BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS GROUP, (MATERIALS MANAGEMENT)
Integrated Office Complex, 3rd Floor,
Lodhi Road, New Delhi – 110 003, INDIA
Phone: 011 – 41793299, Fax: 011 - 24365869
Email :smmittal@bhelindustry.com

TENDER ENQUIRY NO.:	**E - 4583194**	**DATE :**	**20/10/2008**
DUE ON DATE :	**19/12/2008**	**TIME :**	**10.15 Hrs. (IST)**
PROJECT :	AL-JABAL-AL-GHARBI (WEST MOUNTAIN)-GAS TURBINE POWER PROJECT RUWAIS LIBYA		
ITEM :	420 KV XLPE POWER CABLES WITH ACCESSORIES AS PER CLAUSE 1.3 OF TECHNICAL SPECIFICATION NO. TB-313-316-001		

Please find herewith enclosed above mentioned tender enquiry along with following enclosures:

√1.	Tender Enquiry	√5.	Checklist (BHEL/TBG/SOI/01)
√2.	Our Terms and conditions	√6.	Schedule of commercial & technical deviations
√3.	Schedule of prices (BHEL/TBG/SP/01)	√7.	Technical Specification
√4.	Activity schedule (BHEL/TBG/ATS/01)	√8.	Packing and other erection marks

You are requested to submit your most competitive offer so as to reach us positively by the tender opening date and time. THE TENDERS NOT RECEIVED WITHIN SCHEDULED DATE AND TIME ARE LIKELY TO BE IGNORED. BHEL shall not be responsible for any postal delay.

IN YOUR OWN INTEREST YOU ARE ADVISED TO CAREFULLY READ "TERMS AND CONDITIONS FOR INDIGENOUS TENDER ENQUIRY". INCOMPLETE BIDS AND / OR BIDS NOT COMPLYING WITH TENDER CONDITIONS SHALL BE TREATED AS NON RESPONSIVE & ARE LIKELY TO BE IGNORED.

In case Tender Documents are not received within 7 days of this Fax message, intimate BHEL accordingly. If no intimation is received, it will be considered that you have received tender enquiry & delay in submission due to late receipt of tender documents will not be entertained.

Please acknowledge the receipt of tender enquiry and fax back this letter by ticking the appropriate item below:

EXECUTIVE (TBMM) :
NAME : S.P. SINHA
DESIGNATION : DY. MANAGER / TBMM

ACKNOWLEDGEMENT BY TENDERER

We acknowledge the receipt of tender:

a) The offer against subject enquiry shall be submitted by the scheduled date & time.

b) We regret to quote. The item in reference is out of our manufacturing range.

c) We regret because of our prior commitments.

d) Any other reason.

(Signature and Seal of Tenderer)

TENDER ENQUIRY NO.: E – 4583194, DATE 20/10/2008

TO
S.M. MITTAL, AGM / TBMM
Fax No. 011 – 24365869

BHARAT HEAVY ELECTRICALS LTD.

(TRANSMISSION BUSINESS GROUP)

GENERAL TERMS AND CONDITIONS FOR ENQUIRY

NOTE: This format is to be submitted in original only, duly filled in. Reproduction of this format on bidder's letter head or on other paper is not acceptable.

Sr. No	ENQUIRY NO. E-4583194, date 20/10/2008
1.	1. Sealed quotations are invited for the items mentioned in the enquiry. Quotations should be typed and free from over writing and erasures, corrections or additions must be clearly written both in words and figures and attested, otherwise offer may be rejected. 2. Bidder must ensure that their quotation is received / dropped in the tender box on or before 10.15 AM of the due date of opening in **Material Management Division,** **Transmission Business Group,** **BHEL, Integrated Office Complex,** **Lodhi Road, New Delhi – 110 003, India.** **Phone : 091-11- 41793299, Fax :091-11-24365869,** **Email: smmittal@bhelindustry.com, spsinha@bhelindustry.com.** 3. The same shall be opened at 10.30 AM on the same day. Tenders received late may be rejected. Bidders sending tenders by courier or post, to ensure that it is delivered one day before as same day delivery may not reach above office by due time. 4. Bids are to be submitted in Two parts: i) Techno-commercial bid (Part I) – To be submitted in duplicate. A copy of price bid (Part II) (without prices) is also to be enclosed in Part I bid. ii) Price bid (Part II) – To be submitted only in one copy in a separate sealed envelope. This should not contain any Technical or Commercial Terms. The rates should be quoted both in figures and words. In case of any difference between figures and words, the quoted rate in words will prevail over figure. If there is a calculation mistake in multiplication of unit rate with quantity, then the unit rate quoted will be considered for calculation. Both Part I and Part II bids are to be sealed in separate envelope and both envelops to be kept in another common envelope. Each envelope should be sealed and super scribed with enquiry no., item / package name, project name and due date of opening. 5. For any Technical clarification, please contact **Mrs. Aruna Gulati, Sr. Manager / TBEM** **BHEL, Integrated Office Complex,** **Lodhi Road, New Delhi – 110 003, India** **Phone : 091-11- 41793286, Fax :091-11-24369509,** **Email: aruna@bhelindustry.com** For any commercial clarification please contact person issuing enquiry. 6. Price bid should not contain any information / description / terms & condition other than given in Part-I of the bid except prices, otherwise bid is liable for rejection.

Sr. No	ENQUIRY NO. E-4583194, date 20/10/2008
	7. Price bid submitted along with the bid shall remain valid up to validity of offer. Unsolicited Supplementary / Revised price bid submitted during validity period of offer, unless asked by BHEL, shall not be considered. Withdrawal of quotation by the bidder, at any stage after its opening, may entail blacklisting of vendor. **8. Enquiry condition for where the scope against this tender includes Installation and Commissioning of the equipment / material** There will be separate contract awarded for Supply portion and Site execution portion. For Supply portion General Terms and Conditions mentioned here shall be applicable for Site execution portion, Terms and conditions for Installation services shall be applicable. However, any breach in either of the contract shall be deemed as the breach of other contract also.
2.	**PRICES:** **A.** The prices as quoted in price schedule part –II are firm through out the currency of contract. **B**. The break-up of price shall be as under:- **i) Ex-works Price:** FOB price including seaworthy packing and forwarding charges. **ii) Freight & Insurance:** Freight charges must be quoted separately from Port of Loading to **Libiyan Seaport. Transit insurance from Port of Loading to Port of Discharge will be in BHEL's scope hence not to be quoted.** **iii) Erection / Commissioning supervision charges:** If asked in the technical specification, to be quoted separately along with taxes and duties applicable on them. Note : The purchase order shall be placed on Ex-works basis.
3.	**TERMS OF PAYMENT:** - a) **FOR SUPPLY PORTION**:- By irrevocable LC which will be opened after placement of order and receipt of performance bank guarantee for 10% of order value. All bank charges to supplier's account. **90%** against original invoice, original bill of lading, packing list, MICC (dispatch clearance given by BHEL quality group), guarantee certificate, certificate of origin. **10%** against material receipt at site against material receipt certificate by BHEL Site Incharge. b) **FOR INSTALLATION SERVICES:**- 100% direct payment within 15 days after acceptance of the installation services work.
4.	**GUARANTEE:** The equipment / material shall be guaranteed for 18 months from the date of delivery or 12 months from the date of commissioning, which ever is earlier. The defective material / component shall be replaced free of cost at site.

Sr. No	ENQUIRY NO. E-4583194, date 20/10/2008
5.	**SECURITY CUM PERFORMANCE BANK GUARANTEE**: In the event of an order, tenderer shall furnish BG towards Security Cum Performance for 10% of total value of P.O., within two weeks of placement of P.O. valid till 60 days beyond the guarantee period, from a reputed Bank of the bidder's country, subject to Purchaser's approval, in our prescribed format. The original BG shall be sent by issuing bank directly to AGM - FINANCE, INDUSTRY SECTOR, BHARAT HEAVY ELECTRICALS LIMITED, INTEGRATED OFFICE COMPLEX, LODHI ROAD, NEW DELHI – 110 003, (INDIA).
6.	**INSPECTION:** BHEL and / or customer may inspect the Equipment/Material before dispatch. In the event BHEL / Customer waives off inspection, certified TEST REPORTS and RESULTS shall be submitted for approval. Supplier shall obtain approval on Test reports and MICC (Material Inspection Clearance Certificate), before dispatch of equipment. BHEL / Customer may also carry out stage inspection during manufacturing of the ordered item.
7.	**DISPATCH DOCUMENTS:** Dispatch documents (Negotiable documents) shall normally comprise Original Invoice, AWB / Bill of Lading, Shipping / Packing lists (case wise), Certificate of country of origin, Material Inspection Clearance certificate (MICC), Test Certificates & approval of acceptance & routine test certificates and manufacturer's guarantee certificate.
8.	**DELIVERY PERIOD:** Bidder to specify delivery period in weeks from the date of LOI / PO in the activity schedule format enclosed with enquiry. Time for conduction of type test, if required, is to be separately indicated. Note: BOL/AWB date or Invoice date whichever is later shall be considered as delivery date for supply portion and date of completion of installation work shall be considered as delivery date for installation work.
9.	**DELAYED DELIVERY:** In case of delay in execution of order beyond the lot wise contractual delivery, an amount of ½ % of total Ex-Works Value per week or part there-of subject to maximum of 5% of total Ex-Works value of P.O. will be withheld.
10.	**VALIDITY:** The offer shall be valid for 120 days from the due date of opening.
11.	**ACCEPTANCE / REJECTION OF TENDER**: BHEL reserves the right to reject in full or part, any or all tender without assigning any reason thereof. BHEL also reserves right to vary the quantities mentioned in the tender.
12.	**EVALUATION:** Comparative statement shall be prepared based on overall quantity basis unless otherwise indicated in the enquiry. Evaluation of offers shall be done on the basis of delivered cost to BHEL.
13.	**DEVIATION**: The bids having deviation(s) w.r.to tender are liable for rejection. However, BHEL, at its discretion, may load the prices for evaluation of offer with prior intimation to bidder.
14.	**ARBITRATION**: All cases of disputes emanating from and relating to this contract, the matter shall be referred to the sole arbitration of Unit Head / GM, BHEL or any other person (including an employee of BHEL, even though he had to deal with the matter relating to this contract in any manner) nominated by him to act as sole arbitrator. The arbitration shall be under 'The arbitration and contract act 1996' and the rules there under as amended from time to time. The arbitrator may from time to time with the consent of the parties enlarge the time for making and publishing the award. The venue of arbitration shall be any Indian city as decided by BHEL.
15.	**LEGAL SETTLEMENT:** All suits/claims in respect of this contract shall be in the courts having jurisdiction at New Delhi.

