revision.

All burrs and irregular edges shall be ground smooth before galvanizing.

After all shop work is complete, all structural *assemblies* shall be punched with the Erection Mark and be hot dip galvanized. Before galvanizing the steel section shall thoroughly be cleaned of any paint, grease, rust, scale, acid/ alkali or such other foreign matters as are likely to interfere with the galvanizing process or with the quality and durability of the zinc coating. Pickling shall be carefully done and shall be proper.

Minimum weight of zinc coating shall be 610gms/sqm. However, higher coating may be provided as per requirement.

The galvanized surface shall consist of a continuous and uniformly thick coating of zinc, firmly adhering to the surface of steel. The finished surface shall be clean and smooth and shall be free from defects like discolored patches, bare spots, unevenness of coating, spelter which is loosely attached to the steel, globules, spiky deposits, blistered surface flaking or peeling off, etc. The presence of any of these defects noticed on visual or microscopic inspection shall render the material liable to rejection.

There shall be no flaking or loosening when struck squarely with a chisel faced hammer. The galvanized steel member shall withstand minimum four one minute dips in copper sulphate solution as per IS: 2633 – latest revision.

When the steel section is removed from the galvanizing kettle excess spelter shall be removed by 'bumping'. The processes known as 'wiping' or 'scrapping' shall not be used for this purpose.

Defects in certain members indicating presence of impurities in the galvanizing bath in quantities larger than that permitted by the specification, or lack of quality control in any manner in the galvanizing plant shall render the entire production in the relevant shift liable to rejection.

All the galvanized structural steel assemblies and accessories shall be treated with sodium dichromate or an approved equivalent solution after galvanizing, so as to prevent white storage stains.

If the galvanizing of any assembly is damaged, BHEL shall be shown of the extent of damage and if so directed the galvanizing may have to be redone in the similar manner as stated above at no extra cost.

Contractor shall also supply *Zinc Rich Paint of Reputed make for Galvanised Assemblies*, for repairing galvanized surfaces damaged in transit, and minor modifications done at site during erection.

Galvanizing tests *at works* shall be made from time to time on as many samples as may be considered necessary. The supplier shall supply all samples and equipment and carry out the tests without any extra cost.

2.4 PAINTING

The painted rack and Hanger assembly shall be painted as following with approved color, shade & brand as per approved drawing and documents by BHEL/ customer

1. Sand Blasting shall be done before application of primer.
2. Supplier shall furnish painting procedure for approval indicating curing time between each coat and final paint. Painting to be carried out in separate area away from fabrication and sand blasting and ensure no ingress of foreign particles on the painted surface.
3. Epoxy zinc phosphate primer of min 50micron thickness.
4. Minimum two coats of Epoxy finish paint with thickness of 30 micron to 35micron
5. Total DFT (Dry Film Thickness) 80 micron minimum.

2.5 INSPECTION OF MATERIALS

GENERAL:

Contractor shall give notice to BHEL in advance for inspection of materials. All rejected material shall be promptly removed from the shop and replaced with new material for BHEL approval/ inspection. The fact that certain material has been accepted at Contractor's shop shall not invalidate final rejection at site by BHEL if it fails to be in proper condition or has fabrication inaccuracies which prevent proper assembly. No materials shall be painted, galvanized or dispatched to site without the inspection and approval by BHEL unless such inspection is waived off in writing by BHEL.

Shop inspection by BHEL, for submission of test certificates and acceptance there of by BHEL shall not relieve contractor from the responsibility of furnishing material conforming to the requirements of these specifications, nor shall it invalidate any claim which BHEL may make because of defective or unsatisfactory material and workmanship.

Contractor shall provide all the testing and inspection services and facilities for shop work. For fabrication work carried out in the field the standard of supervision and quality control shall be maintained as in shop fabricated work. The inspection and testing shall be conducted in a manner satisfactory to BHEL.

The inspection and tests shall be as given below and the minimum requirement shall be as per quality plan attached. The final Quality plan shall be decided between Supplier, BHEL and Customer/ Owner.

MATERIAL TESTING

TESTS

Details of tests for Cable Trench Material shall be as per latest versions of the standards as follows:

1. Dimensional and visual examination - As per BHEL approved drawing.
2. Mass of Galvanisation - IS: 6745
3. Test for galvanising (Acceptance Test)
4. Uniformity of zinc coating - IS: 2633
5. Chemical composition test -As per IS: 2062.
6. Tensile - As per IS: 2062.
7. Bending test -As per IS: 2062.

If mill test reports are not available for any steel materials the same shall be got tested by the contractor and demonstrate conformity with the relevant specification to the full satisfaction of BHEL. The cost of such tests shall be borne by the contractor.

DIMENSIONS AND WORKMANSHIP:

The Steel *Rack / Hanger Assemblies may* be inspected at all stages of fabrication and assembly to verify that dimensions, tolerances, alignment and surface finish, are in accordance with the requirements shown in approved drawings.

INSPECTION OF TEST FAILURE:

In the event of any failure of structural steel members to meet an inspection or test requirement, contractor shall inform BHEL and must obtain permission from the BHEL before repair is undertaken. The quality control procedures to be allowed to ensure satisfactory repair shall be subject to approval by BHEL.

2.6 PACKING TRANSPORTATION AND DELIVERY

After completion of final inspection and marking, the fabricated galvanized structural items shall be packed and loaded for transportation.

Packing must be adequate to protect items against bending and any mechanical injuries and damage to galvanized film during loading and unloading. As far as possible, like member should be bundled together and tied.

