SYRIAN ARAB REPUBLIC

MINISTRY OF ELECTRICITY

PUBLIC ESTABLISHMENT OF ELECTRICITY FOR GENERATION & TRANSMISSION CONTRACTS DEPARTMENT

2 X 200 MW TISHREEN TPP EXTENSION

TECHNICAL SPECIFICATION

OF

ELEVATORS

TECHNICAL SPECIFICATION:–
PE-TS-323-502-A001

BHARAT HEAVY ELECTRICALS LIMITED

POWER SECTOR

PROJECT ENGINEERING MANAGEMENT

NOIDA (INDIA)

INDEX

VOLUME – II-B

SECTION – A

INTENT OF SPECIFICATION

1.0 SCOPE

1.1 This specification is intended to cover design, engineering, manufacture, inspection & testing at manufacturer's works or at sub vendor's works, painting, sea worthy packaging (if shipment is done via sea), forwarding, delivery at site, unloading, handling and storage at site, structural work, minor civil works, erection & commissioning, trial run, PG test at site and handing over to customer at site for one (1) no. elevator (with machine room), complete with all accessories (like ARD, etc.), including Erection & Commissioning Spares and Maintenance Tools & Tackles for 2 x 200 MW Tishreen TPP Extension to be installed in TG Hall (Central Control Room).

1.2 Elevator shall conform to latest editions of relevant BS EN 81/DIN/other standards applicable for Elevators in Syrian Arab Republic.

1.3 It is not the intent to specify completely herein all details of design and construction of equipment. However, all the equipment shall conform in all respect to high standards of engineering, design, workmanship and be capable of performing in continuous commercial operation up to desired period. The equipment shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgment is not in full accordance herewith.

1.4 The general terms and conditions, instructions to bidder and other attachments referred to elsewhere are made a part of the tender specification. The equipment, materials and works covered by this specification are subject to all the attachments referred in the specification. The bidder shall be responsible for and governed by all the requirements stipulated hereinafter.

1.5 No deviation is permitted in normal case. Deviation if any shall be clearly brought out clause by clause in the enclosed schedule; otherwise it will be presumed that the bidder's offer is strictly in line with NIT specification.

1.6 In the event of any conflict between the requirements of two clauses of this specification documents or requirements of different codes and standards specified, the more stringent requirement as per the interpretation of the owner shall apply

2.0 QUALIFYING CRITERIA

Vendor should have executed following work in power plant /process industries /refineries / steel/cement/fertilizer/ building/mall/office, during last seven years ending on last date of bid submission:

Design, engineering, supply, erection and commissioning of at least two (2) orders of passenger elevators with capacity, landings and travel as per tender enquiry or more, under successful operation for at least last two (2) years at each installation from the date of bid opening.

Relevant document in support of above are required to be submitted.

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SECTION B

PROJECT INFORMATION

PROJECT INFORMATION

1.	**Owner**	PUBLIC ESTABLISHMENT OF ELECTRICITY FOR GENERATION AND TRANSMISSION (PEEGT)
2.	**Project**	2X200 MW TISHREEN TPP EXTENSION
3.	**Owner's consultant**	NO CONSULTANT TILL DATE
4.	**Location**	50kms east of Damascus.
5.	**Nearest Airport**	Damascus International Airport
6.	**Nearest Railway Station**	----------
7.	**Access to site**	*Through Sea* : Tartous Port (Distance from site: 300 kms approximately) *By Air* : Damascus Airport (Distance from site: 50kms)
8.	**Site data**	
A	**Altitude**	605.7 above Mean Sea Level
B	**Ambient Air Temperature**	
1.	Design maximum	
	(a)Equipments	45ºC
	(b)Dry Cooling Tower	40ºC
2.	Design Minimum	-11ºC
C	**RELATIVE HUMIDITY**	
	Design Relative Humidity	56%
D	**RAINFALL**	
1.	Maximum Intensity of Rainfall	25 mm/hr
E	**WIND VELOCITY & PRESSURE**	
1.	Basic Wind speed	35m/s
F	**SEISMIC ZONE**	UBC 1997,Zone-3
9.0		

A	Max. Ambient temperature for design of electrical equipment in non-air conditioned area	45 ºC
B	Min. Ambient temperature for Design of electrical equipment in non-air conditioned area	-11 ºC
10.0	AC Voltage Level For power generation	15.75 kV± 5 %, 3 phase, 50 Hz (-5 to +3%)
A		
B	AC Voltage Level For power evacuation & start-up / standby power	230 kV± 5 %, 3 phase, 50 Hz (-5 to +3%)
C	AC Voltage Level For Aux Power Distribution	6.3 KV, 3 phase, 3 wire, 50 Hz
		400 V, 3 phase, 4 wire, 50 Hz
		220 V, 1 phase, 2 wire, 50 Hz
D	Voltage & Frequency variation	6.3 KV / 400 V/ 220 V AC systems and the equipments connected on these systems shall be suitable for Voltage variation of ± 10 %, frequency variation of (+) 3% to (-) 5% and 10% combined variation (sum of absolute values) of voltage and frequency.
E	The rated voltage level for motors shall be as follows: • Above 200 kW • Above 200 W & upto 200 kW • Upto 200 W	 • 6.0 KV • 380 V • 220 V
F	AC supply voltage for space heating, lighting and small power distribution	220 V,1ph, 50 HZ
G	AC control voltage	110 V, 1ph, 50 HZ
H	UPS Voltage	230 V, 1ph, 50 Hz
I	DC Voltage for motor, protection, control and emergency lighting	220 V
J	DC Voltage for control & instrumentation	24 V
K	AC emergency supply	400 V, 3 Ph, 3 wire
L	DC Voltage variation	187 V - 242 V for 220 V DC
11.0	**Fault levels**	
A	230 KV System	40 kA for 1 sec

B	6.3KV System	40 kA for 1 sec
C	400V System	50 kA for 1 sec for PCC /PMCC / MCCs with breaker incomer
		50 kA for 0.2 sec for MCCB protected MCCs/DBs
D	220V DC System	15 kA
12.0	**GROUNDING**	
A	230 KV System	Solidly grounded
B	Generator	High resistance grounded through distribution transformer, transformer secondary loaded with resistor.
C	6.3KV System	Low Resistance Grounded through earthing transformer, transformer secondary loaded with resistor, with Earth-Fault Current limited to 300A
D	400 V System	Solidly grounded
E	220V DC System	Ungrounded
F	Diesel Generator	Ungrounded

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SECTION C

SPECIFIC TECHNICAL REQUIREMENTS

1.0 INTRODUCTION

Passenger Elevator (with machine room) shall be provided for access to various operating floors/platforms in **TG hall** and to facilitate movement for operating and maintenance personnel. TG Hall Layout for various of operating floors is attached elsewhere in the specification.

2.0 SCOPE OF EQUIPMENT SUPPLY AND SERVICES

2.1 The scope shall include all items / accessories, service along with all electrical equipment etc. required to meet all design, installation, operation, safety, protection and other requirements of BS EN 81/DIN/other standards applicable for Elevators in Syrian Arab Republic.

2.2 One (1) No. passenger elevator (with machine room) shall be provided and the same shall conform to various sections of technical specification, Data-sheet A and latest revision of BS EN 81/DIN/other standards applicable for Elevators in Syrian Arab Republic.

2.3 Elevator shall include but shall not be limited to the following:-

1. Elevator car
2. Guide rails for car and counterweights
3. Counterweight
4. DCEM brakes
5. SS Pushbuttons (Luminous Type)
6. Spring buffer for car and counterweight
7. Driving arrangement including motor, gear box, sheaves etc.
8. All electrical equipment including power cable, control cable, controller panel, safety devices including push buttons, limit switches, safety switches, indicators etc.
9. Car doors and hoist way doors
10. Car operating panel, digital control, car position indicator at all floors, luminous hall buttons, auto door operation mechanism, alarm bell, car light & Ventilation fan in car
11. Intercom connection
12. Ropes for hoisting
13. Fireman's switch
14. Machine room structures to support all overhead machinery
15. Circuit breaker, switch-fuse unit etc. in machine room for terminating the power supply cable (power supply cable provided by purchaser up to machine room level), other power/control and trailing cabling and equipment earthing
16. Ladder in pits
17. Emergency light with rechargeable battery
18. All fixing materials required to fix rails, brackets, equipment including nuts and bolts.
19. Fascia plates and sill angles.
20. ELCB, if required as per statutory requirement.

21. Any other equipment required to meet satisfactory operation of elevator, any local statutory/regulatory body and prevailing lift act in the region of installation.
22. Car lighting. Recessed fluorescent light fittings for adequate illumination.
23. Mirror
24. Music system to be provided for calling floors along with voice synthesizer for floor announcement.
25. Recommended spares for five (5) years of trouble operation. Bidder to furnish un-priced list along with the offer.
26. One set of Maintenance tools and tackles along with un-priced list with the offer. These tools shall not be used for erection/commissioning purposes and shall be in an unused and new condition. Each tool shall be stamped so as to be identified easily for its use and supplied in a steel tool box properly packed.
27. Automatic rescue device with battery drive - Modern advanced electronic drive system of rescuing passenger trapped in an elevator shall be provided.
28. Emergency safety devices – The lift shall be provided with safety device attached to the lift car frame and sustaining the lift car up at governor tripping speed with full rated load in car.
29. All steel embedment for fixing landing doors / indicators etc. to the elevator well shaft and fascia plate shall be supplied by the bidder
30. Guide rails complete with supporting brackets for the car and counter weights.
31. Complete paint as per painting schedule (specified elsewhere in the specification) required to be applied on the equipment within the scope.
32. Initial charge of all lubricants and fluids.
33. All equipment foundation bolt/anchor bolts, insert/embedment plates etc., sleeves, anchoring steels and any item required to complete the job satisfactorily shall be provided by the bidder. The bidder shall also provide for the grouting of anchor bolts, sleeves, anchoring steel etc. and other anchorages.
34. Any other steel works as well as all other accessories/components not specified in the technical specification but necessary for making the elevator complete.
35. All minor building (civil) works and structural work including the supply of steel items, associated with installation of equipments in the machine room, hoist way, landing door, frames, scaffoldings and elevator pit, shall form part of bidders scope of supply. BHEL will provide the elevator well complete with foundation and RCC walls around the lift well together with overhead machine room. The machine room will be provided with RCC floor slab with necessary pockets for anchor bolts and slots.
36. Complete Erection, testing and commissioning, including all testing and commissioning materials, consumables, erection and commissioning spares as required for erection of elevator.
37. Bidder shall be responsible for obtaining all necessary approval from statutory and regulatory body and lift inspector. All registration and statutory inspection fees if any, in respect of his work pursuant to this contract shall be to the account of the elevator vendor. Preparation of all necessary drawings/data/documents for obtaining necessary approval of statutory authorities prevalent in the region of installation on behalf of the customer. Should any such inspection or registration need to be re-arranged due to the fault of the vendor or his sub-contractor, the additional fees for such inspection and / or registration shall be borne by the vendor.