Sr. No	ENQUIRY NO. E-4583194, date 20/10/2008
16.	**SUBCONTRACTING:** In case further subcontracting of BHEL order or part thereof is envisaged by supplier, the same can be done after written permission is obtained from BHEL. However it shall not absolve the supplier of the responsibility of fulfilling BHEL purchase order requirements.
17.	**RISK PURCHASE:** In case the successful bidder fails to supply or fails to comply with the terms & conditions of the purchase order, BHEL reserves the right to source such material/ component / equipment/ system from any other agency at the risk and cost of the successful bidder.
18.	**ADJUSTMENT OF RECOVERY:** Any amount payable by the supplier under any of the condition of this contract shall be liable to be adjusted against any amount payable to the supplier under any other works/contract awarded to him by any BHEL unit. This is without prejudice to any other action as may be deemed fit by BHEL.
19.	**FORCE MAJEURE CONDITION:** If by reason of war, civil commotion, act of god, Government restrictions, strike, lockout which are not in control of supplier the deliveries are delayed, supplier shall not be held responsible.

Signature of Bidder
Seal

SCHEDULE OF PRICE

(BIDDERS TO STRICTLY ENSURE SUBMITTING THE PRICE BIDS IN THIS FORMAT)

TENDER ENQUIRY NO. : E-4583194, DATE 20/10/2008

SL. NO.	DESCRIPTION OF ITEM	UNIT	QUANTITY	UNIT FOB PRICE	TOTAL FOB PRICE	UNIT FREIGHT UPTO LIBYAN PORT	TOTAL FREIGHT UPTO LIBYAN PORT	UNIT SUPERVISION / ETC PRICE	TOTAL SUPERVISION / ETC PRICE
1	2	3	4	5	6	7	8	9	10
	TOTAL PRICE								

NOTE: 1. PLEASE NOTE THAT UNPRICED COPY OF PRICE BID (i.e. WITH ALL PRICES BLANKED) SHALL BE FURNISHED ALONG WITH TECHNO-COMMERCIAL BID.
2. REQUIRED COPIES OF FORMAT BE MADE & DETAILS MAY BE ANNEXED.
3. THE PRICES MUST BE QUOTED IN THE PRESCRIBED UNIT ONLY.
4. SEAWORTHY PACKING CHARGES ARE INCLUSIVE.

ACTIVITY SCHEDULE

(To be filled – up by the supplier)

NOTE: This format is to be submitted in original only, duly filled in. Reproduction of this format on bidder's letter head or on other paper is not acceptable.

ENQUIRY NO. E-458294, DATE 20/10/2008

SL. NO.	ACTIVITY	ACTIVITY TIME IN WEEKS	CUMULATIVE TIME IN WEEKS FROM LOI/PO DATE	REMARKS IF ANY
1.	Submission of documents necessary for getting manufacturing clearance like Drawings, date sheet etc.			
2.	Approval of documents in Cat-I from BHEL / Customer *			
3.	Manufacturing time			
4.	Inspection call			
5.	Customer Inspection and Despatch Clearance			
6.	Transportation to destination.			
7.	Installation Services			

Note : 1) * Supplier must ensure the completeness and correctness of the requisite documents before submission for approval. Delay in approval on account of incomplete / inadequate information shall be the responsibility of supplier.

2) Inspection call should be given in the prescribed format only. Inspection calls not in the prescribed format shall not be entertained.

3) Qty to be offered for inspection should be in accordance within Delivery-schedule – lot. BHEL reserves the right not to entertain multiple inspection calls for a Delivery – lot and delay on this account shall be the responsibility of Supplier.

Signature & Seal of Supplier

Date:

ENQUIRY NO. E-458294, DATE 20/10/2008

CHECKLIST

SCHEDULE OF INFORMATION TO BE FURNISHED WITH THE OFFER

NOTE: This format is to be submitted in original only, duly filled in. Reproduction of this format on bidder's letter head or on other paper is not acceptable.

Put a tick mark on "YES" if the information is enclosed with the offer or put a tick mark on "NO" if the information is not enclosed or write "NOT APPLICABLE" if the information is not applicable.

1.	Technical offer with detailed schedule of equipment / material and spares enclosed.	YES / NO
2.	Guaranteed Technical Particulars as per Section – 4 enclosed.	YES / NO
3.	Schedule of deviation, if any, clause wise with respect to Technical Specification enclosed.	YES / NO
4.	Standard Manufacturing Quality Plan enclosed.	YES / NO
5.	GA Drawings with dimensions and weights & foundation / fixing details enclosed.	YES / NO
6.	Drawing and Data submission schedule enclosed.	YES / NO
7.	Type Test Reports enclosed.	YES / NO
8.	Bar Chart showing the schedule indicating time required for design, manufacture, test and inspection, transport, erection, site testing and commissioning enclosed.	YES / NO
9.	Makes of all components as per technical Specification enclosed.	YES / NO
10.	Schedule of commercial deviation exception from the General Terms and Conditions	YES / NO

The above checklist is verified for:-

Offer Ref. :

Equipment :

Submitted by : M/s

Project Reference. :

Signed with Seal .....

Date .....

ENQUIRY NO. E-458294, DATE 20/10/2008

SCHEDULE OF COMMERCIAL DEVIATION

The following are the deviations / variations exception from the General Terms and Conditions:-

SL. NO.	CLAUSE NO. OF GENERAL TERMS & CONDITIONS	STATEMENT OF DEVIATION

Incase, this schedule is not submitted, it will be presumed that the equipment / material to be supplied under this contract is deemed to be in compliance with the General terms and Conditions.

If there is NIL deviation, even then the format to be filled as NIL DEVIATION.

NOTE: Continuation sheets of like size and format may be used as per the Bidder's requirement and shall be annexed to this schedule.

Place .....

Date .....

Signature of the authorized representative of

Bidder's Name .....

Designation .....

Company seal .....

ENQUIRY NO. E-458294, DATE 20/10/2008

SCHEDULE OF TECHNICAL DEVIATION

The following are the deviations / variations exception from the Technical Specifications:-

SL. NO.	CLAUSE NO. OF TECHNICAL SPECIFICATIONS	STATEMENT OF DEVIATION

Incase, this schedule is not submitted, it will be presumed that the equipment / material to be supplied under this contract is deemed to be in compliance with the Technical Specifications.

If there is NIL deviation, even then the format to be filled as NIL DEVIATION.

NOTE: Continuation sheets of like size and format may be used as per the Bidder's requirement and shall be annexed to this schedule.

Place .....

Date .....

Signature of the authorized representative of

Bidder's Name .....

Designation .....

Company seal .....

BHARAT HEAVY ELECTRICALS LTD.
(TRANSMISSION BUSINESS GROUP)

TERMS & CONDITIONS FOR SUPERVISION / INSTALLATION SERVICES

NOTE: This format is to be submitted in original only, duly filled in. Reproduction of this format on bidder's letter head or on other paper is not acceptable.

Sl. No.	Terms & Conditions
1.0	**SCOPE OF WORK:** As per our Technical Specification No. TB-TB-313-316-001
2.0	**COMMENCEMENT OF WORK**: Project start / zero date for this work shall be intimated by BHEL.
3.0	**COMPLETION SCHEDULE**: Bidder to specify delivery period in weeks from the date of Project start / zero date in the activity schedule format enclosed with enquiry.
4.0	**OVER RUN CHARGES**: No over run charges are payable.
5.0	**IDLE LABOUR CHARGES:** No idle labour charges will be admissible in the event of any stoppage of work resulting in the contractor's workmen being rendered idle due to any reason at any time.
6.0	**SECURITY-CUM-PERFORMANCE GUARANTEE:** The contractor shall furnish security-cum-performance BG for 10% of total contract value within two weeks of placement of work order valid till guarantee period from a reputed Bank of the bidder's country, subject to Purchaser's approval n the prescribed format . The BG should be sent directly by your banker to AGM - FINANCE, INDUSTRY SECTOR, BHARAT HEAVY ELECTRICALS LIMITED, INTEGRATED OFFICE COMPLEX, LODHI ROAD, NEW DELHI – 110 003, (INDIA).
7.0	**INSURANCE:** The Contractor shall take insurance cover(s) to cover his Tools and Plant assets, workman compensation and third party liability. The contractor shall make available the original insurance cover(s) to the Engineer for necessary verification before commencement of work.
8.0	**GUARANTEE:** Though the work will be carried out under the supervision of BHEL Engineers, the contractor shall be responsible for the quality of the workmanship and shall guarantee the work done for a period of 15 months from the date of putting the complete system into commercial operation or 18 months from the date the system is declared completely erected, duly tested and accepted by customer, whichever is later and shall rectify free of cost all defects due to faulty erection detected during the guarantee period starting from the date of the completion of rectification. In the event of the contractor failing to repair the defective works within the time specified by the engineer, BHEL may proceed to undertake the repairs of such defective works at the contractor's risk and cost without prejudice to any other rights under the contract and recover the same from security deposit/ other dues of this project or any other project executed by the contractor.
9.0	**TERMS OF PAYMENT:** The terms of payment shall be as specified under Clause 3 of General Terms and Conditions of Overseas Enquiry.