Proper lifting devices shall be used for loading at shop and unloading at site in order to protect items against bending, mechanical injuries and damage to galvanized film/ *paint.*

Loading, transporting and unloading shall be done in compliance with transportation rules.

Slender and projected parts shall be braced properly with additional spacer steel bars, spacer wood etc, before loading for transportation, to protect against bending or any other damages during transportation.

Items must be carefully loaded and tied up properly to prevent bending, falling etc. during transportation.

The small parts such as plates, gussets, cleats etc. shall be securely tied with the wire, and packed in double gunny bags and cased as per the actual requirements..

As far as possible the delivery of fabricated galvanized *assemblies* shall be as per the order stipulated by BHEL and to suit the erection sequence at site.

Contractor shall make good/ replace at his own cost any damage occurred during loading, transporting, unloading and stacking of fabricated Rack / Hanger Assemblies as directed by BHEL. No extra payment on this account shall be entertained under any circumstances.

2.7 APPLICABLE STANDARDS

All applicable standards, codes of practice etc., shall be latest edition including official amendments and revisions. List of some of the applicable standards, in original codes and references is as given below

1.	IS : 209	- Zinc Ingot.
2.	IS : 228	- Method of chemical analysis of pig iron, cast iron, plain carbon and low alloy steel.
3.	IS : 406	- Methods of analysis of zinc (Spelter).
4.	IS : 800	- Code of practice for general construction.
5.	IS : 6745	- Method for determination of mass of zinc coating on zinc coated iron and steel articles.
6.	IS : 806	- Code of practice for use of steel tubes in general building construction.
7.	IS : 808	- Dimensions for hot rolled steel beam, column, channel and angle sections.
8.	IS : 814	- Covered electrodes for manual metal arc welding of carbon and carbon manganese steel.
9.	IS : 816	- Code of Practice for use of metal

		arc welding for general construction in mild steel.
10.	IS : 817	- Code of practice for training & testing of Metal Arc welders.
11.	IS : 4759	- Hot dip zinc coating on structural steel and other allied products.
12.	IS : 1599	- Method of bend test
13.	IS : 1608	- Method of tensile testing of steel products.
14.	IS : 1852	- Rolling and cutting tolerances for hot rolled steel products.
15.	IS : 1978	- Line pipe
16.	IS : 2062	- Steel for general structural purposes.
17.	IS : 2074	- Ready Mixed Paint, air drying red oxide zinc, chrome, priming.
18.	IS : 2629	- Recommended practice for hot dipped galvanising on Iron & Steel.
19	IS : 2633	- Methods for testing uniformity of coating on zinc coated articles.
20.	IS : 4923	- Hollow Steel sections for structural use-specification

SECTION - 3

PROJECT DETAILS AND GENERAL SPECIFICATIONS

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	

3.3 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.

3.4 DOCUMENTATION

3.4.1 DRAWINGS

All drawings for cable trays , etc. shall be prepared in AutoCAD. All dimensions and data shall be in SI metric units.

All items of the equipment should be clearly identified by proper part number in the contract drawings. Such parts which are to be dispatched to site from works in dispatch able units and are re-assembled at site should be marked by proper identification marks at works and indicated in the drawings and quantified. All the items of the shipping list should be identified in the drawings.

The drawings submitted by the subcontractor shall be reviewed by the purchaser as far as practicable within 4 weeks of receipt of drawings and shall be modified by the subcontractor if any modifications and / or corrections are required by the purchaser. The subcontractor shall incorporate such modifications and / or corrections and submit the final drawings within 2 weeks of receipt of commented drawings for approval. Any delay arising out of failure of the subcontractor to rectify the drawings in good to time shall not alter the contract completion date.

Approval of drawings or work by the purchaser/consultant shall not relieve the subcontractor of any of his responsibilities and liabilities under the contract.

In case of any modification that may be necessary during erection or commissioning of the equipment, the subcontractor shall carry out modifications in the original drawing & submit 'As Built' drawings.

The title block of drawings shall contain the following information incorporated in all contract drawings

Title block for _____ project:

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

3.4.2 DOCUMENTS TO BE SUBMITTED ALONGWITH OFFER

1) Guaranteed Technical Particulars

3.4.3 DOCUMENTATION SCHEDULE AT CONTRACT STAGE

A (No. of Copies)	For Approval
6 to 15 (As per Project requirement)	Copies of GA drawings with projects details, dimension, equipment weight, fixing details, tolerances and terminal details etc.
6 to 15	Copies of GTP
6 to 15	Copies of type test reports
6 to 15	Copies of manufacturing quality plan.
B (No. of Copies)	**After Approval and For Information/Distribution.**
6 to 15 (As per Project requirement)	Copies of GA drawings
6 to 15	Copies of GTP
6 to 15	Copies of type, Routine & Acceptances tests.
6 to 15	Copies of manufacturing quality plan.
6 to 15	Copies of shipping list detailing the description & quantities of all items being dispatched separately, with shipping weights, number of cases and dimensions.

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

3.5 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.

3.6 SURFACE TREATMENT

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

3.7 WELDING

All welding shall be done by a qualified welder.

3.8 PACKING AND MARKING

3.8.1 PACKING

Cable Tray Material 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 a way to avoid damage during transits.

For export project, the packing shall be SEAWORTHY as explained in section1.