38. Preparation of civil input drawings for elevator pit, shaft, machine room etc.
39. Necessary consumables and instrumentation as required for inspection and testing at works as well as at site including pre-commissioning activities, if any, shall be arranged by the successful bidder at their own cost.
40. Any other service required for making the installation complete in all respect within battery limits and for satisfactory erection & commissioning of the equipment, unless specifically excluded from scope.

3.0 SERVICES TO BE PROVIDED BY THE PURCHASER

a. Civil work for hoist way, machine room, pit complete with the side enclosure and interconnecting platforms if any.
b. Window air conditioner of minimum 2T capacity in the machine room.
c. Electric hoist with traveling trolley of 3T capacity to facilitate handling of equipment in the machine room.
d. Hoist way lighting and machine room lighting.
e. Earthing leads up to machine room level, light outlet point at the middle of hoist way
f. Power supply cables up to machine room level.

4.0 TERMINAL POINTS

a. Hoist way, machine room and pit with buffer foundation.
b. Beams at certain intervals for fixing rail supporting brackets. (Bidders to indicate at what interval beams are required for fixing rail supporting brackets).
c. Cut-outs and pockets in machine room floor for mounting various equipment to be located in machine room.
d. Trap door in the machine room.
e. Staircase/suitable access from the last landing to machine room.
f. Opening in walls of air conditioner , as required
g. Earthing leads in machine room.
h. Power supply cable shall be terminated by BHEL in machine room. Further cabling (all cables including power, control and instrumentation) shall be provided by the bidder.

5.0 SPECIFIC REQUIREMENTS

a. Bidder to furnish deviations (clause wise), if any in the enclosed deviation schedule. In absence of duly filled in deviation schedule it will be presumed that the offer is totally in line with technical specification.
b. Bidder shall furnish duly filled in data sheet-B along with the offer. In absence of duly filled in data sheet offer shall be treated to be incomplete.
c. Bidder to ensure and confirm that the spares of elevator shall be available in local Syrian markets.
d. Concerning the operational requirements, inspection mode (revision mode) for maintenance and inspection of defects should be provided.
e. Bidder shall comply to the quality requirements as enclosed with specification. Bidder shall also furnish necessary drawings/documents/data/catalogues along with the offer. **Quality Plan submitted shall be subject**

to client/client's consultant/ BHEL approval during detail engineering. Basic quality checks (mandatory) to be carried out are as follows:

Quality Assurance - Passenger Elevators

TESTS /CHECKS / Items	Material Test	DPI/MPI	Ultrasonic Test	Dimensions/Physical	Functional/ Operational Test/ Run Test	Performance Test	Other Tests	All routine tests as applicable	Plain shade, thickness &	Assembly/fit up
Shaft/ Rack/Gears	Y	Y	Y	Y						
Geared Machine					Y					
VVVF Panel				Y	Y		Y3	Y	Y	
Electrical motor				Y	Y			Y		
Complete Lift/ Elevator				Y	Y	Y1	Y2			Y

Y1 –TEST TO BE DONE AT SITE

Y2 - LOAD/OVERLOAD TEST TO BE DONE AT SITE AS APPLICABLE.

Y3 – Burn in test on electronic card

NOTE: 1. This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the applicable practices and procedures followed along with relevant supporting documents during QAP finalization.

f. All equipment shall be painted as per painting schedule attached elsewhere in the specification.

g. Sea Worthy Packing shall be done for all the items transported by sea. Details of sea-worthy packing are specified elsewhere in technical specification.

6.0 DESIGN CRITERIA

The design criteria and equipment specification will be as follows.

a. The lift will be provided with automatic leveling device which will take care of overrun and under run of the car and rope stretch will be such that the car floor is within 6.0 mm from the landing level at the floors while in operation.

b. Automatic Terminal Stops – The lift will be equipped with upper and lower terminal switches arranged to stop the car automatically within the limit of the top car clearance and bottom run-by, from any normal operating speed.

c. The elevator car shall be provided with car and landing doors fabricated out of bright finished S.S. 304 sheets. PVC tiles flooring, concealed fan and indirect lighting, emergency lighting, intercom, car position and travel direction indicator.

d. As the elevator is to provide service in a power station, it is necessary for the equipment to be anti-corrosive epoxy paint. This will include application of paint as per attached painting schedule. The electrical equipment will have enclosures meeting degree of protection as covered under electrical specification.

e. The elevator as a whole will comply with relevant BS EN 81/DIN/other standards applicable for Elevators in Syrian Arab Republic. The elevator shall be provided with AC VV VF type control system.

f. Doors are automatic, center opening with emergency key opening at all landings, horizontal sliding type for car as well as for hoist way. Trap door shall be provided as per BS EN 81/DIN/other standards applicable for Elevators in Syrian Arab Republic. **Car & Landing Doors shall be rated for minimum one hour fire resistance and the elevator shall be treated as "Fire Lift"**.

g. The lift will be automatically stopped by upper and lower terminal switches. The elevators will have an emergency stop switch, limit switches and other safety devices according to statutory rule.

7.0 POWER SUPPLY ARRANGEMENT

Three phase 380V, AC, 50 Hz, and single phase 220V, AC, 50Hz supply feeders will be provided in the machine room by BHEL. The junction box having MCCB/MCB/RCCBs of adequate rating as required shall be arranged by the vendor to receive the above supplies for further distribution to the Elevator equipment. All further cabling and wiring from the junction box shall be carried out by the Elevator vendor.

8.0 PERFORMANCE GUARANTEE TESTS

After installation of complete elevator, necessary trial run and performance tests for the duration indicated in the general technical requirement shall be carried out by the Contractor in the presence of Purchaser to determine that equipment supplied is satisfactorily installed and commissioned.

The performance tests to be conducted shall include the following:

a) Cab/Car operates smoothly for full length of travel.

b) Cab/Car stops at each platform elevation under both loaded and unloaded conditions.

c) Cab/Car travels at specified speed when loaded at specified capacity.

d) Enclosure doors operate properly.

e) Mechanical and electrical equipment function as specified.

f) Input power at motor terminal at specified design capacity and speed.

g) Test for Overload, over speed, travel & hoist speed.

All performance tests shall be conducted by the Contractor and the procedure for conducting such tests shall be approved by Owner. Other tests and guarantees shall be as specified elsewhere in the specification.

9.0 OPTIONAL SPARES

As per list given below.

Bidder to note that prices of these items shall be valid for 5 Years after expiry of Guarantee Period (as covered under GCC).

a) Bearings for motor – 1 set

b) Brake linings – 1 Set

c) Contactors and relays – 1 Set

d) Roller guides for cabin and counter weight – 1 Set

e) Complete Controller (compliant to IEC) – 1 no.

10.0 DRAWING, DATA AND INFORMATION TO BE SUBMITTED ALONG WITH BID

1. Copy of pre-bid clarification, if any, duly signed and stamped.
2. List of recommended spares parts for three (5) years successful operation of the system to be indicated in the un-priced bid, if any.
3. List of maintenance tools & tackles.
4. A copy of this sheet “Electrical Equipment Specification for Elevators and sheet “Electrical Scope between BHEL and Vendor” with bidder’s signature and company stamp.
5. List of Erection and Commissioning spares.
6. Electrical load requirement (as per Electrical Load Data Format).
7. Deviation schedule (if any) with reference to specific clauses of the specification along with reason for such deviation. No deviations, unless taken up in the enquiry stage itself by vendor and accepted by BHEL, will be reviewed by BHEL after firm order.
8. Copy of un priced bid indicating “ QUOTED”/”NOT QUOTED"/”Not Applicable” as the case may be.
9. Write-up on interlocks, controls and safety devices being provided.
10. General Arrangement drawing of Elevator (including hoist way, pit well etc.), machine room, equipment in machine room, foundation & loading details of machine room floor & the concrete structure, pit details for civil foundation and loading details.

11. Filled in vendor data sheet for Elevator and motor. (As per attached format attached in Section D)
12. Block diagram showing detailed scope division of work for civil / structural/ electrical items between BHEL and elevator vendor.
13. The make, type, capacity, range of all bought out items to be furnished by the vendor along with the offer for information. However, makes of sub-vendor items is subject to approval of ultimate customer during detail engineering.

11.0 DRAWING, DATA, INFORMATION TO BE FURNISHED BY SUCCESSFUL BIDDER AFTER AWARD OF CONTRACT

1. All drawings, data and information for review and approval of purchaser/consultant.
2. Detailed layout drawings including foundation and structural design data for elevator shaft and elevator machine room. The data shall include braking load on guides, reaction of buffers on lift pits, reaction on support point on machine room, hoist way etc.
3. Details of block outs, embedment, inserts on RCC works.
4. Write for Electrical Control, Power and control schematic wiring diagram.
5. Write-up explaining the sequence of operation of control circuits and elevator components when an operation button is pressed.
6. Performance and characteristics curves for motors.
7. Drawings of control panels, operating panels, position indicators, in car and hoist way, push button station and call registered tell-tale lights at hoist way. These include Electrical Control Diagram and detailed circuit diagrams and physical arrangement/location diagrams of various electrical components in the Controller in the machine room, in the hoist way, in the car, at the landing etc.
8. Detail of pit floor, landing and landing entrance, machine room floor etc.
9. Calculation for various components e.g., Rope, brake, motor power calculation, etc as desired by the customer/BHEL.
10. Other Drawings and data as necessary.
11. Other Drawings and data as necessary.
12. Reports on shop tests and test certificates.
13. Material and performance test certificates.