SL. No.	Terms & Conditions
10.0	**ESCALATION / PRICE VARIATION:** Prices shall be firm for total contract period and extended period, if any, and no price escalation / price variation will be applicable.
11.0	**COMPENSATION FOR DELAY IN EXECUTION:** In case the contractor fails to complete the work within the time specified or any extension thereof subject to force major condition, the contractor shall be liable to pay by way of compensation, a sum equal to half percent (½%) of the contract price, per calendar week or part thereof by which the commissioning is delayed, subject to a ceiling of 5% of the contract price.
12.0	**ADDITIONAL EXPENDITURE:** In case any additional expenditure is incurred in the works arising out of the faulty execution of the works by the contractor, such additional expenditure shall be borne by the contractor.
13.0	**REGULATION OF LOCAL AUTHORITIES AND STATUS :** The contractor shall adhere to the regulation of local authorities and status.
14.0	**DISCIPLINE OF WORKMEN:** The contractor shall adhere to the disciplinary procedure set by the owner in respect of his employees and workman at site.
15.0	**FORCE MAJEURE:** The force majeure shall be as specified under Clause 19 of General Terms and Conditions of Overseas Enquiry.
16.0	**ARBITRATION:** The arbitration shall be as specified under Clause 14 of General Terms and Conditions of Overseas Enquiry.

We understand that the bids having deviation (s) w.r.t tender are to be out rightly rejected. BHEL, however at their discretion, if consider the bid, have undisputable right to load the prices for price comparison as they deem fit.

Signature of Supplier
With seal

BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION PROJECTS ENGINEERING MANAGEMENT

New Delhi

DOC. No.	TB-313-316-001		Prepared	Checked	Approved
TYPE OF DOC.	TECHNICAL REPORT	NAME	Aruna	Ramnath	M.I.Khan
TITLE		SIGN	sd	sd	sd
400 kV XLPE -INSULATED POWER CABLES & TERMINATIONS		DATE	05.06.08	05.06.08	05.06.08
		GROUP	TBEM	W.O. No	88001
CUSTOMER	General Electric Company of Libya (GECOL)				
CONSULTANT	M/s ACESCO				
Project Doc. No.	BHEL/WM/TB/4423/Extn. Rev. 02				
PROJECT	AL-JABAL AL-GHARBI (WEST MOUNTAIN) – GAS TURBINE POWER PROJECT RUWAIS LIBYA				

CONTENTS

Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS
02	28.08.08	AG	R.Koul	R.Koul	Alternative offer for 400 Sq. mm size cable also requested
01	31.07.08	AG	Dr. RN	R.Koul	BOQ clearly defined

Distribution	To	IO	TBMM		
	Copies	6	6		

SECTION 1

SCOPE AND SPECIFIC TECHNICAL REQUIREMENTS

1.1 SCOPE

This specification covers the requirement for design, manufacture, testing, Sea worthy Packing, transportation from manufacturer's works to the site, supervision of cable laying and installation and commissioning of 420 kV XLPE-insulated, single-core power cables and outdoor and Indoor cable termination. The transit insurance & custom clearance / port clearance are in BHEL's scope.

The materials are required for the following project.

Name of customer	:	General Electric Company of Libya (GECOL)
Name of the project	:	AL-JABAL AL-GHARBI (West Mountain) Gas Turbine Power Project, Ruwais Libya
Name of Consultant	:	M/s ACESCO

These cables are intended to connect the two number generator transformers with the existing 420 kV GIS feeders. The cables in the transformer yard will be connected to Generator transformer through outdoor cable terminations. Interconnection between outdoor termination and transformer bushing shall be by means of ACSR Moose conductor. On 400 kV switchyard side, cable will be terminated in GIS section through GIS termination.

1.2 SPECIFIC TECHNICAL REQUIREMENTS

S. No.	PARTICULARS	UNIT	DATA
1.	**Type of the cable**	**Insulation**	**XLPE**
2.	**No of phases per circuit**	**Nos**	**3**
3.	**No of Cable per phase**	**No**	**1**
4.	Rated System Voltage	kV	420
5.	Nominal System Voltage	kV	400
6.	System earthing	-	Effectively Earthed
7.	Rated system frequency	Hz	50 ± 3%
8.	Continuous Load current	A rms	250
9.	Short time thermal withstand current	kArms	40 for one second
10.	Peak dynamic withstand current	kA_p	100
11.	1.2/50μs lightning impulse withstand voltage (dry)	kV_p	1425
12.	Rated switching Impulse withstand voltage	kVp	1050
13.	1-minute dry power frequency withstand test voltage	kV	As per IEC
14.	Limits of the temperature rise for conductor , XLPE insulation and sheath	Deg C	As per IEC
15.	Minimum Creepage distance for terminations	mm / kV	31
16.	Maximum single run length	mts	**Approx. 750**
17.	In case single length is not feasible to transport, no. (minimum no. to the possible extent) of joints to be proposed by the bidder	Nos	TO BE FURNISHED BY SUPPLIER
18.	Material of the conductor	-	Copper
19.	Cross – sectional area of the conductor	Sq mm	**630/400 (I)**

20.	Shape		Compacted circular
21.	Conductor Screen		Extruded semiconducting compound
22.	Material of Insulation		Extruded XLPE
23.	Insulation Screen		Extruded semiconducting compound
24.	Metallic sheath		Corrugated Aluminium
25.	Outer Sheath		Flame retardent Polyethyline
26.	Earthing on GIS side		Solidly Earthed Link Box without Sheath voltage limiter
27.	Earthing on AIS side		Earthed Link Box with Sheath voltage limiter
28.	Operating temperature of the conductor		
	Maximum permissibletemperature during normal operation under combined effect of ambient & max. load	Deg C	90
	Maximum permissible temperature during short circuit under combined effect of ambient & max. load	Deg C	250
29.	Cable Route		Major route in trench
30.	Length marking		At every meter

1.3 DETAILED SCOPE

S. No.	*Description*	*Quantity*
1.	420 kV, Power cables (1-CORE, **630 / 400** (1) -Sq.mm** stranded copper conductor, extruded semicon compound conductor screen, unfilled cross linked polyethelene (XLPE) insulation, extruded semicon compound insulation screen, swellable tape water blocking semicon tap, *Copper tape screen,* corrugated aluminium sheath, with bitumen coating, and overall black FR PVC sheath with overall graphite coating suitable for laying in air (surface trenches)	4.5 kms*
2.	Detailed design, complete manufacturing including type & routine testing as per relevant standards for S.No.1 above	-
3.	Providing Engineering data & drawings for customer's review, approval & records	-
4.	Outdoor cable terminations for above cables with clamps suitable for connecting Twin Moose ACSR Conductor	6 Nos.
5.	Indoor cable terminations suitable for GIS switchgear	6 Nos.
6.	Link boxes for the connection of the cable sheath to the grounding system including copper cable required for earthing at GIS side	6 Nos.
7.	Sheath Voltage Limiter (SVL) on the transformer side terminations but without boxes and copper connections to the earth.	6 Nos.

8.	In case single length is not feasible to transport, (minimum number of proposed joints for all runs to be supplied)	*To be included by the bidder*
9.	Cabling accessories such as cable trefoil clamps	As required
10.	Any other equipment not mentioned above but essentially required for satisfactory operation of the system	As required
11.	Mandatory Spares	NIL
12.	Sea worthy Packing, transportation, from manufacturer's works to the site, excluding transit insurance & custom clearance / port clearance	
13.	Supervision of Cable Laying (Special tools and tackles, if required, to be brought to site by supplier)	
14.	Cable Termination (Special tools and tackles, if required, to be brought to site by supplier)	
15.	Site testing(Special tools and tackles, if required, to be brought to site by supplier)	

*** Exact length & cut length shall be given after approval of the final layout by the customer before start of the manufacturing. The final quantity of the cable may change to the order of ±30%.**

****Supplier to give detailed cable sizing calculation justifying the size of the cable.**

Supplier will submit detailed bar chart indicating all the milestones from Engineering till manufacturing/ testing, dispatch to site and commissioning

(1) **Supplier to quote for both 630 sq mm and 400 sq mm sizes along with cable sizing calculations (Maximum continuous current=290 A, Fault current=40 kA for 1 sec). BHEL reserves the right to place order for either of the sizes.**

SECTION 2

TECHNICAL REQUIREMENTS

General

This section covers the general technical requirements of XLPE-insulated power cables and cable terminations, testing at works and site testing.

The materials/ equipment to be supplied shall be capable of meeting all intended duties.

2.2 Applicable Standards

The XLPE Cables and the associated accessories shall conform to the following International standards, as amended/ revised till date, as appropriate:

IEC 62067(2001)	Power cables with extruded insulation and their accessories for rated voltage above 150 kV up to 500kV – Test methods and requirements.
IEC 60060 Part-1	High voltage test techniques
IEC 60187	General definitions & test requirements
IEC 60068	Seismic test methods for the equipment
IEC 60183	Guide to the selection of High Voltage Cables
IEC 60228	Conductors for insulated cables
IEC 60229	Tests on cable over sheaths
IEC 60230	Impulse test on cables and their accessories
IEC 60270	Partial Discharge Measurements
IEC 60287	Calculation of continuous current carrying capacity & losses
IEC 60332 Part-1	Test on Electric Cables under fire conditions
IEC 60502	Power Cables with extruded insulation and their accessories
IEC 60506	Switching Impulse test on EHV Insulators
IEC 60540	Test methods for insulations and sheaths of electric cables and cords
IEC 60811 Part-1 to Part-4	Common test methods for insulating and sheathing materials of electric cables
IEC 60840	Tests for power cables with extruded insulation
IEC 60859	Cable connections for gas insulated metal enclosed cwitchgear
IEC -60885 Part-3	Electrical test methods for electric cables
IEC 62087	
CIGRE WG21.03 (Electra 151) (Dec 1993)	Recommendation for electrical tests on extruded cables and accessories
IEEE 48	Test procedures and requirements for high voltage cable terminations
IEEE 404	Joints for use with solid dielectric cables
IEEE 635	Guide for selection and design of aluminium sheath

2.3 Cables

Cables shall be manufactured in accordance with the applicable clauses of relevant IEC standards.