3.8.2 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
(To be submitted by the supplier at the contract execution stage)

1.0	Name of the Project	:
2.0	Bidder's Name and Address	:
3.0	Applicable Standards	:
4.0	Application	:
5.0	Material specification	:
6.0	Weight of Zinc coating	:
7.0	Min. thickness of Zinc coating at any spot	:
8.0	Min. Thickness of Painting for Painted Assembly	:
9.0	Colour of Paint for Painted assembly	:
10.0	Weight of assembly	:

Name of the firm:----------

Signature of the Tenderer:----------

Designation:----------

Date:

Place:

SECTION - 5

CHECK LIST FOR INFORMATION TO BE FURNISHED WITH OFFER

FURNISH 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.	Equipment	Rack/hanger assembly	YES / NO	
2.	Material of rack	MS	YES / NO	
3.	Material certificate	As per Standard specification	YES / NO	
4.	Weight of zinc coating	610gm/m^2	YES / NO	
5.	Required accessories	Included	YES / NO	
6.	Conformance to the Applicable standard	As specified in clause 2.7 , Section -2 of the specification	YES / NO	
7.	All type of assemblies	Considered	YES / NO	
8.	*Item considered for additional Zinc Coating*	Considered	YES / NO	
9.	*Weight of Assemblies shall be as per IS 808 or considering Desnsity of 7850 kg/m^3*	*As specified in clause 2.1.3of Section -2 of the specification*	YES / NO	

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.

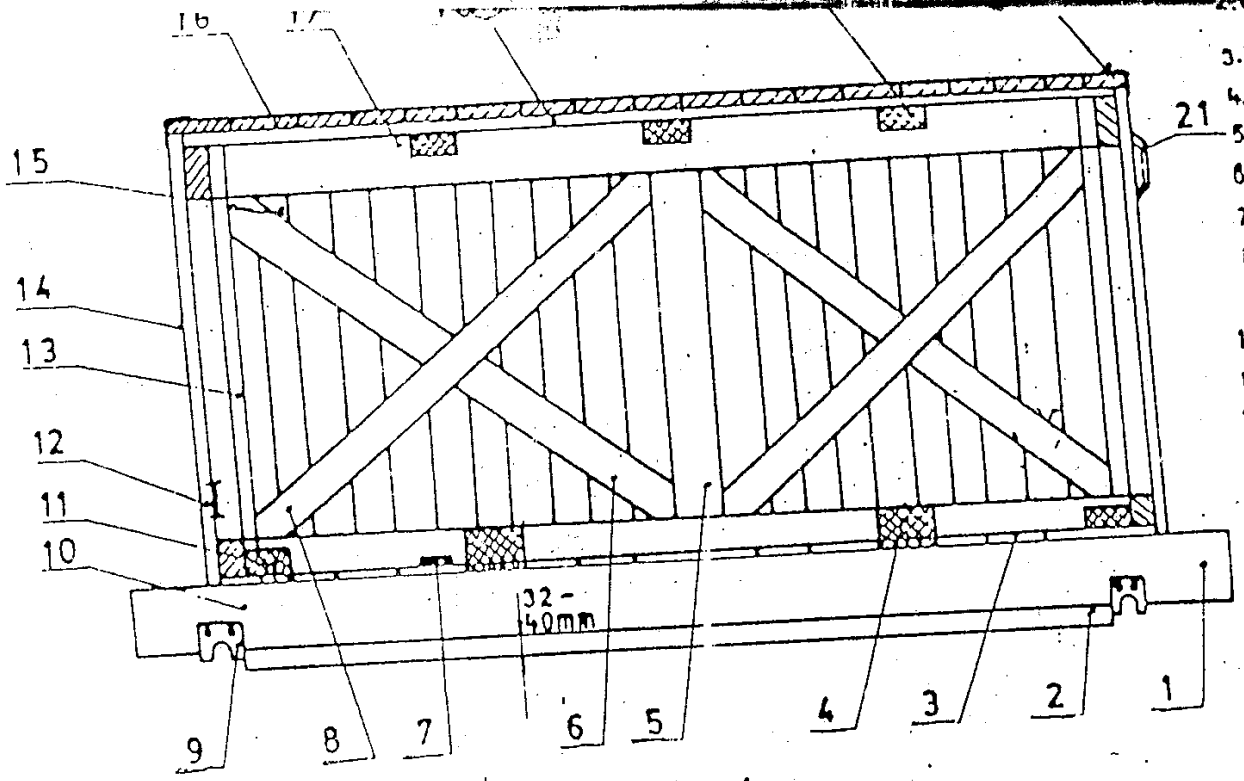
Dispatch details such as consignor/consignee address, contract and case details, country of origin , port of delivery, stacking instructions shall be written on one of the side of boxes. An anodised aluminium plate shall be provided on one side of the boxes.