TECHNICAL SPECIFICATION

FOR

ELEVATORS

(ELECTRICAL PORTION)

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER

The equipment and services to be provided by bidder under this specification shall be as detailed here below but shall not be limited to the following:

1. Services and Equipment as per "Electrical Scope between BHEL and Vendor".
2. Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The bidder without any extra charge shall provide the same.
3. Erection and Commissioning spares.
4. Erection & Maintenance tools & tackles.
5. Electrical load requirement for ELEVATORS
6. All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
7. Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer / BHEL approval without any commercial and delivery implications to BHEL.
8. Various drawings including GA drawing, data sheet as per required format, quality plans, calculations, test reports, test certificates, operation and maintenance manuals, characteristic curves, wiring diagrams/schemes etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implications to BHEL.
9. Motors shall meet minimum requirement of Electric motor specification.
10. All routine tests and type tests reports as per applicable standards shall be furnished at contract stage.
11. Purchaser will furnish data sheets to the vendor after award of contract. Vendor shall furnish filled in data sheets meeting the specification requirements.

2.0 EQUIPMENT & SERVICES TO BE PROVIDED BY PURCHASER FOR ELECTRICAL & TERMINAL POINTS:

Refer "Electrical Scope between BHEL and Vendor".

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

1. Bidder shall confirm total compliance to the electrical specification without any deviation from the technical / quality assurance requirements stipulated. In line with this, the bidder as technical offer shall furnish two signed and stamped copies of the following:
    a) A copy of this sheet "Electrical Equipment Specification for ELEVATORS and sheet "Electrical Scope between BHEL and Vendor" with bidder's signature and company stamp.
    b) List of Erection and Commissioning spares.
    c) List of Erection & Maintenance tools & tackles.
    d) Electrical load requirement.

2. No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

4.0 LIST OF ENCLOSURES

1. Annexure I – Electrical scope between BHEL & vendor.
2. Technical specification – Specification for Electric Motors/Actuators and cables
3. Testing Requirements.
4. Quality Plan for LV Motors.
5. Load Data Format.

ANNEXURE – I
ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

S. NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	380V Local Starter Panel with motor starter	Vendor	Vendor	BHEL will provide 1 No. 380 V & 1 No. 220 V AC supply feeder in Machine Room for elevators.
2	Power cables, control cables, screened control cables and any special cables (if required) between equipment supplied by vendor.	Vendor	Vendor	
3	Cabling material (cable trays, accessories, cable tray supporting system, conduits etc).	Vendor	Vendor	
4	Equipment Earthing	Vendor	Vendor	All equipments metallic enclosures / frames, metal structure etc. shall be grounded at two points each to the nearest grounding points / risers provided by BHEL / customer. Necessary details will be furnished during contract stage.
5	Motors	Vendor	Vendor	
6	Cable glands and lugs for equipment supplied by vendor	Vendor	Vendor	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type tinned copper heavy duty lugs for power cables. 3 solder less crimping type heavy duty copper lugs for control cables.
7	a) Input cable schedules (C & I) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for C&I systems for vendor supplied equipment shall be furnished during detail engineering by vendor in soft copies in the BHEL cable schedule format.
8	Equipment layout drawings	Vendor	-	
9	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

DATASHEET 'A' – LV Motors

SL.NO.	PARAMETERS	UNIT	TISHREEN
	MOTOR		
1	DESIGN AMBIENT TEMP	DEG. C	45
2	VOLTAGE SUPPLY AND VARIATION	VOLT	380V, ± 10%
3	FREQUENCY WITH VARIATION	Hz	50, + 3% & - 5%
4	COMBINED VOLTAGE & FREQUENCY VARIATION		10%
5	MAX ACCEPTABLE RATING OF MOTOR AT 380V	KW	Up to 200 KW
6	SYSTEM FAULT LEVEL AND ITS DUARTION	KA	50 KA, 1 Sec
7	SUTABILITY OF TERMINAL BOX FOR FAULT LEVEL AND DURATION	KA	50 KA, 0.2 sec
8	CLASS OF INSULATION & TEMP RISE LIMITED TO		Class-F and Temp Rise limited to Class-B
9	MIN. STARTING VOLTAGE		80%
10	MOTOR RATING FOR SINGLE PHASE SUPPLY		0.2 kW & Below
11	MAXIMUM LOCKED ROTOR CURRENT	% OF FLC	600% plus IS tolerance
12	ACCEPTABLE NOISE LEVEL	DB	85dB at 1m
13	TYPE OF STARTER PROVIDED IN MCC		DOL
14	DOP OF ENCLOSURE		IP- 55 for motors placed Externally IP-54 for motors placed Internally
15	SPACE HEATER REQUIREMENT		30KW & ABOVE

16	PAINT SHADE		During Contract Stage
17	SPECIAL REQUIREMENT		Type Test Reports more than 5 years old are not acceptable.
18	APPLICABLE STANDARD		IEC 60034

TECHNICAL DATASHEET OF CABLES

1. LT Power & Control Cables

S.NO.	PARTICULARS	DETAILS	
		LT POWER CABLES	**LT CONTROL CABLES**
1	**REFERENCE STANDARD**	IEC-60502 (Part-1, latest edition)	IEC-60502 (Part-1, latest edition)
2	**SYSTEM**	380 V AC , 220 V AC & 220V DC	220V DC & 110 V AC
3	**VOLTAGE GRADE**	1.1 KV	1.1 KV
4	**CONDUCTOR**		
	MATERIAL	STRANDED, UNTINED (PLAIN) ANNEALED HIGH CONDUCTIVITY COPPER , CLASS 2	STRANDED, UNTINED (PLAIN) ANNEALED HIGH CONDUCTIVITY COPPER , CLASS 2
	STANDARD	IEC- 60228	IEC- 60228
	SHAPE	CIRCULAR/ SHAPED	CIRCULAR
	MINIMUM SIZE	2.5 SQ.MM.	2.5 SQ.MM.
5	**NO. OF CORES**	1C,2C,3C, 3.5C, 4C	AS PER CLAUSE 4.2.1
6	**INSULATION**	PVC, TYPE-A	PVC, TYPE-A
	STANDARD	IEC 60502-1	IEC 60502-1
7	**INNER SHEATH**	SINGLE CORE CABLES- NO INNER SHEATH MULTI- CORE CABLES - PVC TYPE - ST1	PVC TYPE - ST1
	STANDARD	IEC 60502-1	IEC 60502-1
8	**ARMOUR**	NA	NA
	STANDARD	NA	NA
9	**OUTER SHEATH**	FRLS, PVC TYPE - ST1, BLACK COLOUR	FRLS, PVC TYPE - ST1, BLACK COLOUR
	STANDARD	IEC 60502-1	IEC 60502-1

2. Screened Control Cables

S.NO.	PARTICULARS	DETAILS
1	**VOLTAGE GRADE**	225V(PEAK VALUE)
2	**TYPE OF CABLES**	TYPE F (INDIVIDUAL & OVERALL SCREENED) & TYPE G (OVERALL SCREENED)
3	**CODES AND STANDARD**	VDE 0815, VDE 0207, Part-4, Part-5, Part-6, VDE 0816, VDE 0472, SEN 4241475 class F3, IEEE 383, IS 10810 (latest editions and it's amendments).
3(i)	**CONDUCTOR**	
(a)	**MINIMUM CROSS SECTION AREA**	0.5 sq.mm
(b)	**CONDUCTOR MATERIAL**	STRANDED, UNTINED PLAIN ANNEALED HIGH CONDUCTIVITY COPPER
(c)	**CONDUCTOR GRADE**	ELECTROLYTIC
(d)	**NO. & DIA OF STRANDS**	7 X 0.3 mm
(e)	**NO. OF PAIRS**	0.5 sq.mm. - 2P, 4P,8P,12P,16P,20P
		1.5 sq.mm. - 2P
(f)	**STANDARD**	VDE 0815
(ii)	**INSULATION**	
(a)	**MATERIAL**	PVC, compound Y I3
(b)	**THICKNESS IN mm**	0.3 (NOMINAL)
(c)	**VOLUME RESISTIVITY (MIN) IN ohm-cm**	$1x\ 10^{14}$ at 20 deg .C & $1x\ 10^{11}$ at 70 deg .C
(d)	**VOLTAGE RATING**	225 V PEAK OPERATING VOLTAGE
(e)	**STANDARD**	VDE 0207 Part 4
(iii)	**PAIRING & TWISTING**	
(a)	**MAX. LAY OF PAIRS (mm)**	50
(b)	**CONDUCTOR /PAIR IDENTIFICATION**	AS PER ATTACHED ANNEXURE- B
4	**SHIELDING**	
(a)	**TYPE OF SHIELDING**	AL-MYLAR TAPE
(b)	**INDIVIDUAL PAIR SHIELDING**	APPLICABLE FOR TYPE-F CABLE ONLY
(c)	**OVERALL SHIELDING**	APPLICABLE FOR BOTH TYPE-F & TYPE-G CABLES
(d)	**MINIMUM THICKNESS OF INDIVIDUAL PAIR SHIELDING**	28 MICRON
(e)	**MINIMUM THICKNESS OF OVERALL CABLE ASSEMBLY SHIELDING**	55 MICRON
(f)	**SHIELDING COVERAGE**	100% WITH AT LEAST 20% OVERLAP