The cable shall have stranded compact round copper conductor, semi-conducting conductor screen. The insulation shall be XLPE. The insulating layer shall be provided with and semi-conducting screen. The cable shall be provided with a metallic sheath. The cable shall be designed and manufactured to eliminate ingress of moisture under all laying conditions. Cables shall be manufactured with the 'state-of-art-technology', ensuring long, trouble-free service life under all operating conditions. All the three layers, viz., conductor screen, XLPE insulation and insulation screen, shall be extruded in one simultaneous operation.

No splice shall be made in the conductor as a whole, or in any wire comprising the conductor throughout its length. The conductor shall be circular, non-segmental and very well compacted to facilitate a smooth interface between conductor screen and insulation.

The cable shall be designed and manufactured to withstand the mechanical forces caused by the specified short circuit current and the insulation stresses caused by an earth fault current. The metallic sheath together with the metallic screen where provided, shall be able to withstand the earth fault current of 40 kA for a period of one second. The cable charging currents shall be as low as possible. The supplier shall furnish the detailed calculations for rating of selected cable size and losses for XLPE cables with derating in capacity for the specified design ambient temperature and other laying conditions. Calculations shall be furnished *for cables laid in* surface trench installation. The laying conditions are as below:

- The eccentricity of the core shall not exceed 10% and the ovality of the core shall not exceed 5%
- Design ambient air temperature: 50°C
- Ground Temperature: 40°C
- Maximum conductor temperature: 90°C

The outer sheath shall be of extruded black PVC type ST2 with graphite coating. The outer sheath shall be of sufficient and composition as to withstand attacks from termites, rodents, etc.
At least following identification / marking shall be provided over outer sheath of the cable at an interval of 5 m throughout the length of the cable by embossing

- Rated Voltage
- Conductor size
- Insulation type
- Manufacturer's name
- Year of manufacture
- Ultimate Customer's name

Sequential marking of the length of the cable in meters by embossing at every meter shall be done.

2.4 Cable Terminations

The cable sealing ends shall be porcelain termination suitable for outdoor installation in heavily polluted atmosphere, laden with dust and other products of a power station.

Accessories shall consist of stress relief system comprising of premoulded / prefabricated material. The termination for open connection shall be housed in porcelain insulators to give high creepage distance.

The termination shall be resistant to UV exposure. The cable sealing end terminals for terminating the cables shall be fully compatible with the cables to be supplied. The cable terminations shall be rated at 420 kV. Field tests shall be made in conjunction with cables after installation of the cables and terminals.

The supplier shall furnish the design of the cable termination supports for BHEL/GECOL approval. Supplier will also furnish the loadings to be taken for the design of foundations.

2.5 Cable Drums

Cables shall be supplied in steel drums.

Immediately after the inspection, both ends of each cable length shall be sealed by means of end caps in the presence of the inspector. Cable drums shall be of rugged construction, with a drum diameter of ample dimensions to accommodate the single- conductor cables. The drum cable length shall be chosen considering the lengths to be laid at site. No negative tolerance on the required lengths may be adopted.

Each drum shall be marked, by stenciling thereon, with an arrow the direction in which the drum should be rolled. **The drums are returnable and will be removed by the supplier from the site.** The cable drums shall be supplied with definite cable length (to be informed before start of manufacturing) within +/- 2 m tolerance. Contractor shall not be reimbursed for excess lengths supplied. Cable drums with shorter lengths shall not be accepted.

2.6 Installation & Commissioning

Cable drum shall be unloaded, handled and stored on hard and well drained surface so that they may not sink. In no case , the drum shall be stored flat i.e. with horizontal. Rolling of drums shall be avoided as far as possible. For un-reeling the cable, drum shall be mounted on suitable jacks or on cable wheels and shall be rolled slowly so that the cable comes out over the drum and not from below. All possible care shall be taken during unreeling and laying to avoid damage due to twist, kink or sharp bends. Cable ends shall always be kept sealed by heat shrinkable PVC caps to prevent damage and ingress of moisture.

While laying the cable, power rollers shall be used at every 2 meter interval to avoid cable touching ground. The cables shall be pushed over the rollers by a gang of people positioned in between the rollers. Cables shall not be pulled from the end without having intermediate pushing arrangement. Pulling tension shall not exceed recommended values. Selection of cable drum for each run shall be planned so as to avoid using straight through joint. Cable splices will not be allowed unless approved by customer.

The cables shall be laid and terminations installed by skilled and experienced workers, fully qualified to carry out the work. The Contractor shall be fully responsible for the preparation of the cable insulation and conductors and correct termination of each cable. The supplier shall also be responsible for providing clamps, required to support cables on trays for cable laying in trenches.

In surface trench, cable will be laid in trefoil arrangement on aluminium trays and will be fixed with trays by clamps made of non-magnetic material. These surface trenches will be covered by suitable trench covers.

The sheath voltage under full load conditions shall be within safe limits. The value of sheath voltage shall be furnished for approval. Sheath shall be solidly grounded at GIS end. The connection to earth shall be as short as possible to prevent HV impulses and spikes. A sheath voltage limiter shall be provided on the transformer side termination to control the sheath voltage. These voltage limiters shall be without boxes.

2.7 Tests

The cables and cable terminations shall be subjected to tests as per applicable standards in the presence of GECOL and/ or his authorized representative. After installation the cables shall also be subjected to tests at sites. All tests shall be carried out generally as per the different standards listed in Cl. 2.2 above.

2.7.1 Type Tests (IEC 62067)

In lieu of conducting the fresh type tests, supplier should submit the valid type test reports for BHEL/GECOL approval. In absence of valid type test reports (Type test reports more than 5 years old will not be valid), supplier shall conduct the type tests as per relevant IEC standards at no extra cost to customer. The supplier shall offer material for selection of samples for type testing, only after getting quality assurance plans approved. The sample shall be manufactured strictly in accordance with the approved Quality Assurance Plan.

Following type tests shall be carried out.

a) Electrical type test on complete cable system (Cl 12.4)

i) Check for insulation thickness of cable for electrical type test (Cl 12.4.1)
ii) Bending test (Cl 12.4.4)
iii) Partial discharge test (Cl 12.4.5)
iv) Tan δ measurement (Cl 12.4.6)
v) Heating cycle voltage test (Cl 12.4.7)
vi) Lightning impulse voltage test followed by a.c. voltage test (Cl 12.4.9)
vii) Examination (Cl 12.4.10)
viii) Resistivity of semi-conducting screens (Cl 12.4.11)

b) Non electrical type test on cable components and on complete cable (Cl 12.5)

i) Check of cable construction (Cl 12.5.1)
ii) Tests for determining the mechanical properties of insulation before and after ageing (Cl 12.5.2)
iii) Tests for determining the mechanical properties of oversheaths before and after ageing (Cl 12.5.3)
iv) Ageing tests on pieces of completed cable to check compatibility of materials (Cl 12.5.4)
v) Loss of mass test on PVC sheaths of type ST2 (Cl 12.5.5)
vi) Pressure test at high temperature on oversheaths (Cl 12.5.6)
vii) Test on PVC oversheath ST2 at low temperature (Cl 12.5.7)
viii) Heat shock test on PVC oversheath ST2 (Cl 12.5.8)
ix) Hot set test for XLPE insulation (Cl 12.5.10)
x) Test under fire conditions (Cl 12.5.13)
xi) Water penetration test (Cl 12.5.14)

2.7.2 Acceptance Tests (Sample Tests) on Cables (Cl. 10 of IEC 62067)

Following tests shall be carried out on minimum 10% of the drums subject to minimum one sample in each lot:

a) Tests on conductor (Cl 10.4 & 10.5)
b) Measurement of thickness of insulation and oversheaths (Cl 10.6)
c) Measurement of thickness of metallic sheath (Cl 10.7)
d) Measurement of diameters (Cl 10.8)
e) Hot set test for XLPE insulation (Cl 10.9)
f) Measurement of capacitance (Cl 10.10)
g) Lightning impulse voltage test followed by power frequency voltage test (Cl 10.12)

2.7.3 Sample tests on Accessories

Tests and its procedure to be proposed by the supplier for GECOL/BHEL's approval.

2.7.4 Routine Tests

Following routine test shall be carried out as per Clause 9 of IEC 62067 on samples drawn from each drum and each accessory.

a) Partial discharge test (Cl 9.2)
b) Voltage test (Cl 9.3)
c) Electrical test on non metallic sheath of the cable (Cl 9.4)
d) Voltage test on outer sheath as per Clause 3.1 of IEC 60229

2.7.5 Site Tests

The suppliers shall furnish field quality assurance plans giving different checks and tests, including high voltage tests, to be carried out at site to ensure a maintenance-free installation. Atleast following site test shall be carried out as detailed in Clause 14 of IEC 62067.

a) DC voltage test of the oversheath (Cl 14.1)
b) AC voltage test of the insulation by applying a voltage U_0 to be applied for 24 hours (Cl 14.2) - **GECOL will make the arrangements for charging this cable from GIS side.**

2.8 Design Requirements

Supplier of the cable system shall furnish the details calculations along with technical data sheet for verification/approval of design parameters elected. Detail design calculations/documents will be submitted for approval to GECOL/BHEL: supplier shall also confirm by calculations if there is any requirements of bonding cable and shall furnish the specifications of the same in the tender.

a) Calculation of continuous current capacity for specified cable laying conditions
b) Adequacy of XLPE insulation thickness.
c) Calculation for short circuit currents for metal sheath or screen.
d) Calculation for adequacy of metallic sheath/ screen for short circuit current carrying capability.
e) Calculation of sheath induced voltage for single end bounding/ double end bounding.

f) Manufacturing Quality plan
g) Field quality plan for site installation, commissioning and testing
h) Instruction manual for jointing and cable laying.