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

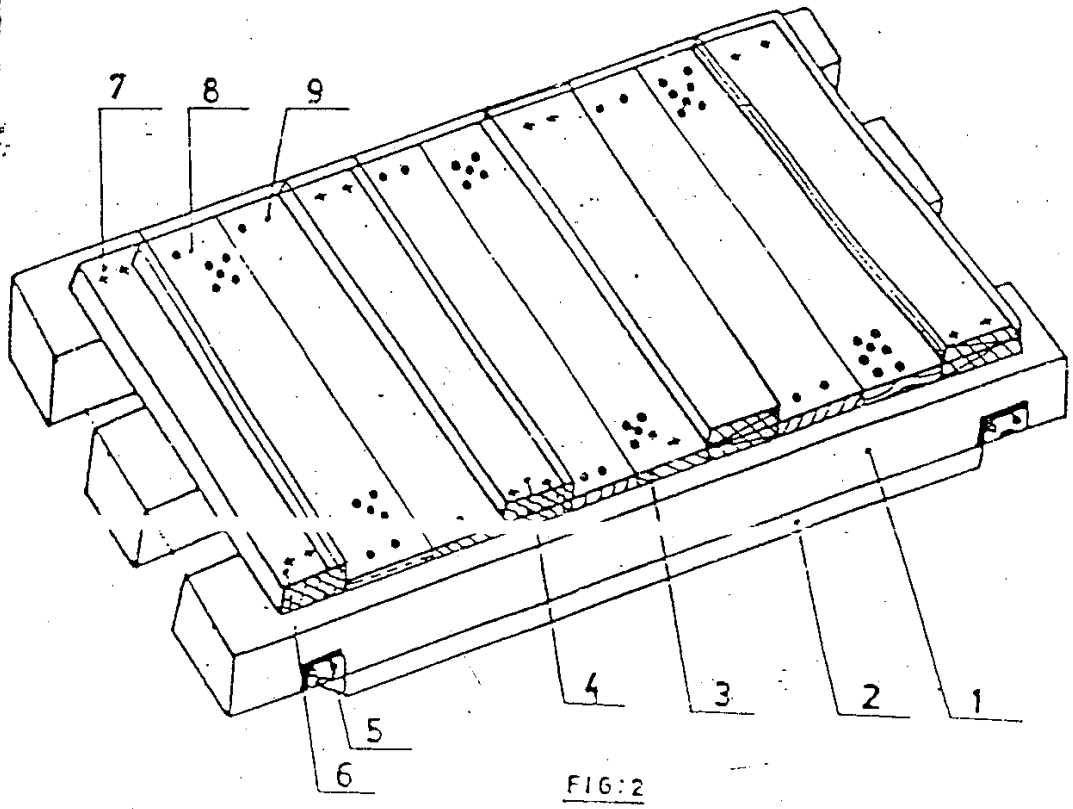


FIG:2

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

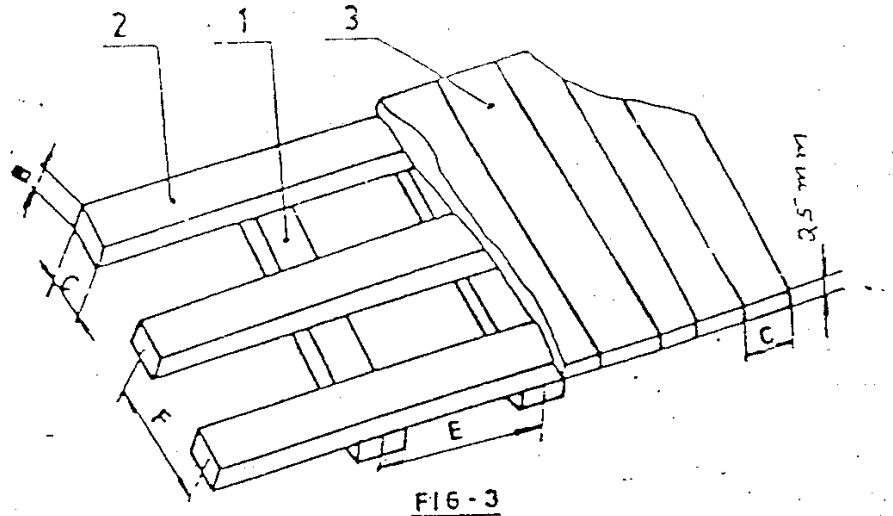
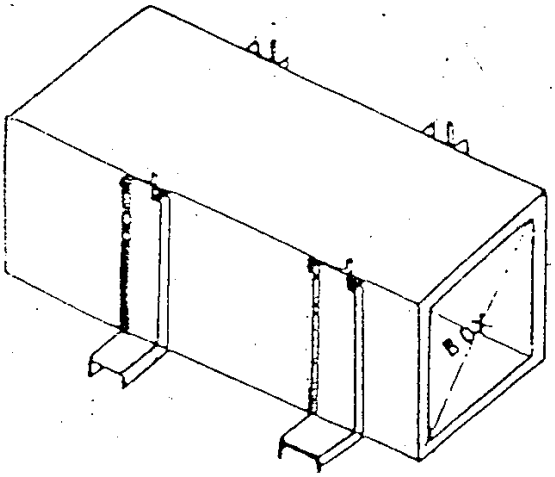