(g)	**DRAIN WIRE FOR INDIVIDUAL SHIELD (F-TYPE) & OVERALL SHIELD (G-TYPE)**	ANNEALED TINNED COPPER SIZE (NO. OF STRANDS/ SIZE:- 7/0.51sq.mm.) AS PER VDE 0815		
5	**ARMOUR**	NA		
	STANDARD	NA		
6	**OUTER SHEATH**			
(a)	**MATERIAL**	FRLS PVC (compound YM1)		
(b)	**THICKNESS**	As per VDE 0816 and shall not be less than 1.8 mm		
(c)	**COLOUR**	BLUE		
(d)	**STANDARD**	VDE 0207 Part-5		
7	**ELECTRICAL PARAMETERS**			
	PARAMETER	0.5 mm2 (IS & OS) Type-F	0.5 mm2 (OS) Type-G	1.5 mm2 (OS) Type-G
(a)	**Mutual Capacitance (max.) at 0.8 kHz, nF/Km**	120	100	100
(b)	**Conductor Loop Resistance (max.), Ohm/Km**	73.4	73.4	24.6
(c)	**Insulation Resistance (min), M Ohm/ Km**	100	100	100
(d)	**Cross Talk attenuation (min) at 0.8kHz, Db**	60	60	60
(e)	**Characteristic impedance (max.) at 1 kHz**	320	340	230
(f)	**Attenuation (max.) at 1 kHz db/Km**	1.2	1.2	0.8

3. Design Considerations for Power Cables

In general, Power Cables are sized to satisfy the following three criteria:

1. 'Short circuit current withstand capacity for applicable fault current and duration.
2. 'Full load current carrying capacity under installation conditions (i.e. with suitable de-rating factors to cover site conditions such as ambient temperature, grouping and cable laying configuration.)
3. Maximum voltage drop limits under steady state / transient state as applicable.

NOTES:

All cables including trailing cables shall conform to latest edition of relevant IEC standards.

ELECTRICAL LOAD DATA FORMAT

LOAD TITLE	RATING (KW / A)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/ INTT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONTROL CODE	REMARKS	LOAD No.
	NAME PLATE	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY								SIZE CODE	NOs				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

NOTES:
1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)
2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=380 V, E=220 V (1 PH), F=110 V (dc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V
: ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTER CONTROLLED)

BHEL	LOAD DATA (ELECTRICAL)	JOB NO.	323	ORIGINATING AGENCY		PEM (ELECTRICAL)
		PROJECT TITLE	2 X 200 MW TISHREEN TPP EXTN.	NAME		DATA FILLED UP ON
		SYSTEM / S	ELEVATOR	SIGN.		DATA ENTERED ON
		DEPTT. / SECTION		SHEET 1 OF 1	REV. 00	DE'S SIGN. & DATE

PAINTING SPECIFICATION

1.0 GENERAL

This schedule is intended to cover the requirement for surface preparation, cleaning, supply of the paint materials, and application of paints on all mechanical equipment, steel structures, piping, ducts, chutes, etc. required for the power plant.

The term "painting" referred herein covers rust preventive and decorative coating along with surface protection. The quality of surface preparation & painting shall be suitable for the plant & equipment to be installed at Tishreen TPP.

2.0 CODES AND STANDARDS

All materials and workmanship shall conform to relevant Indian/reputed International Standards. In particular the following shall be referred:

a) SIS.05.59.00 – Pictorial Surface preparation Standards for painting Steel Surfaces
b) BS 4232 – Surface Finish of Blast Cleaned Steel for painting

The following Indian Standards may be referred to for carrying out the painting job:

IS:5	:	Colours for ready mixed paints and enamels
IS:1303	:	Glossary of terms relating to paints
IS:2379	:	Colour code for identification of piplines
IS:2524	:	Code of practice for painting of non-ferrous metals in buildings (Parts I & II)
IS:2395	:	Code of practice for painting of concrete, masonry and plaster surfaces (Parts I & II)
IS:6278	:	Code of practice for white washing and colour Washing
IS:3140	:	Code of practice for painting asbestos cement building products
IS:158	:	Ready mixed paint, brushing, bituminous, black, leadfree, acid, alkali, water and heat resisting
IS:2074	:	Ready mixed paint, air drying, red Oxide Zinc Chrome,priming
IS:104	:	Ready mixed paint, brushing, Zinc Chrome, priming
IS: 2932	:	Enamel , synthetic, exterior (a) undercoating (b) Finishing
IS-1477	:	Code of practice for painting of ferrous metal in buildings.
		Part – I: Pretreatment
		Part – II: Painting

3.0 EXTENT OF PAINTING

3.1 Structural steel work

3.2 Various types of static and rotary equipment inclusive of electric motors, etc.

3.3 Steel tanks and vessels.

3.4 Metallic duct work such as ventilation ducts, gas ducts including supports, Hangers, etc.

3.5 Surface made of aluminum, brass, bronze, stainless steel, cast iron and other corrosion resistant alloys are not required to be painted unless specified except for aesthetic purpose or for identification bands.

All machined mating surfaces (e.g. flanges) shall be properly cleaned, greased and protected before despatch.

3.6 The complete paint system for any item includes the following activities :

a. Proper surface preparation
b. Application of primer coats
c. Application of intermediate coats
d. Application of finished coats

All the above coats shall be of quality paint products and of approved make as stipulated in this painting schedule.

3.7 Manufacturer may follow his standard painting provided the same is suitable for the operating and environmental conditions where the equipment are to be installed. In such cases the manufacturer's painting procedure shall be subject to Purchaser's /Consultant's approval and superior to the requirements enlisted here.

4.0 GENERAL REQUIREMENTS

4.1 All materials used shall be new and of first class quality from reputed manufacturers. The application procedure, manufacturer and brand of paint to be used shall be subject to Purchaser's approval.

4.2 The colour scheme for the entire plant equipment and piping shall be got approved by the Contractor from the Purchaser / Consultant before application of paint.

4.3 The surface preparation, and type of primer/paint etc. shall be as per Annexures enclosed herewith.

4.4 Procedure for inside painting of vessels, heat exchangers, tanks etc, shall be developed by the equipment suppliers considering fluid properties, if the same is not indicated. This procedure and quality of paint shall be subject to Purchaser's / Consultant's approval.

4.5 Hot insulated pipes shall be only primer painted. All other piping shall have a base colour.

All piping, insulated shall have colour bands near valves, fittings, joints, specialties, equipment,walls, etc. for identification of conveyed fluid as per approved colour scheme.

4.6 Manufacturer's specific recommendation, if any, shall be followed during surface preparation of paint, if the same is more stringent than this specification.

4.7 Surface preparation and painting work shall not be carried out under the following weather conditions :

a. When the surface is wet or excepted to become wet before the paint/primer has dried up due to impending rain, fog or mist.
b. High winds.
c. Ambient temperature below 5 deg.C or surface temperature less than 3deg.C. above dew point.
d. Relative Humidity is more than 85%.

4.8 The contractor shall provide suitable protection for adjacent plants from air borne material during cleaning and spraying to the satisfaction of Purchaser/Consultant.

5.0 SURFACE PREPARATION

5.1 Surface preparation being a pre requisite for any paint application, shall be such as to clean the surface thoroughly of any materials which will be conducive to premature failure of the paint.

5.2 All surfaces shall be cleaned of loose substances and foreign materials, such as dirt, rust, scale, oil, grease, welding flux, etc. irrespective of whether the same has been spelt out in the standards in order that the prime coat is rigidly anchored to the virgin metal surface. The surface preparation grade of Swedish Standards Institution SIS – 055900 or

equivalent standards such as SSPC – VIS 1.67 or DIN 55928 (Part 4) or BS 4232 or IS: 1477 (Part I) shall be followed.

5.3 The acceptable surface preparation quality/grade are described under each painting system. The procedures are solvent cleaning, Hand tool cleaning, power tool cleaning and blast cleaning.

a. Solvent cleaning

The surface shall be cleaned by wiping, immersion, spraying or vapour contacting of a suitable solvent or washing with an emulsion or alkaline solution to remove oil, grease, dirt, old paint, etc. Solvent cleaning shall not remove rust, scales, mill scales or weld flux. Therefore, before application of paint, solvent cleaning shall be followed by other cleaning procedures as stated below.

b. Hand tool cleaning

The surface shall be cleaned by vigorous wire brushing done manually to St-1 quality. This method effectively removes loosely adherent materials but would not affect residues of rust or mill scales that are firmly adherent.

c. Power tool cleaning

The surface shall be cleaned by electric or pneumatic tools to St-2/St-3 quality. The tools shall be used carefully to prevent excessive roughing of surface and formation of ridges and burns. This method will remove loosely adherent materials but would not affect residues of rust or mill scales that are firmly adherent.

d. Blast cleaning

The surface shall be cleaned by impingement of abrasive materials, such as graded sand grit, shot etc at high velocity created by clean and dry compressed air blast. This method will remove loosely adherent materials as well as adherent scales and mill scales. Prior to application of blast, heavy deposit of oil and grease are removed by solvent cleaning and excessive surface scales are removed by hand tools or power tool cleaning. The surface shall be cleaned to Sa-2 ½ quality which means that to 95% of surface area is free from all rust, mill scales and visible residues, foreign materials, etc. The blast cleaning is not recommended for sheet metal work.

6.0 PRIMER AND PAINT APPLICATION

6.1 Primer shall be applied immediately after surface preparation has been completed.

6.2 Brushing, spraying, roller coating or other suitable method shall be adopted for application of primer and paint and the work shall be carried out strictly as per the recommendation given by the paint manufacturer.

6.3 Primarized surfaces shall be faultless and shall not have mud cracking, dripping over thickness and dry sprays.

6.4 Before application of a paint / primer, the following shall be particularly checked for conformity to this schedule and recommendation of the paint manufacturer.

a. Surface preparation profile.
b. Catalysis ratio for two component paints.
c. Minimum and maximum top coating times.
d. Type and quantity of thinners (if required)
e. Pot life
f. Soundness & thickness of previous coating.