SECTION- 3

PROJECT DETAILS AND GENERAL SPECIFICATIONS

3.1 PROJECT INFORMATION

a)	Customer	:	GENERAL ELECTRICAL COMPANY OF LIBYA (GECOL)
b)	Project	:	AL-JABAL AL-GHARBI (WEST MOUNTAIN) GAS TURBINE POWER PLANT RUWAIS – SUBSTATION PORTION.
c)	Consultant	:	M/S ACESCO
d)	Project Location	:	LIBYA

3.2 SITE CONDITIONS

3.2.1 Ambient Temp.

			OUTDOOR	INDOOR
a)	Ambient air temp. (max.)	:	+ 50 °C	+ 40 °C
b)	Ambient air temp. (min.)	:	- 5 °C	-1 °C
c)	24 hour average (max.)	:	+ 35 °C	+ 35 °C

For cables in the ground 40 °C shall be taken as design value for ambient (ground) temperature.

3.2.2 Relative humidity for design purposes %: 60

3.2.3 Height above mean sea level in meters : 621 meters

3.2.4 Pollution Severity : Heavy (31 mm / kV)

3.2.5 Earth quake data
a) Seismic acceleration : Basic Horizontal Seismic Coefficient 'α'= 0.02

3.2.6 Wind data
a) Mean Max. Wind Speed : 100 km/hr

3.2.7 Sand Storm : 3 weeks per year

3.3 QUALIFYING REQUIREMENT

The sub contractor shall offer type tested equipment as per applicable IEC standards or as specifically specified. The equipment shall be in operation and type test has been conducted on it.

3.4 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 report. All type tests/routine tests/ acceptance tests as specified shall be conducted in the presence of purchaser. Wherever equipment similar to the one being offered has already been type tested, type test reports of the same shall be submitted for scrutiny. Type test reports more than five years old will not be acceptable. There have been no change in the process after type tests have been conducted. Should there be a change in the manufacturing process , the type test has to be repeated at no extra cost to customer.

If these are found suitable and technically acceptable, conducting of type tests shall be waived off. Otherwise the sub contractor will have to carry out the type tests without any extra cost and/or delivery implications.

Where specified by the purchaser, type tests will have to be conducted by the sub-contractor on the equipment in the scope of supply. Such tests shall be witnessed by the customer , for which the tests charges and delivery implications if any shall be indicated separately by the sub-contractor.

3.5 QUALITY ASSURANCE PROGRAMME

The supplier should adopt suitable quality assurance program to control all necessary activities to ensure that the equipment and / or service under the scope are in accordance with this report. A quality plan detailing out the specific quality measures and procedures adopted for controlling the quality characteristics to be submitted for BHEL and customer's approval.

3.6 DOCUMENTATION

3.6.1 Drawings

All dimensions and data shall be in metric units. Sizes larger than A1 shall be avoided.

All items of the equipment should be clearly identified by proper part nos. in the contract drawings. Such parts which are to be dispatched to site from works in dispatchable units are re-assembled at site, should be marked by proper identification marks at works and indicated in the drawings and quantified. The shipping list should be sent along with the general arrangement drawings. All the items of the shipping list should be identified in the drawings.

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

3.6.2 Instruction Manuals

The subcontractor shall submit to the purchaser, draft instruction manuals for approval within 90 days of placement of order. The final instruction manuals complete in all respects shall be submitted 30 days before the first shipment of the equipment. The instruction manuals shall contain full details and drawings of all the equipment furnished, the erection procedures, testing, operation & maintenance procedures of the equipment.

If after the commissioning and initial operation of the plant, the instruction manuals require any modifications/additions/changes, the same shall be incorporated and the updated final instruction manuals shall be submitted.

3.6.3 Documentation schedule at Contract stage

A. For Approval

4 Copies of GA drawings/ technical data sheets with project details, dimension, shipping weights, No. of case & dimension, fixing details, tolerances etc.

4 Copies of type test reports

4 Copies of field quality plan/ quality plan

4 Copies of installation, Operation & Maintenance manual.

B After approval and for information/ Distribution .

4 Copies of GA drawings / technical data sheets

4 Copies of type routine & Acceptance tests certificates.

4 Copies of installation, Operation & maintenance manual.

2 Sets of 'As built' drawings

01 Sets of CD- ROM

3.6.4 Supplier shall not dispatch material without the approval of test certificates.

3.7 PACKING

Packing shall be seaworthy **(as per Annexure 1).**

The supplier shall provide such packing for shipment as is required to prevent damage or deterioration during transit to final destination as indicated in the contract. The packing shall be sufficient to withstand, without limitation, rough handling during transit and exposure to extreme temperatures, salt and precipitation during transit and storage. Packing case size and weight shall be selected by taking in to consideration the remoteness of the good's final destinations and absence of heavy handling facilities at all points in transit.

All cable drums shall be clearly engraved in English as follows.

1. Name of Manufacturer
2. Type of Cable
3. Size and Number of Contractors
4. Voltage
5. Drum Number
6. Length of Cable
7. Purchaser's Order Number
8. Weights- net and gross
9. Shipping – Identification Marks
10. Address
11. Direction of Rotation

Section - 4
Technical Particulars

Sl. No.	Item Description	Unit	Data
1	Manufacturer's Name & Address		
2	Cable Type		Cu/XLPE/Corrugated Al/PVC
3	Rating		
a)	Rated voltage	kV	400
b)	Maximum rated voltage	k V	420
4	Applicable Standard		IEC 62067 Ed. 1
5	Number of cores		1
6	**CONDUCTOR**		
a)	Cross sectional area	mm^2	**630** | **400**
b)	Material		Plain annealed circular
c)	Design		Compacted circular
d)	Overall diameter	mm	Supplier to indicate
e)	Soldering Temperature	deg C	Supplier to indicate
6.1	**CONDUCTOR SCREEN**		
a)	Material		Semi-conducting thermosetting compound
b)	Nominal thickness	mm	Supplier to indicate
c)	Diameter over conductor screen	mm	Supplier to indicate
7	**INSUALTION**		
a)	Material		XLPE
b)	Type of curing		Dry (N2 gas)
c)	Nominal thickness	mm	Supplier to indicate
7.1	**INSULATION SCREEN**		
a)	Material		Semi-conducting thermosetting compound
b)	Nominal thickness	mm	Approx.
c)	Diameter over insulation screen	mm	Approx.
8	**METAL Screen and SHEATH**		
a)	Material		Screen: Copper tape Sheath: Corrugated A1
b)	Nominal thickness	mm	Supplier to indicate
c)	Cross sectional area	sq mm	Supplier to indicate
8.1	**WATER SEALING LAYER**		
a)	Material		Bitumen
b)	Thermal resistivity of material	km/W	N.A
9	**OUTER SHEATH**		
a)	Material		Black FR-PVC (typeST2 in accordance with IEC 62067 Ed. 1)
b)	Minimum average thickness	mm	Supplier to indicate
c)	Diameter over outer sheath	mm	Supplier to indicate
10	**COMPLETED CABLE**		
a)	Overall diameter	mm	Supplier to indicate
b)	Weight per meter	kg/m	Supplier to indicate
c)	Maximum drum length	m	Supplier to indicate

11	MAXIMUM DIELECTRIC STRESS		
a)	At the conductor (assumed smooth)	MV/m	Supplier to indicate
b)	At the conductor screen	MV/m	Supplier to indicate
12	MAXIMUM CONDUCTOR TEMPERATURE		
a)	Laid direct in ground	deg C	90
b)	Drawn in ducts	deg C	90
c)	Erected in air	deg C	90
13	MINIMUM RADIUS OF BEND AROUND WHICH CABLES WILL BE LAID		
a)	Laid direct	m	Supplier to indicate
b)	In ducts	m	Supplier to indicate
c)	In air	m	Supplier to indicate
d)	Nominal internal diameter of pipes or ducts through which cable may be pulled		Supplier to indicate
14	MAXIMUM DC RESISTANCE PER METER OF CABLE AT 20 DEC C		
a)	Conductor	Micro-ohm	Supplier to indicate
b)	Metallic layer	Micro-ohm	Supplier to indicate
c)	Metallic sheath	Micro-ohm	Supplier to indicate
15	AC RESISTANCE PER METER OF CABLES AT MAXIMUM CONDUCTOR TEMPERATURE		
a)	Conductor	Micro-ohm	Supplier to indicate
b)	Metallic layer	Micro-ohm	Supplier to indicate
c)	Metallic sheath	Micro-ohm	Supplier to indicate
16	Insulation resistance		
a)	At 20 deg C	Mega-Ohm	Supplier to indicate
b)	At maximum rated temperature	Mega-Ohm	Supplier to indicate
17	Current carrying capacity		
a)	In air (Ambient temperature 50 deg C)		* For open trench
	One circuit	A min	Supplier to indicate
	Two circuit	A min	Supplier to indicate
	Three circuit	A min	Supplier to indicate
	Four circuit	A min	Supplier to indicate
18	Maximum dielectric loss angle of charging VA of cable at nominal voltage and frequency and conductor temperature of		
a)	50% rated voltage		Supplier to indicate
b)	200% rated voltage		Supplier to indicate

19	Creepage distance of sealing end porcelain	mm	Min. 420 x 31
20	Metallic layer earth fault current carrying capacity for one second, cable fully loaded prior to earth fault and final screen temperature of 250 deg C	kA	Min.40
21	Dielectric loss of completed cable when laid direct in ground per 1000 meters and at maximum continuous operating temp	W	Supplier to indicate
22	Impulse withstand voltage		
a)	Positive 1.2/50 micro-second wave	kVp	1425
b)	Negative 1.2/50 micro-second wave	kVp	1425

B) CABLE TERMINATION KITS FOR 400 kV XLPE INSULATED CABLE

S. No.	Item Description	Unit	Data
			Termination kit
1.	Manufacturer's Name & Address		Same as cable supplier
2.	Type of Cable Termination		Silicon Rubber and Polybutene Oil
3.	Applicable Standards for manufacturing		As per 2.2
4.	Applicable Standards for testing		As per 2.2
5.	Rated Voltage	kV	400
6.	Maximum service voltage	kV	420
7.	Type & Material of bushing		Porcelain
8.	Creepage Distance	mm	420x31

SEAWORTHY 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 handlings and lengthy periods of outdoor storage in adverse weather conditions are required. Workmanship and material used shall be of standard, meeting the technical requirements and 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 No. 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

Annexure 1
Pg 2/17

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 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 side by 100mm

Annexure 1
Pg 3/15

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. Rubberised coir of min. 25 mm thickness and 100 mm width shall be nailed to inner surfaces of bottom and 4 sides of the box.