FIG-3

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



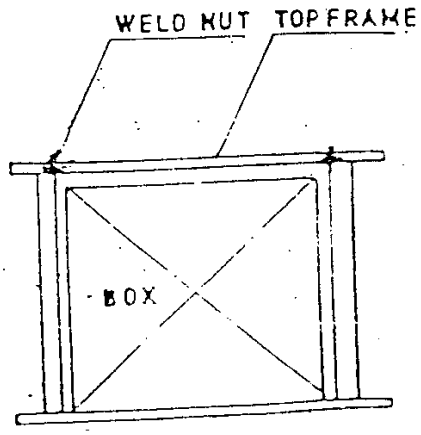


FIG: 4

ARRANGEMENT OF DIAGONAL BRACING AND HORIZONTAL SUPPORT

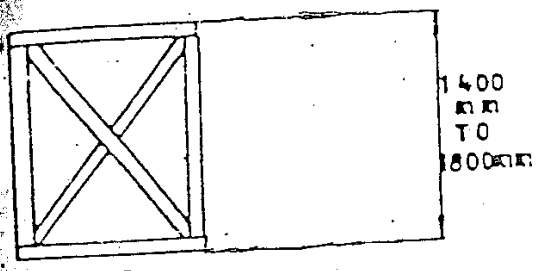


FIG: 6

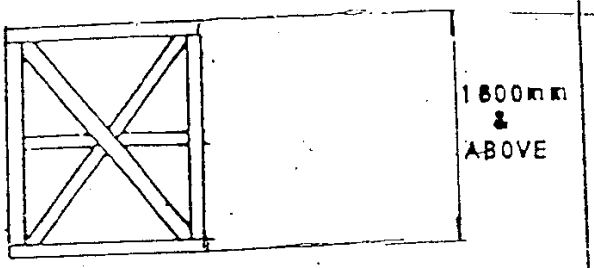


FIG: 8

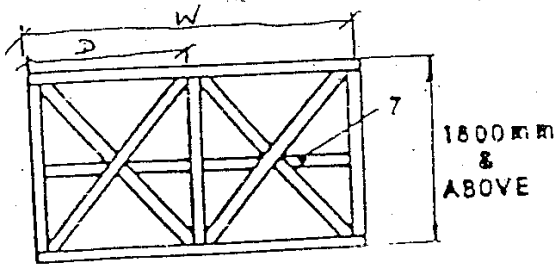


FIG: 9

7- Middle Horizontal Support

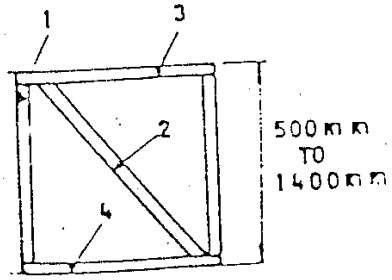


FIG: 5

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

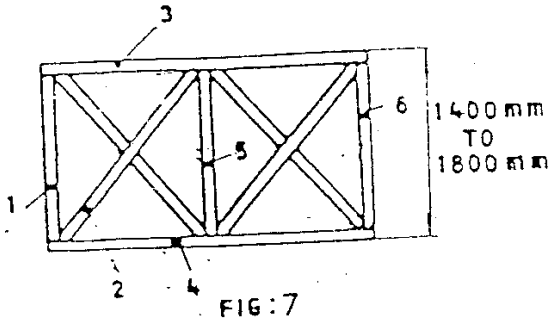
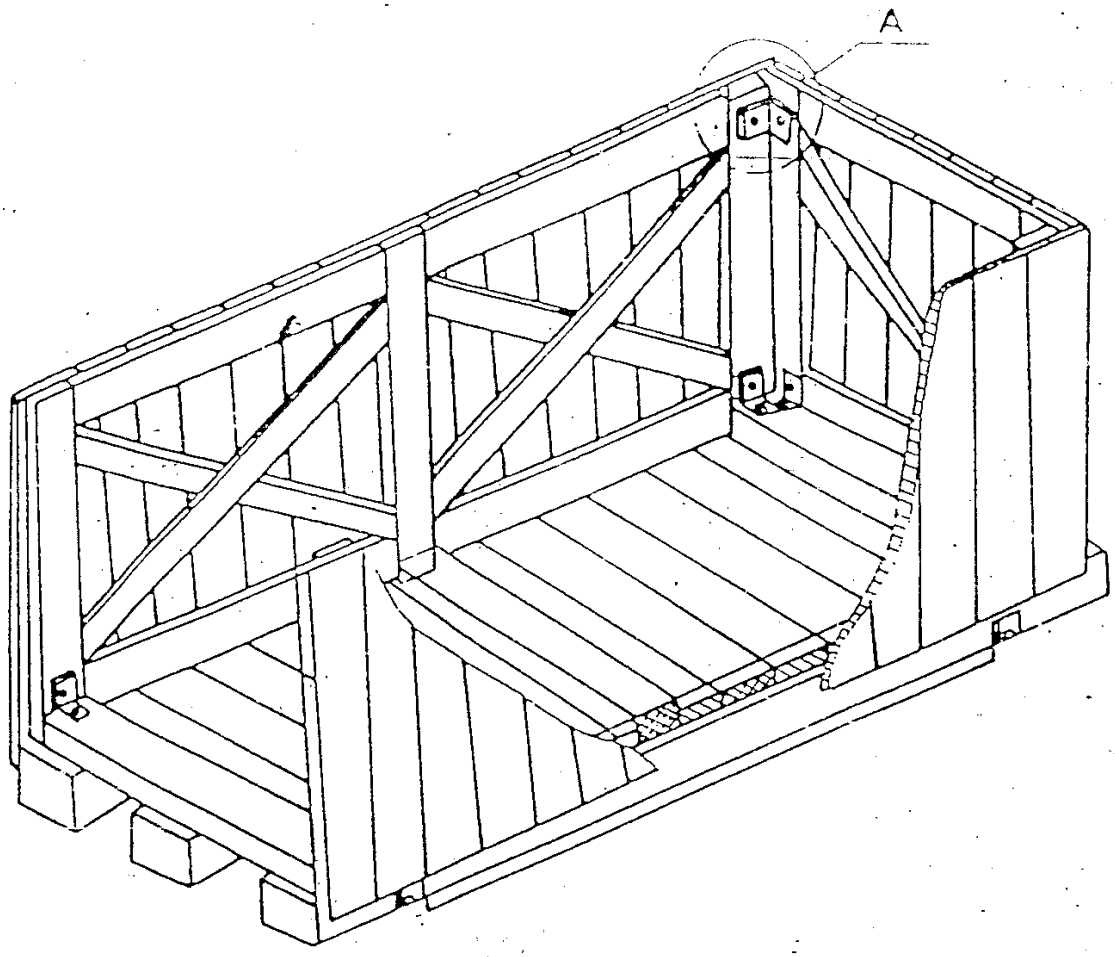