6.5 Particular care shall be taken during application to prevent painting defects, such as, dripping, funs, waviness, non uniform thickness, poor adhesion, discoloration etc.

6.6 Paints shall be properly stirred before and during application to make them homogenous.

6.7 No thinner shall be added to paints unless specifically approved. In such case, thinner recommended by the paint manufacturer shall only be used.

6.8 Shop painted/primed equipment shall be touched up in areas where paint has been damaged, loosened, cracked or rendered brittle. Touch-up shall be carried out by applying same number and type of coats as originally applied after carrying out surface preparation.

6.9 If paints are used for writing identification numbers, said paints shall be consistent with the finish coat.

6.10 Surfaces which cannot be painted after fabrication shall be primed and provided with suitable rust preventive oil before boxing up.

6.11 Paints shall be stored in well-ventilated rooms, far away from heat sources, open flames, sparks and protected from sun. Outdoor storage is not permitted. Storage life shall be clearly indicated on the container. Paints which have thickened or gelled or contained in non-original containers or in unsealed containers shall not be used.

6.12 Paint shall be applied in accordance with manufacturer's recommendations. The work shall generally follow IS 1477 (Part II).

6.13 Each coat of paint shall be dried sufficiently before application of next coat.

6.14 The contractor shall furnish paint manufacture's test report or technical data sheet shall indicate among other things the relevant standards, if any, composition in weight percent of pigments, drying time, viscosity, spreading rate, flash points, method of application, etc.

6.15 The suggestive colour code to be followed during painting are enclosed as Ann III and shall be finalized during detailing of various items/ packages.

7.0 PAINTING SCHEME

Painting schedules for various systems/items are furnished as Annexure – I & II. Vendors of different packages/items shall furnish detail painting schedule for customer approval during detail engineering as per this guide specification/schedule.

8.0 PAINT MAKES

a. Asian Paints (I) Ltd.
b. Shalimar Paints Ltd.
c. Berger Paints India Ltd
d. Bombay Paints
e. Goodlass Nerolac
f. Hempel Paints (Singapore)
g. Jenson & Nicholson (I) Ltd.
h. Jotun Paints
i. CDC Carboline (I) Ltd.

ANNEXURE – I
PAINTING SPECIFICATION

Item Description	Surface Preparation Grade / Surface profile	Primer Coat			Intermediate Coat			Finish Coat			Total DFT in microns
		Primer Paint	No. of Coats	DFT in microns	Intermediate Paint	No. of Coats	DFT in microns	Finish Paint (See Note)	No. of Coats	DFT in microns	
Various type of equipment, valves etc. (Temp. upto 90 Deg. C)	Degreasing and surface preparation to SA 2 1/2	Epoxy based polyamide cured (2) pack HB zinc phosphate primer	1	50-75 per coat	Epoxy based MIO pigmented polyamide cured paint	1	50 per coat	Aliphatic Acrylic (2) pack glossy polyurethane paint	2	Min. 30 per coat	160-185
Piping / Structurals / Vessels etc. (Temp. upto 90 Deg. C)	Degreasing and surface preparation to SA 2 1/2	Epoxy based polyamide cured (2) pack HB zinc phosphate primer	1	50-75 per coat	Epoxy based MIO pigmented polyamide cured paint	1	50 per coat	Polyamide cured epoxy finish coating	2	Min. 35 per coat	170-195
Equipment with temp. above 90 Deg. C & upto 200 Deg C)	Degreasing and surface preparation to SA 2 1/2	(2) pack polyamide cured epoxy zinc rich primer	2	Min. 35 per coat	-	-	-	Heat resistant Al paint (only for non insulated surfaces)	2	20 per coat	120 (70 for insulated surfaces)

Elect. / control panels etc.	Seven tank process	Epoxy based polyamide cured (2) pack zinc phosphate primer	1	35 per coat	Epoxy based TIO2 pigmented polyamide cured paint (shop)	1	40	Aliphatic Acrylic (2) pack polyyurethane finish paint	2	30 per coat	135
Equipment in corrosive areas like CPU (regeneration) Dosing skid, etc.	Blast clean to Sa 21/2	HB Epoxy resin based zinc phosphate primer	1	50 per coat	Epoxy based MIO pigmented paint	1	50 per coat	Polyamide cured Epoxy finish coat	2	25 – 35 per coat	150 - 170
Floor grills, ladder/rungs, steps treads, hand rail	Hot dip Galvanising shall be done as per IS 4736										

NOTES

1. Surface preparation shown is as per Swedish Standards SIS 05-5900. Degreasing will be as per Standard SSPC-SP1.
2. Incase of insulated surfaces, only primer coats shall be applied.
3. GM/SS items with piping and G.I. pipes will not be painted. However these items coming under Fire Fighting System shall be painted Fire Red as per TAC guidelines. Further SS/GI piping shall be given necessary colour banding for identification as per approved colour scheme/coding.
4. All instruments shall be painted as per manufacturer standard practice.
5. All structural steel items shall be painted at site. Equipment shall be finish painted at shop.
6. Method of painting application shall be as per paint manufacturer's recommendation.
7. **Based on above painting schedule, detailed painting schedule will be prepared by respective package supplier and these be submitted to BHEL for Final approval.**

ANNEXURE – II
(PAINTING SPECIFICATION)

SUGGESTED COLOUR CODES FOR PAINTING

SL. NO.	ITEM/SERVICE	COLOUR	IS-5	COLOUR (BAND)	IS-5
1.0	Structures, platforms, galleries, ladders and handrails	Dark Admirality Grey	632	-	-
2.0	Fans, pumps, motors, compressors, Blowers	Light Grey	631	-	-
3.0	Tanks (without insulation and cladding)				
3.1	Outdoor, Stand pipes, vent pipes	Aluminum	-	-	-
3.2	Indoor	Aluminum	-	-	-
4.0	Vessels & all other proprietary equip-ment (without insulation & cladding)	Light grey	631	-	-
5.0	Switchgear	Light grey	631	-	-
6.0	Control & relay panels	Light grey	631/7078 of IS 1650	-	-
7.0	Transformers	Dark Admiralty Grey	632	-	-
8.0	Machinery guards	Signal red	537	-	-
9.0	Piping (without insulation and cladding)				
9.1	Water System				
a)	Boiler feed	Sea green	217	-	-
b)	Condensate	Sea green	217	Light brown	410
c)	D M Water	Sea Green	217	Light orange	557
d)	Soft water	Sea green	217	French blue	166
e)	Bearing cooling water	Sea green	217	French blue	166
f)	Potable & filtered water	Sea green	217	French blue	166
g)	Service & clarified water	Sea green	217	French blue	166
h)	Raw water	Sea green	217	White	-
i)	Cooling water	Sea green	217	French blue	166

SL. NO.	ITEM/SERVICE	COLOUR	IS-5	COLOUR (BAND)	IS-5
9.2	Compressed Air System				
a)	Service air	Sky Blue	101	-	-
b)	Instrument air	blue	101	White	-
9.3	Oil system				
a)	Fuel oil	Light brown	410	French	166
b)	Light oil	Dark Brown	412	Brilliant green	221
c)	Lubricating oil	Light brown	410	Light grey	631
d)	Control oil	Light brown	410	Light orange	557
e)	Transformer oil	Light brown	410	Light orange	557
9.4	Gas system				
a)	Carbon dioxide	Canary yellow	309	Light grey	631
9.5	Fire services	Fire red	536	-	-
9.6	Fuel pipes (lignite)	Light brown	410	-	-
9.7	Drainage	Black	-	-	-
9.8	Stand pipes and all Vent pipes	Aluminum	-	-	-

NOTES:

1. This colour code basically refers to IS:2379 for piping with necessary modifications.
2. Where band colour is specified, same shall be provided at 10 meter intervals on long uninterrupted lines and also adjacent to valves and junctions.

VOLUME – II B

SECTION – D

STANDARD TECHNICAL REQUIREMENTS

Lift equipment shall include the following basic features:

1. LIFT CAR

The car platform frame and sling shall be of steel construction. The platform shall be suitably isolated from its sling. The car shall be enclosed with suitably braced and reinforced sheet metal panel. The sheet metal panel shall have ventilation slots at the base.

The car platform shall be robust in construction and elegant in appearance. The car shall be provided with the following:

a. For better safety, elevator vendor to provide car top barricade on car top to ensure that service personnel stay inside the car region. A selector switch and a set of push buttons shall be provided on the top above the ceiling of the car to operate the elevator locally for inspection and maintenance. The selector switch when set to position "inspection" shall exclude control from other places and movement of the car in the desired direction shall be effected by the push buttons. For normal operation of the elevator, the selector switch shall be set to the position working. It shall be possible to operate the elevator only when the appropriate button is kept in pressed condition. The roof shall be strong enough to support at least two persons.

b. The car shall be provided with an emergency alarm push button inside the Lift car which shall be clearly marked. The alarm shall be clearly audible outside the Lift way in order to obtain assistance in case of breakdown or failure between the floors.

2. CAR DOOR

Sides of the door shall be flush with all seams continuously welded. The car door shall be provided with locking gear of heavy and robust construction, so arranged mechanically and interlocked that the doors cannot under any circumstance be opened unless the Lift car is within a particular landing zone. Conversely the Lift shall not move until all the landing doors are closed and interlocked properly.

The live load coming into play shall be taken into consideration while designing doors, doorframe and hanger tracks. The car doors shall be designed such that their closing and opening is not likely to injure a person. These doors shall be fire rated.

3. LANDING DOORS

All landing openings in the Lift well enclosure shall be protected with doors, which shall extend the full height and width of the landing opening. The type of door provided shall be similar to the Lift car door. Every landing door shall be fitted with a locking device. The door shall be suitably interlocked so that they cannot open unless the car is within a particular landing zone. The levers operating the locking devices shall not interfere with the landing side or Lift enclosures. These doors shall be smoke tight and fire rated.