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 into directly content 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 bee provided on the boxes indicating position of boxes for handling, storage and nature of consignment. For guidelines ref fig 16. The ink used for this purpose as well as for marking despatch instruction shall be indelible/nonwashable marking ink. /12

6.0 *DESPATCH DETAILS:*

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

Despatch 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 as per details and specifications given in fig 13 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.

LM3

Annexure 12
Pg 4/15

BOTTOM FRAME ARRANGEMENTS

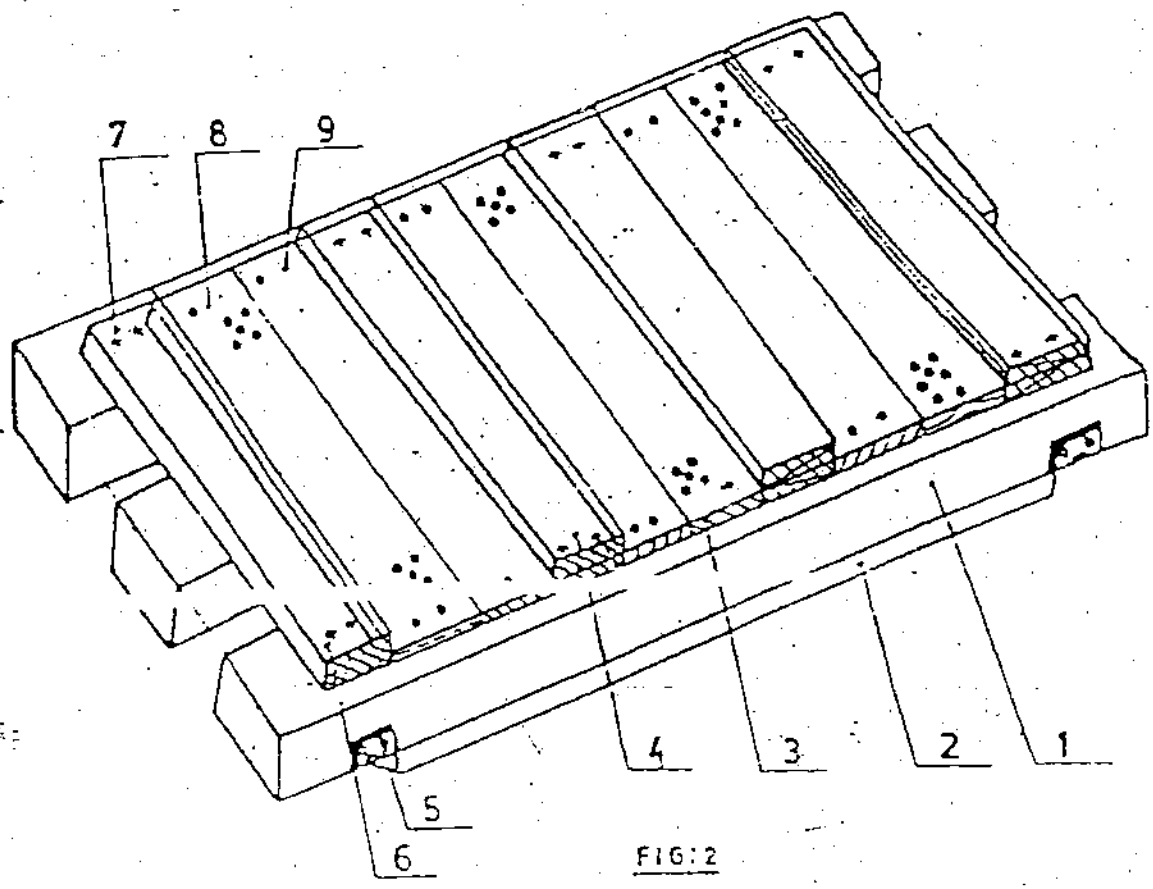


FIG:2

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

Annexure 1
Pg 5/15

TOP FRAME ARRANGEMENT

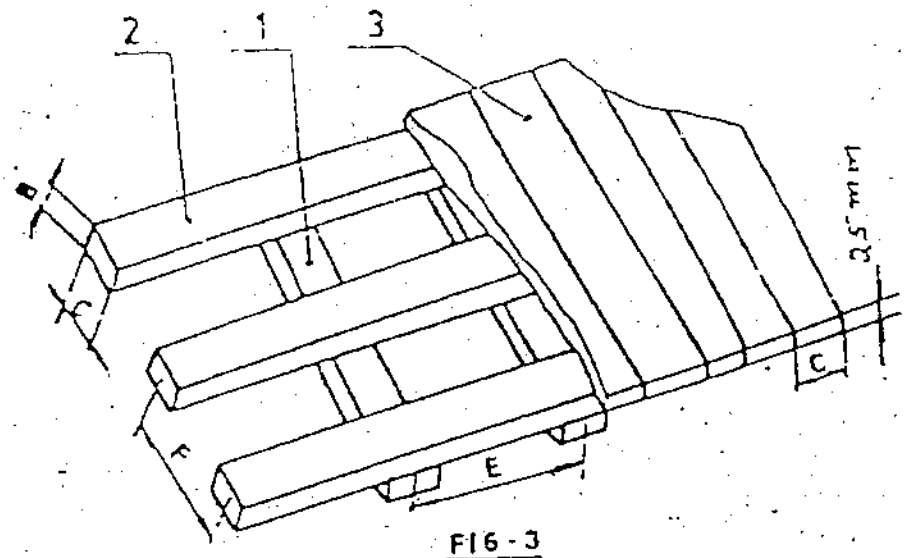
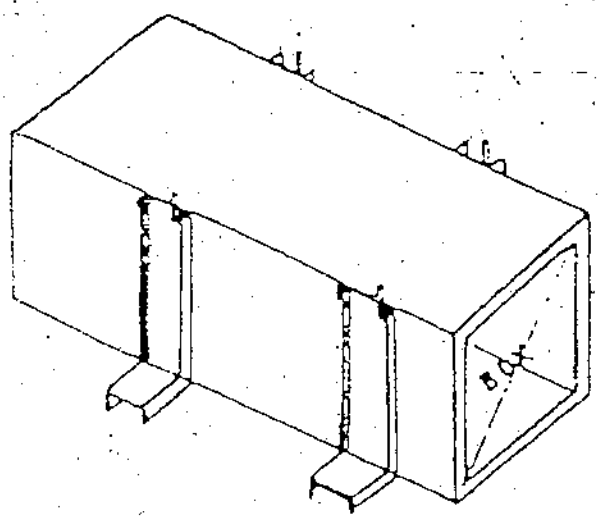


FIG-3

Dim F : 700 to 1000 mm
Dim E : 500 to 900 mm
B X C : 30 X 100 mm.

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

ARRANGEMENT OF C-CLAMPS AROUND CASES



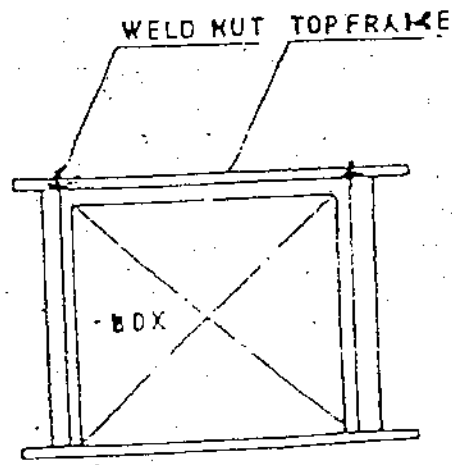


FIG: 4

10

ARRANGEMENT OF DIAGONAL BRACING AND HORIZONTAL SUPPORT

Annexure 1
Pg 6/17

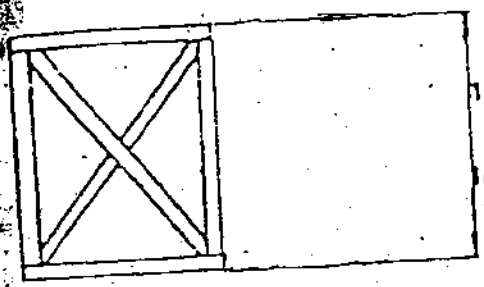


FIG:6

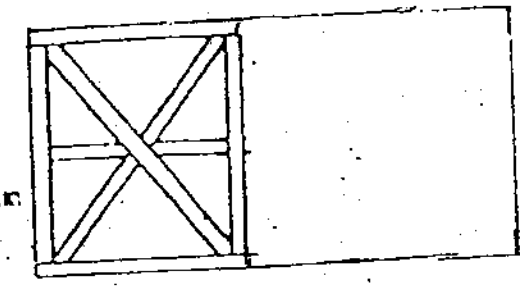


FIG:8

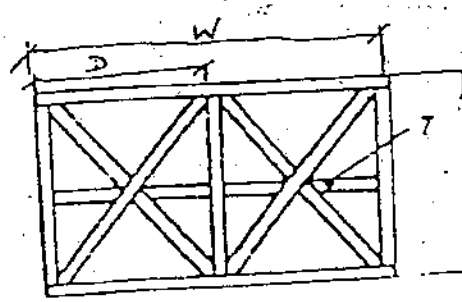


FIG:9

7- Middle Horizontal support

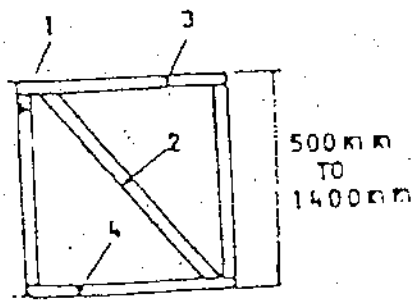


FIG:5.