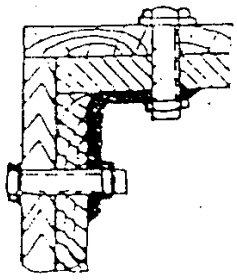
FIG: 7

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

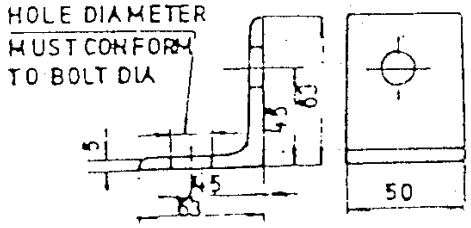


FIG:10

ARRANGEMENT OF SLING - PLATE ON CASES

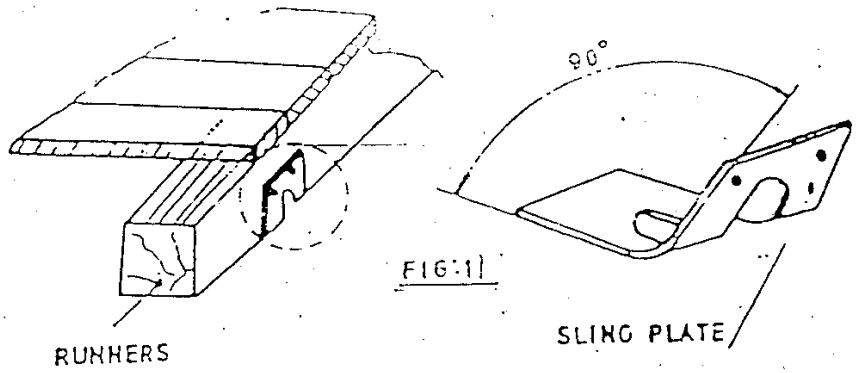


FIG:11

Table

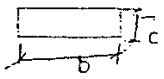
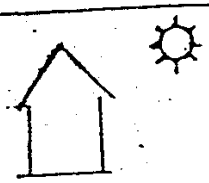
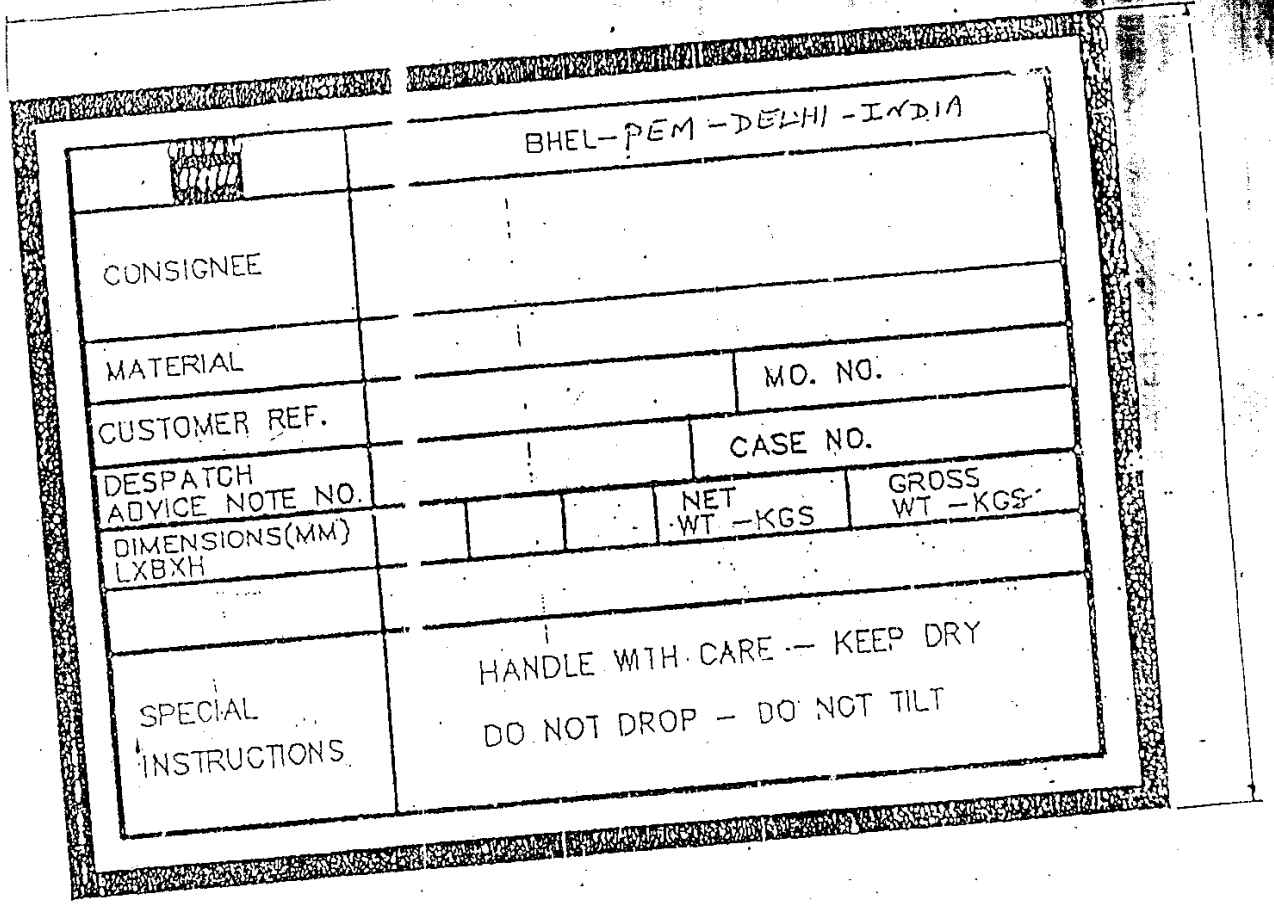
Load	Length of Slides 600	800	1000	1200	1300	1500	2000
	Cross Section b x c 						
500	50 x 100	50 x 100	50 x 100	50 x 100	75 x 100	75 x 100	100 x 100
800	50 x 100	50 x 100	75 x 100	75 x 100	75 x 100	75 x 100	100 x 100
1000	75 x 100	75 x 100	75 x 100	100 x 100	100 x 100	100 x 110	100 x 150
1500	75 x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