4. LOAD PLATE

A load plate displaying the rated load of the Lift in terms of persons and kilograms shall be fitted in the car in a conspicuous position.

5. SUSPENSION ROPES

The car and the counter weights shall be suspended by steel wire ropes. Chain shall not be used for suspension. Not less than four independent stranded steel wire suspension ropes shall be used for car or counter weights of the Lift with traction drive. The minimum factor of safety shall not be less than 12. The suspension ropes shall conform to latest edition of relevant BS EN 81/DIN/Republic of Syrian Arab Standards for Specification for steel wire suspension ropes for Lifts and hoists.

6. SHEAVES AND PULLEYS

All driving sheaves and pulleys fixed to and revolving with the shaft shall be fixed by means of sunk keys of sufficient strength and quality. BS EN 81/DIN/other standards applicable for Elevators in Syrian Arab Republic Sheaves and pulleys shall be made of cast steel (made as per relevant BS EN 81/DIN/Republic of Syrian Arab standards) free from cracks, sand holes and other injurious defects. They shall have suitable flanges and smoothly machined rope grooves. The diameter of the sheave or pulley shall be as specified in the latest edition of BS EN 81/DIN/Republic of Syrian Arab Standards.

7. SHAFT

Shafts and axles shall be of forged steel. They shall have sufficient rigidity and bearing surface. Any shaft when stepped shall be turned to a reasonable radius at the point of reduction.

8. COUNTER WEIGHTS

The Elevator shall be provided with suitable counter weights located in the Lift shaft. The counter weight shall be designed for smooth and easy operation of the Lift and shall be in accordance with the relevant BS EN 81/DIN/Syrian Arab Republic Standard. Suitable counter weight screen shall be provided in the Elevator shaft. The counter weights shall consist of cast iron weight contained in structural steel frame. It should preferably be equal to that of the car weight plus 40 % of the rated load. The traction should be such that no appreciable slip may occur but that slip shall free to take place upon the landing of either the car or the counter weights.

9. GUIDE RAILS

Guide rails for the car and counter weights shall be machined ‘T’ sections and continuous throughout the entire length and shall be provided with adequate steel brackets and spacing between brackets shall be such that to avoid any deflection during the normal operation. Guide rails section shall be adequate to withstand the forces resulting from the application of the safety gear when stopping the counter weights or fully loaded car. The guide shoes or their lining shall be easily renewable, adjustable and self lubricated. Guides shall be of such length that it shall not be possible for any of the car or the counter weight shoes to run off the guides.

10. BUFFERS

Sufficient number of buffers of spring-loaded type shall be fitted below the Lift car and counter weights. The buffers shall be capable of stopping the car or counter-weights without permanent damage or deformation to itself or any part of the Lift equipment. The number of buffers shall be so fixed as to ensure proper sharing of the impact loads by all of them.

11. EMERGENCY SAFETY DEVICES AND BRAKES

The Lift shall be provided with safety device attached to the Lift car frame and placed beneath the car. The safety device shall be capable of stopping and sustaining the Lift car up to governor tripping speed with full rated load in car. The application of the safety device shall not cause the Lift platform to become out of level in excess of 3 cm/m measured in any direction. Slack rope switches, if necessary, shall also be provided. The Elevator vendor shall also provide personnel evacuation system during the power failure to the Elevator.

The Machine shall be provided with DCEM brakes of sufficient capacity to stop the car at any position with the design load. These brakes shall be designed in such a way that it gets applied automatically in the event of power failure.

12. AUTOMATIC RESCUE DEVICE (ARD) (BATTERY DRIVE)

Contractor shall provide a modern advanced electronic drive system for "RESCUING Passengers Trapped in an ELEVATOR" in case of power failure or any other system failure. Elevator car shall come to nearest landing level and open automatically so that passengers can come out safely.

In addition to the above, bell and cranking device to be provided with hand wheel connected with motor shaft for manual lowering of elevator to the nearest landing level.

13. OVER SPEED GOVERNOR AND GOVERNOR ROPES

Governor shall be located where there is sufficient room for proper operation and where it cannot be struck by the Lift car or counter weight in the event of over run. Each governor shall be marked with tripping speed in terms of a car speed in m/sec and the motor control and brake control circuit shall be opened before or at the time the governor trips. Governor ropes shall be of steel or suitable construction as per relevant standard. The ropes shall run clear of the governor jaws during normal operation of the Lift. The Governor has to be compatible for operation of elevator.

14. LEVELING DEVICE

The Lift shall be provided with a two-way automatic leveling device. The leveling device shall take care of overrun and under run of the car and rope stretch, such that car floor is within 6.0 mm from the landing level at all floors while in operation. Aprons of sufficient depth shall be fitted to the car floor to ensure that no space is permitted between the threshold and the landing while the care is being leveled to floor.

15. MACHINE ROOM AND OVERHEAD STRUCTURES

All the overhead machinery shall be supported on beam to be furnished by the vendor. The machinery support beam shall rest on top of concrete floor (provided by BHEL).

The Lift drive controller and all other apparatus and equipment of Lift installation, except such apparatus and equipment which function in the machine room shall be located at the top of the Lift well. Adequate machine room and hoist way lighting shall be provided by the Elevator vendor. The maximum loads transmitted by the single heaviest equipment both during erection and maintenance of the Lift to the machine room floor and other structures like guides etc. shall be furnished by the Elevator vendor within 15 days of placing the award letter. Sound reducing materials below machines in machine room shall be provided.

16. TERMINAL STOPPING AND FINAL LIMIT SWITCHES:

The Lift shall be equipped with upper and lower normal terminal limit switches arranged to stop the car automatically within the limit of the top car clearance and bottom run by from any speed attained in normal operation. Such limit switches shall act independently of the operating device, the final limit switches and buffer.

Final limit switches shall be provided to stop the car automatically within the top and bottom clearance independent of normal operating device and the terminal limit switches. The final limit switch shall act to prevent movement of the car under power in both directions of travel and shall after operating, remain open until the Lift car has been moved by a hand operating mechanism within the limits of normal travel.

17. INDICATORS

The Lift shall be provided with position indicator of Box type with SS face plate and LED display and call indicator inside the Lift car to show the position of the Lift car with reference to the floor numbers and the landing from which the call is being received. Up and down travel direction and position indicators shall be of standard construction. Audio annunciation also shall be provided inside the car.

18. OPERATION AND INTERLOCKS

The operation of the Lift shall be simplex, selective, collective, and automatic, with or without operator. The Lift operation shall conform to the following requirements.

a) The operation of the Lift shall be through a push button station located inside the car.

b) The Lift shall not move unless the car door, landing door and all other protected openings connected with the control circuit are closed.

c) Two push buttons, one for upward and the other for downward movement at each intermediate landing and one push button at each terminal landing shall be provided in the landing floors in order to call the car.

d) The landing doors shall be interlocked so that the landing door at any floor shall not open when the Lift is not on that floor.

e) Push button shall be fixed in the car for holding the doors open for any length of time required.

19. LIFT DRIVE

The Lift drive shall be equipped with automatic DCEM brakes. The Lift shall be driven by a drive suitable for method of control offered by the Elevator vendor. No friction gearing or clutch mechanism shall be used for connecting the main driving gear to the sheaves.

20. ELECTRIC MOTORS

Motor pull out torque shall be at least 275% of rated torque.

21. CONTROLLERS

The controllers shall be designed to start, accelerate, stop and reverse the Lift when the appropriate push buttons are pressed. It shall be arranged so as to provide maximum convenience to the operator. Contact finger buttons shall be easy to adjust and replace. The speed control device shall be such as to give smooth, easy and accurate speed control. The Lift controls shall be housed in dust and vermin proof enclosures. The controls shall be wired with stranded copper conductor cables. All equipments mounted shall be neatly labeled as per wiring diagram. Ventilating louvers are to be provided in the panels.

The electrical controllers shall be provided with enclosure conforming to IP-21 (minimum or higher). The contactors, relays, resistors etc. used in the total system shall be of open type construction and design. Vendor shall furnish the size of controller panel (Length x Depth x Height) in the offer. Controller shall conform to IEC Standard and its spares should be locally available in Syria.

22. OTHER REQUIREMENTS

Electric high-speed door operators for the opening and closing of the car doors and landing doors shall be furnished and installed. The car and landing doors shall be mechanically connected and shall move simultaneously in opening and closing. The car door and landing door shall be power closed and shall be controlled in opening and closing by oil cushioning mechanism built into the gear unit. Necessary lockable switches shall be provided in the Lift machine room to control the operation of the door. Should the electric power fail, it must be possible for the doors to be manually opened from within the car.

Overload relays shall be provided to protect the drive motor against overload or a power failure. Suitable protection shall be provided on the controller to protect the Lift equipment from phase reversal and low voltage.