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

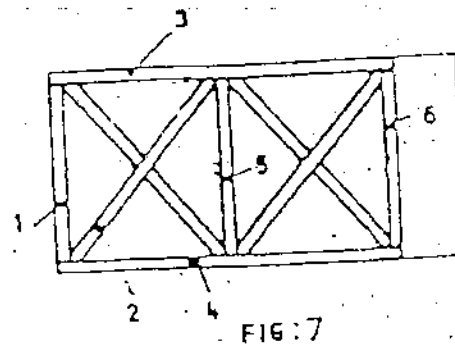


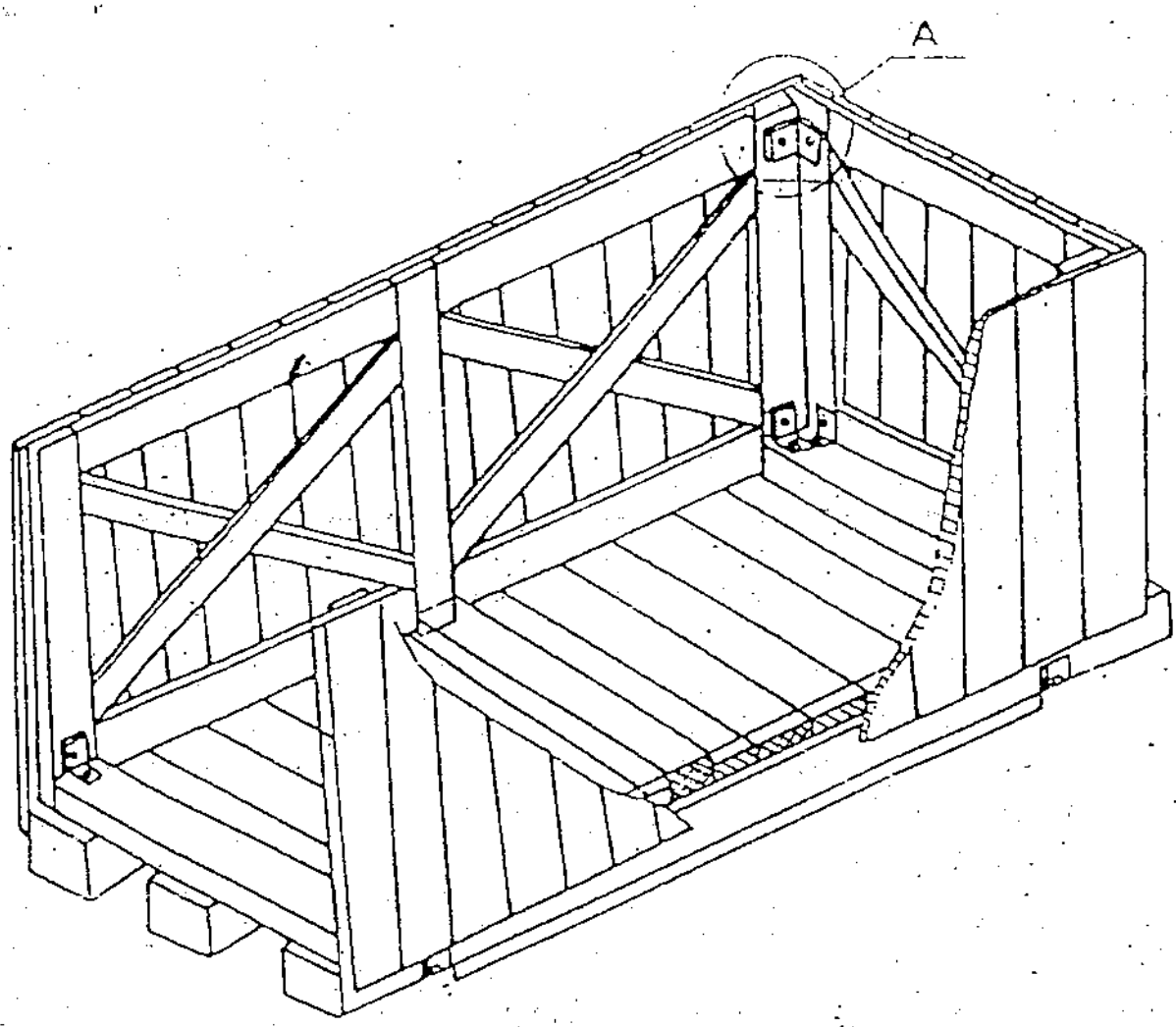
FIG:7

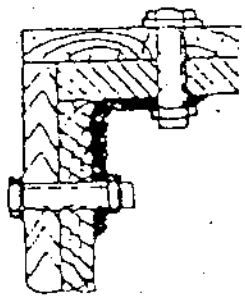
1, 5, 6 - Vertical support
2 - Diagonal Bracing
3 - Upper Horizontal support
4 - Lower Horizontal support

The dimensions of various items shall be as Table-2

Annexure I
Pg 14/15

ARRANGEMENT OF PACKING CASE





DETAIL-A

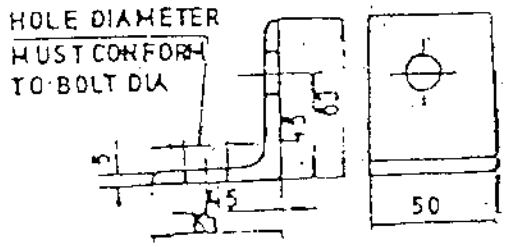


FIG:10

ARRANGEMENT OF SLING - PLATE ON CASES

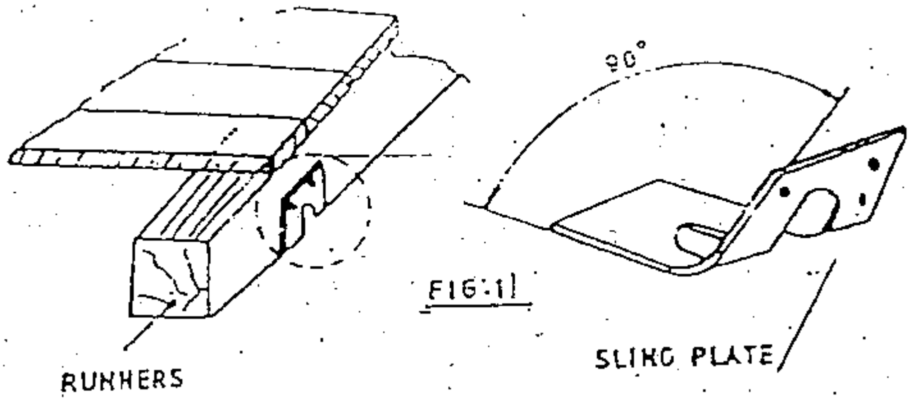


FIG:1]

Annexure I
Pg 3/15

Table I

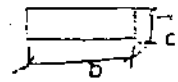
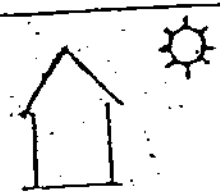
Load	Length of Slides 600	800	1000	1200	1300	1500	2000
	Cross Section b x c 						
500	50 x 100	50 x 100	50 x 100	50 x 100	75 x 100	75 x 100	100 x 100
800	50 x 100	50 x 100	75 x 100	75 x 100	75 x 100	75 x 100	100 x 100
1000	75 x 100	75 x 100	75 x 100	100 x 100	100 x 100	100 x 110	100 x 150
1500	75 x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