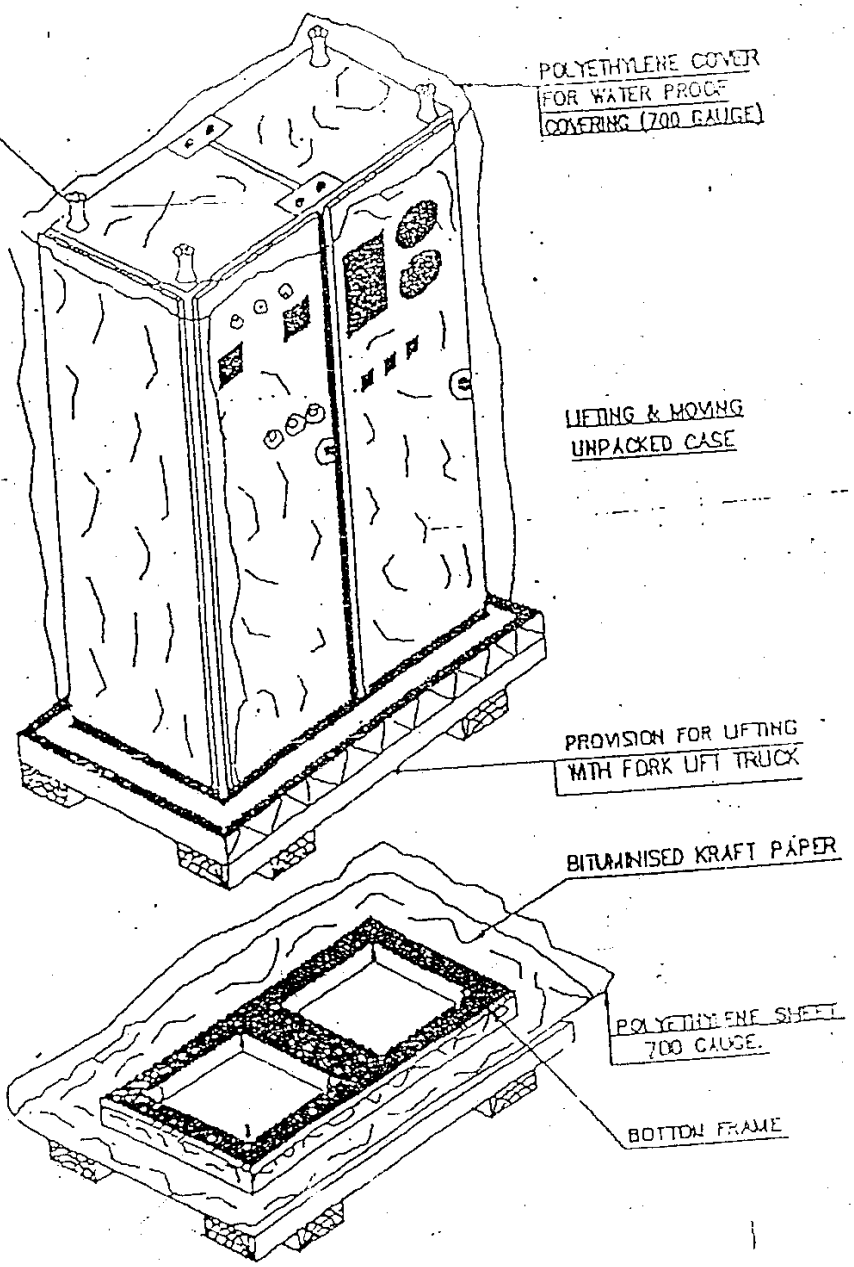

EYE BOLT
POLYETHYLENE COVER FOR WATER PROOF COVERING (700 GAUGE)
LIFTING & MOVING UNPACKED CASE
PROVISION FOR LIFTING WITH FORK LIFT TRUCK
BITUMINISED KRAFT PAPER
POLYETHYLENE SHEET 700 GAUGE.
BOTTOM FRAME