DATASHEET – 'A'

Sl. No.	Item	Description
1	**Lift Particulars**	
1.1	Elevator Location	TG Hall (Central Control Room)
1.2	Type of Service Type of Elevator	Passenger Type Conventional type
1.3	Rated Load on Elevator	13 persons (as per BS EN 81/DIN/other standards applicable in Republic of Syrian Arab for elevator and in no case capacity shall be less than 884 kg)
1.4	Quantity	One (1) No.
1.5	Rated Speed of Lift	1.0 M/Sec
1.6	Total Travel	18.7
1.7	Nos. of floors to be served	Five (5) No. including Ground Elevations – 0.0m, 4.8m, 9.45m, 13.2m, 18.7m
1.8	Design, construction, installation, codes including car size, door size, shaft size, size of platform and car entrance	As per latest revision of BS EN 81/DIN/other standards applicable in Republic of Syrian Arab for elevator
2.	**Car**	
2.1	Size	As indicated above under Sl. No. 1.8
2.2	Car frame	Structural Steel and bolted construction
2.3	Car enclosure	SS-304 (min 1.5mm thick)
3.	**Other facilities in car enclosure**	
3.1	Isolating cushion between car and car frame	Type of cushion shall be rubber pad or spring as per manufacturer's standard
3.2	Handrails on three sides	Mirror stainless steel
3.3	Lighting & fan	Adequate number of cabin fans, recessed fluorescent lamp fittings (as per above indicated standards)
3.4	Ventilation fan in the car	Shall be provided for adequate ventilation of the car by elevator supplier.
3.5	Telephone facility in the lift car	Internal telephone wiring and telephone hand set (with hands free facility)shall be provided. Cabling shall be terminated in Machine Room. Further cabling shall be done by BHEL.
3.6	Automatic rescue device with battery drive	Provided
3.7	Car platform/Floor	PVC Tiles
3.8	Car roof	Shall be provided with a three pin plug 5/15A, socket with switch on top of lift car
4	**Car operating panel**	
4.1	Type of construction	Partial Height car operating panel (COP), Removable type from Car with SS face plate
4.2	Push button	SS Construction Luminous push buttons conforming to IP 54
4.3	Other accessories of car operating panel	Car operating panel with luminous buttons, car position indication (both visual and audio),

		direction arrows, overload audio-visual warning indicator, battery operated alarm bell, emergency light with suitable battery-battery charger and controls, emergency stop switch
5	**Push button and call registered tell tale lights at each landing**	
5.1	Type of construction	Box type with SS face plate
5.2	Push Buttons	SS Construction Luminous push buttons conforming to IP 54
6	**Car position indicator**	Car Position indicator in car and at all floors, tell – tale lights at all floors, battery operated alarm bell and emergency light with suitable battery, battery charger and controls
6.1	Type of construction	As per manufacturer's standard
6.2	Type of display	7 segment LED display
7	**Car & Landing Doors**	
7.1	Type of door	Centre opening, horizontal sliding type. Landing door shall be fire rated for 1hr.
7.2	Method of operation	Power operated with automatic door opening and closing devices.
7.3	Safety shoes complete with accessories shall be provided	Yes
7.4	Safety device for door operation shall be provided	Infrared light curtain shall be provided for safety operation of door
7.5	Door Hangers and Tracks	Provided
7.6	MOC for Car & landing doors	SS 304 (min 1.5mm thk)
8	**Buffers**	Spring type for car and counterweight
9	**Load Plate**	As per manufacturer's standard/as applicable
10	**Counter weight and counter weight frame**	
10.1	Counter weights frame	Fabricated Steel Construction
10.2	Counter weight fillers	Cast Iron
11	**Guide rails complete with supporting brackets for the car and counter weights.**	Provided
12	**Limit switches**	
12.1	Location	Bottom & top terminal, electromechanical , cam operated
13	**Apron / Facia Plate**	Yes
14	**Method of control**	AC VV VF (Microprocessor based) Control with automatic level adjustment. Controller shall conform to IEC Standard**.** The control system shall be of field proven design and having satisfactory track record.
15	**Position of Machine Room**	Directly above the elevator shaft.
16	**Operation**	Selective simplex collective, automatic operation with and without attendant with provision for locking control in "auto" or "Attendant" position. Key type lock switch shall be provided.

17	**Car Safety & Governor**	
17.1	Stopping distance	As per latest revision of BS EN 81/DIN/other standards applicable in Republic of Syrian Arab for elevator
17.2	Type and mode of operation of Over speed Governor device	Centrifugal action
17.3	Tripping speed and design code conform to	As per latest revision of BS EN 81/DIN/other standards applicable in Republic of Syrian Arab for elevator
17.4	Location	At machine room
18	**Power supply**	
18.1	Power	380V (±10%), 3 Phase, 4 wire, 50 Hz (-3 to +5%) supply with a combined voltage and frequency variation of 10% (absolute)
18.2	Lighting & fan	220 Volts, 1 Phase, 50 Hz
19	**Motor details**	
19.1	Type	3 phase AC squirrel Cage Induction motor
19.2	Type of Duty	Lift Duty
19.3	Motor Duty	S4
19.4	Duty Cycle of Motor	40%
19.5	Applicable standard	IEC 60034
19.6	No. Of Starts Per Hour	Elevator Motor shall be suitable for minimum of 150 Starts per hour
19.7	Direction of rotation	Both Clockwise & Anticlockwise
19.8	Class of Insulation	Class-F and Temp Rise limited to Class-B
19.9	Method of Starting	AC Variable Voltage Variable Frequency
19.10	Type of enclosures	IP54
20	**Door Motor**	
20.1	Equipment driven by Motor	Door (car and landing)
20.2	Direction of rotation	Bi-directional
20.3	Applicable standard	IEC 60034
20.4	Type of enclosures	Conforming to IP54
21	**Metallic Wire Mesh between Car & Counter Weight**	Yes, by package supplier
22	**Fire Man Switch**	Yes, by package supplier
23	**Automatic Rescue Device**	Provided
24	**Trailing cables**	FRLS PVC type
25	**Protection class**	Protection class for main control panel shall be IP 21 (min or higher)
26	**Other Accessories to be provided by bidder**	One no 2 kg NAF PIV (HCFC Blend E) type fire extinguisher (conforming to NFPA 2001)

VOLUME – II B

SECTION – D

STANDARD TECHNICAL REQUIREMENTS

(ELECTRICAL)

GENERAL TECHNICAL REQUIREMENTS

FOR LV MOTORS

STANDARD SPECIFICATION NO. – PE-SS-999-506-E101,REV. 00

1.0 INTENT OF SPECIFIATION

The specification covers the design, materials, constructional features, manufacture, inspection and testing at manufacturer's work, and packing of Low voltage (LV) squirrel cage induction motors along with all accessories for driving auxiliaries in thermal power station.

Motors having a voltage rating of below 1000V are referred to as low voltage (LV) motors.

2.0 CODES AND STANDARDS

Motors shall fully comply with latest edition, including all amendments and revision, of following codes and standards:

IS:325	Three phase Induction motors
IS : 900	Code of practice for installation and maintenance of induction motors
IS: 996	Single phase small AC and universal motors
IS: 4722	Rotating Electrical machines
IS: 4691	Degree of Protection provided by enclosures for rotating electrical machines
IS: 4728	Terminal marking and direction of rotation rotating electrical machines
IS: 1231	Dimensions of three phase foot mounted induction motors
IS: 8789	Values of performance characteristics for three phase induction motors
IS: 13555	Guide for selection and application of 3-phase A.C. induction motors for different types of driven equipment
IS: 2148	Flame proof enclosures for electrical appliance
IS: 5571	Guide for selection of electrical equipment for hazardous areas
IS: 12824	Type of duty and classes of rating assigned
IS: 12802	Temperature rise measurement for rotating electrical machnines
IS: 12065	Permissible limits of noise level for rotating electrical machines
IS: 12075	Mechanical vibration of rotating electrical machines

In case of imported motors, motors as per IEC-34 shall also be acceptable.

3.0 DESIGN REQUIREMENTS

3.1 Motors and accessories shall be designed to operate satisfactorily under conditions specified in data sheet-A and Project Information, including voltage & frequency variation of supply system as defined in Data sheet-A

3.2 Motors shall be continuously rated at the design ambient temperature specified in Data Sheet-A and other site conditions specified under Project Information
Motor ratings shall have at least a 15% margin over the continuous maximum demand of the driven equipment, under entire operating range including voltage & frequency variation specified above.

3.3 Starting Requirements

3.3.1 Motor characteristics such as speed, starting torque, break away torque and starting time shall be properly co-ordinated with the requirements of driven equipment. The accelerating torque at any speed with the minimum starting voltage shall be at least 10% higher than that of the driven equipment.

3.3.2 Motors shall be capable of starting and accelerating the load with direct on line starting without exceeding acceptable winding temperature.

The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value as per Data Sheet - A during the starting period of motors.

3.3.3 The following frequency of starts shall apply

i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.

ii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. (not to be repeated in the second successive hour)

iii) Motors for coal conveyor and coal crusher application shall be suitable for three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be suitable for mimimum 20,000 starts during the life time of the motor

3.4 **Running Requirements**

3.4.1 Motors shall run satisfactorily at a supply voltage of 75% of rated voltage for 5 minutes with full load without injurious heating to the motor.

3.4.2 Motor shall not stall due to voltage dip in the system causing momentary drop in voltage upto 70% of the rated voltage for duration of 2 secs.

3.5 **Stress During bus Transfer**

3.5.1 Motors shall withstand the voltage, heavy inrush transient current, mechanical and torque stress developed due to the application of 150% of the rated voltage for at least 1 sec. caused due to vector difference between the motor residual voltage and the incoming supply voltage during occasional auto bus transfer.

3.5.2 Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.

3.6 Maximum noise level measured at distance of 1.0 metres from the outline of motor shall not exceed the values specified in IS 12065.

3.7 The max. vibration velocity or double amplitude of motors vibration as measured at motor bearings shall be within the limits specified in IS: 12075.

4.0 **CONSTRUCTIONAL FEATURES**

4.1 Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor or semi-indoor motors shall conform to degree of protection IP: 55 as per IS: 4691and shall be of weather-proof construction. Outdoor motors shall be installed under a suitable canopy

4.2 Motors upto 160KW shall have Totally Enclosed Fan Cooled (TEFC) enclosures, the method of cooling conforming to IC-0141 or IC-0151 of IS: 6362.

Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled

4.3 Motors shall be designed with cooling fans suitable for both directions of rotation.

4.4. Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.

4.5 Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.

4.6 In case Class 'F' insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class 'B' insulation.
In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C.

4.7 **Terminals and Terminal Boxes**

4.7.1 Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A.

Unless otherwise stated in Data Sheet-A, motors of rating 110 kW and above will be controlled by circuit breaker and below 110 kW by switch fuse-contactor. The terminal box of motors shall be designed for the fault current mentioned in data sheet "A".

4.7.2 unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end.

4.7.3 Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or U W & V respectively.

4.7.4 Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation.

4.7.5 Motor terminals and terminal leads shall be fully insulated with no bar live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A.

4.7.6 Degree of protection for terminal boxes shall be IP 55 as per IS 4691.

4.7.7 Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes.