Annexure 1
Pg 11 of 12

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

Annexure I
Pg. 12/15

	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

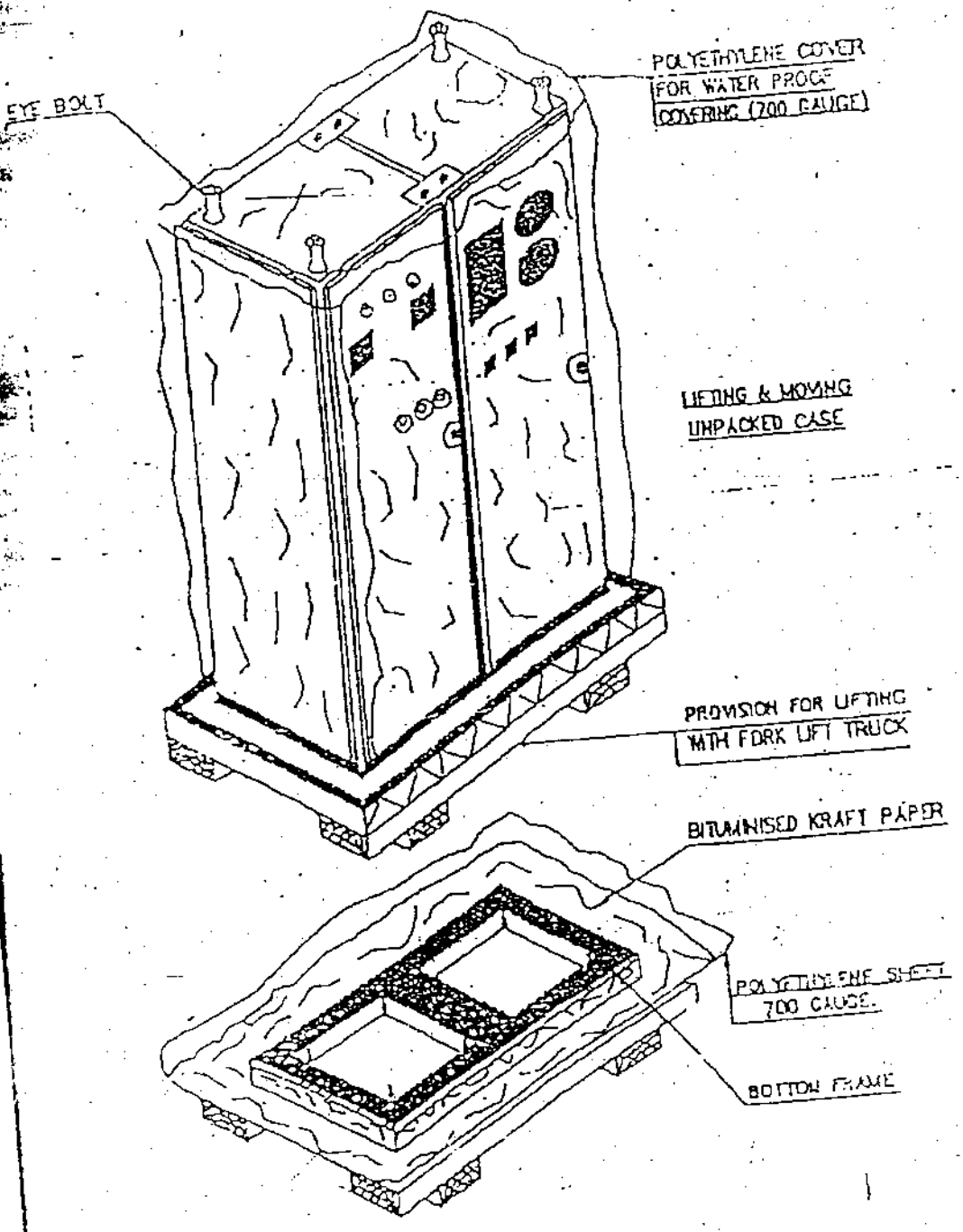

EYE BOLT
POLYETHYLENE COVER FOR WATER PROOF COVERING (200 GAUGE)
LIFTING & MOVING UNPACKED CASE
PROVISION FOR LIFTING WITH FORK LIFT TRUCK
BITUMINISED KRAFT PAPER
POLYETHYLENE SHEET 700 GAUGE.
BOTTOM FRAME

FIGURE-14

Annexure 1
Pg 14/15

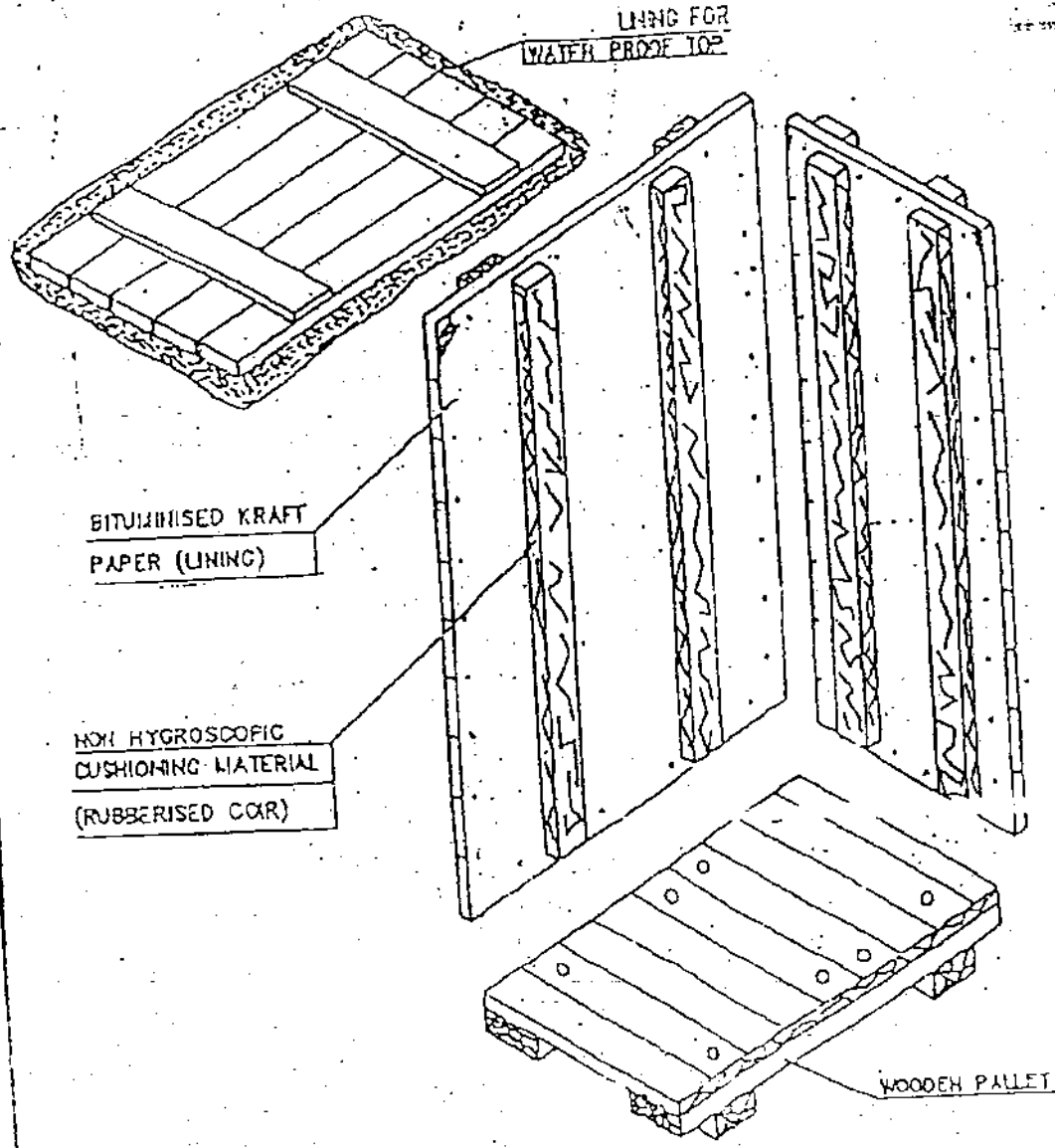


FIGURE-15

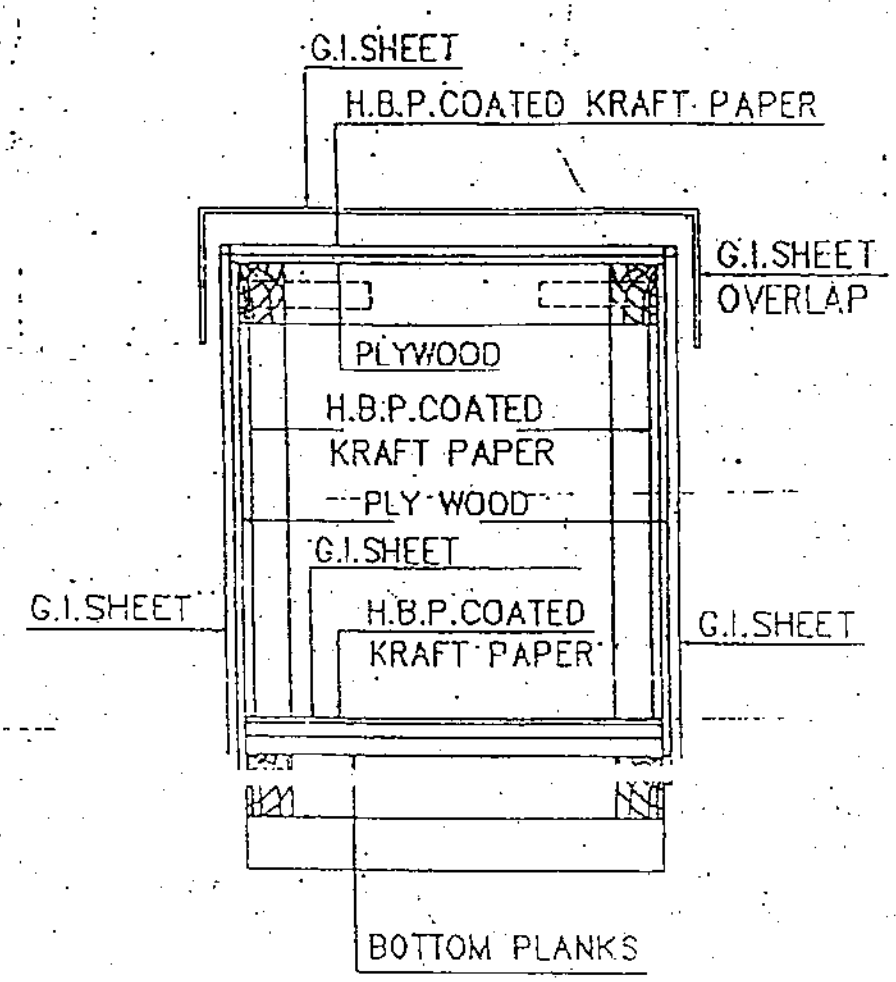


FIG-16 : CLOSED PACKING CASE WITH G.I.SHEET SHOWING LAYERS OF PACKING MATERIALS.