FIGURE-14

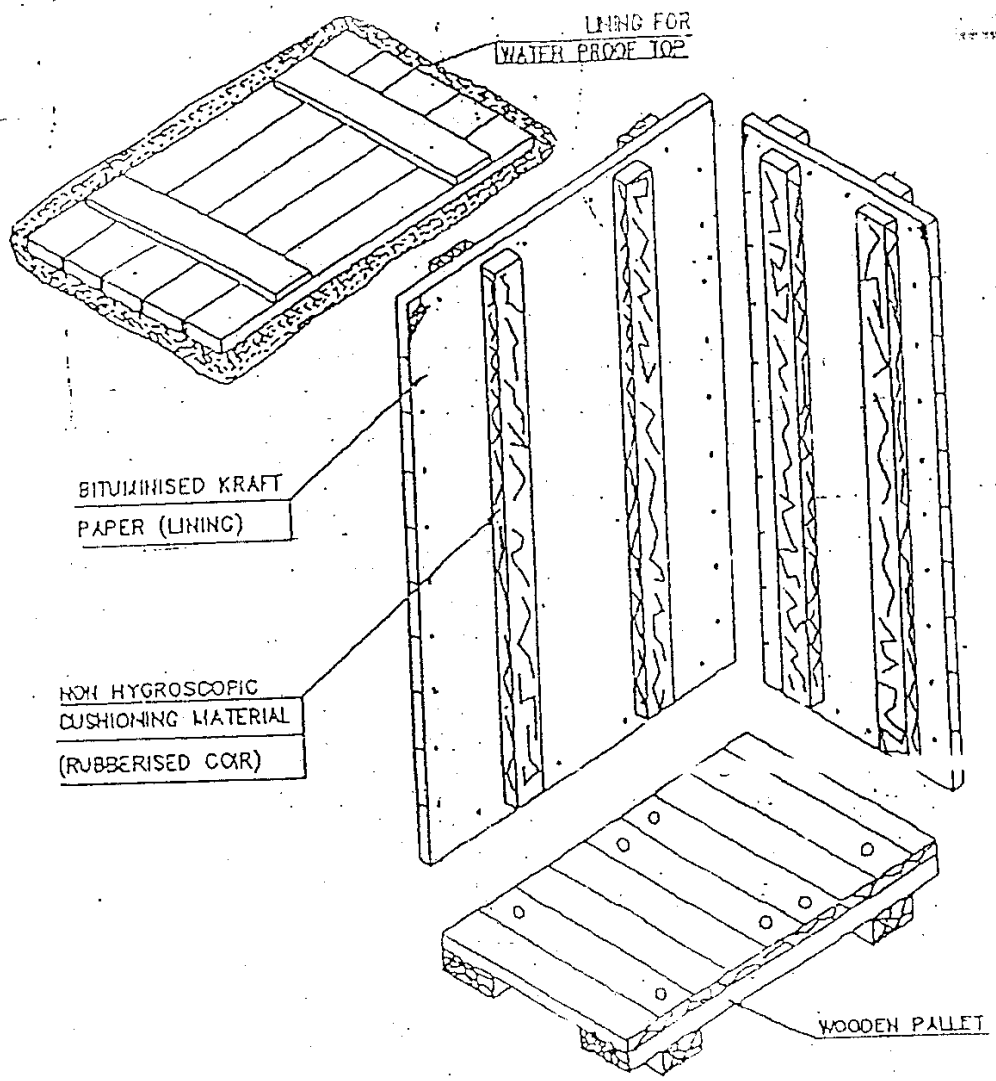

LINING FOR
WATER PROOF TOP
BITUMINISED KRAFT
PAPER (LINING)
NON HYGROSCOPIC
CUSHIONING MATERIAL
(RUBBERISED COIR)
WOODEN PALLET

FIGURE-15

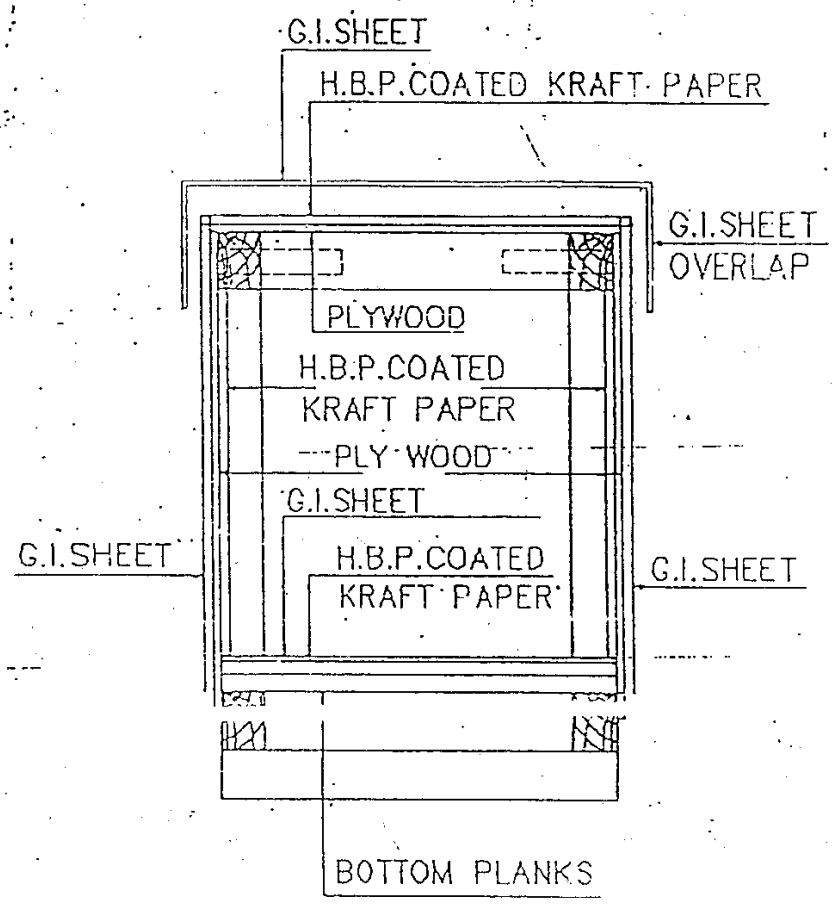


FIG-16 : CLOSED PACKING CASE WITH G.I.SHEET SHOWING LAYERS OF PACKING MATERIALS.