4.7.8. Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors.

4.7.9 Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type.

4.8 Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given in Data Sheet-A shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal.

4.9 **General**

4.9.1 Motors provided for similar drives shall be interchangeable.

4.9.2 Suitable foundation bolts are to be supplied alongwith the motors.

4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above.

4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956.

4.9.5 All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz.

4.9.6 Name plate with all particulars as per IS: 325 shall be provided

4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions.

5.0 INSPECTION AND TESTING

5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied.

5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser.

5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan.

5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A.

6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT

a) OGA drawing showing the position of terminal boxes, earthing connections etc.
b) Arrangement drawing of terminal boxes.
c) Characteristic curves:
(*To be given for motor above 55 kW unless otherwise specified in Data Sheet*).

i) Current vs. time at rated voltage and minimum starting voltage.
ii) Speed vs. time at rated voltage and minimum starting voltage.
iii) Torque vs. speed at rated voltage and minimum voltage.
For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling.
iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.

STANDARD QAP – LV MOTORS

	QUALITY PLAN	CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
		BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-006/0			SPECIFICATION TITLE			
	SHEET 1 OF 2	SYSTEM			ITEM AC ELECT. MOTORS BELOW 75KW (LV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.O	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUFR'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	3	-	-	
2.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	3	-	-	
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	3	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./ RELEVANT IEC	MFG.SPEC. RELEVANT IEC	-DO-	3	-	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	IEC/ BHEL SPEC./ DATA SHEET	SAME AS COL.7	TEST REPORT	3	2,1	2,1	NOTE -1
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IEC	INSPN. REPORT	2	1	-	

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN	CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
		BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-006/0			SPECIFICATION : TITLE :			
	SHEET 2 OF 2	SYSTEM			ITEM AC ELECT. MOTORS BELOW 75KW (LV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IEC & DATA SHEET	IEC & DATA SHEET	INSPN. REPORT	3	1	-	

NOTES:

1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON

2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.

3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.

BHEL	**PARTICULARS**	**BIDDER/VENDOR**
	NAME	
	SIGNATURE	
	DATE	BIDDER'S/VENDORS COMPANY SEAL

VOLUME – II B

SECTION – D

STANDARD TECHNICAL SPECIFICATION FOR SEA-WORTHY PACKING FOR EXPORT JOBS

(STANDARD SPECIFICATION NO. PE-TS-888-100-A001)

1.0 Purpose

The purpose of this specification is to describe minimum packing requirements for the different items/equipment for all export Project and also to define marking and shipping requirements during transportation by ship, road and air for all export jobs.

2.0 SCOPE

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

The scope this specification is to define VENDOR's responsibilities in terms of:

- Preservation of the GOODS/items/equipments before packing.
- Packing of the GOODS for road, rail, sea and/or air transportation to desired destination i.e. project site
- Making cases/crates
- Chemical Treatment/Fumigation before packing to prevent fungus, damage due to termite, borer, rats, etc.
- Marking of cases/crates.
- Other Services required.

3.0 Application

This specification is applicable to all the goods to be transported to project site and requires to be in transit for longer duration. *However, for "Misc cable erection items", "Fire sealing system" & "Exothermic welding material", the packing requirements shall be as per the procurement specification.*

4.0 Definitions

"BHEL" : Main EPC vendor

"OWNER" : Customer for a particular export project.

"VENDOR" : Company(ies)/VENDOR(s) to whom the BHEL has placed Purchase Order for GOODS/ items/system/package.

"GOODS": means all or part of the articles, material, equipment supplies including technical documentation, as described in the Purchase Order, to be supplied by VENDOR.

"PACKER": Packaging Company to whom VENDOR intends to sub-contract the packing in case they do not have own packing capability/facilities .

"FREIGHT FORWARDER" : Means the Company responsible for performing freight forwarding activities.

5. General Information

The following requirements are intended as minimum requirements, and compliance to these requirements in no way absolves or relieves VENDOR of any responsibility or obligation outlined in the Purchase Order. In all circumstances, the packing will be designed and constructed in order to support GOODS during transportation as well as to prevent the Goods from damage due to impact, extreme climatic conditions, sun and rain. It must be ensured that the delivery of the GOODS to the jobsite by sea, road or air, in good condition.

GOODS shall be export packed in compliance with the best-established practices for international projects, in accordance with the following instructions. In the event of any conflict between these specified requirement and the established practices, specification requirement shall govern.

Due to climatic conditions and the complex transport operation(s), it is essential that protection and packing is of the highest standard. Packing means to efficiently protect the GOODS during the total transport operation; from the moment they leave the factory until they are delivered to the jobsite, including handling operations (loading/unloading) and storage.

When VENDOR do not have packing capabilities/facilities of their own and therefore intends to sub-contract, VENDOR have to inform BHEL/Purchaser of the name and address of proposed PACKER(s) for approval.

6.0 Criteria for Selection of Packaging

Packages are to be made according to categories, described in articles 8.1 to 8.5, depending on the type of materials, their fragility and size.

These categories have been established for the protection of equipment and material during multi-mode transports, i.e.: combination of overland and sea transport; containerization, air transportation.

In a general manner, the GOODS have to be packed in such a way that crates, bundles, pallets can be stored into General Purpose containers, wherever possible.

If VENDOR has any doubt about the correct method of protection or packing, he should contact BHEL/Purchaser in order to mutually agree on the adequate type of packing to be used.

Materials can be classified in following categories

- Hazardous Material
- Non-Hazardous Material
-

Further to above categorisation, non-hazardous materials can be sub- categorised for selection of packing.

6.1 Hazardous Materials

Though handling of hazardous material may is not applicable in the scope of this specification. All hazardous material must be packed in adherence to the detailed requirement relating to packing, marking and labelling set out in the most recent report of the Board's Standard Advisory Committee on the Carriage of Dangerous Goods in Ships for sea freight, and the Restricted Articles Regulations, laid down by the International Air Transport Association for airfreight.

6.2 Non-Hazardous GOODS

The scope of this specification is to provide necessary guidelines for packing for power plant equipment, components, Pipings & Valves, Fittings, other structural items, electrical items, spare parts and erection materials. The procedure is defined in subsequent paragraphs in details in clause no. 8.0.

7. 0 Marking Instructions & Despatch details, Storage Code

7.1 Marking Instructions & despatch details

Packages and crates will be marked with indelible black paint, resistant to seawater. Marking must be perfectly legible.

The shipping marks, which will be as per fig-13, shall be stencilled on two sides and one end in clear characters at least 5 centimetres high (where crate size permits, otherwise use optimum size for each package dimension).

When the GOODS are to be shipped in containers then marking may be stencilled on one end only. However, packages must be stowed in a manner that shows these marks.

Crates containing fragile articles must be packed with special precaution against risk of breakage and must be stencilled on all sides "FRAGILE - HANDLE WITH CARE". Where crates are not to be overturned, VENDOR must show on the crates, clear and readily visible identification as per fig-12, to ensure they are kept in the correct position.

Packages/equipment of 2,000 kg or more must be marked with slinging points on all sides, in addition to the centre of gravity marks.

Number packages consecutively i.e. 1 of 10, 2 of 10, etc. Do not duplicate package numbers. VENDOR is responsible for any loss or damage caused by incorrect marking.

All cases/crates shall also be marked with the appropriate international standard graphic symbols for handling as shown in Fig 12.

As a minimum, all cases/crates are to be marked clearly on all four sides with:

- "HANDLE WITH CARE"
- "RIGHT SIDE UP"
- **"KEEP DRY"**

In the case of packages with a single gross weight totalling 2,000 kg and/or a height of more than 1m, the centre of gravity shall be clearly marked with the symbol on two adjoining sides. For all items of equipment with an eccentric centre of gravity this symbol shall be marked at the bottom, side and top of the package.

The slinging and lashing points shall be marked with a chain symbol.

When packing in cases/crates, these packages shall also have metal corners at the slinging points. (Fig-11)

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

Dispatch details such as consigner/consignee address, contract and case details, country of origin, port of delivery, stacking instructions shall be written on one side of the boxes. An anodized aluminum 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 aluminum packing slip holder to be nailed on the external surface of the box. One more copy of the packing slip wrapped in polyethylene bag is to be kept inside the box at the pertinent place.

7.2 Storage Code

The type of storage required is required to be specified, it will be shown on each packaging in **RED colour.**

X Crates or packages to be stored outdoor without covers
XX Crates or packages to be stored under tarpaulin
XXX Crates or packages to be stored in covered or enclosed premises
XXXX Crates or packages which must be stored in air-conditioned premises

8.0 GUIDELINES FOR PACKING GOODS

8.1 In the subsequent paragraphs details of different types of packings for different types of GOODS are defined. Vendor shall make packing details/procedure based on the guidelines and submit for approval.

8.1.1 Packing for Pipe, Fittings, Flanges and Valves, Structural Steel

Particular attention should be brought to pipe, fittings, flanges, valves and structural steel. Packing categories for piping and fittings will differ according to the diameter and wall thickness of these products. VENDOR shall comply with the following established practice.

IMPORTANT NOTE:
Depending on the project schedule and availability of ocean vessels, the piping and structural steel may be shipped in containers. In this event, VENDOR has to arrange the packages in such a way it allows the stuffing into Open Top in gauge containers.

8.1.2 Pipe

Where practicable, pipe lengths shall be limited to 11.8 meters.
All pipes **2"** included and below shall be packed in crates. All pipes to be capped and ends sealed with waterproof tape.

Pipes over 2" up to 6", shall be bundled and banded in bundles of uniform length. Bundling is carried out with U-IRON or traversal planks, joined with threaded connecting rods with locknuts. Quantities and strapping positions depend on the lengths, with a 120 cm spacing to prevent distortion. Bundle weight shall not exceed 2,000 kg. All pipes are to be capped and ends sealed with waterproof tape (tape is not necessary if end caps are of the pre-shrunk or self-sealing type).

Pipes larger than 6" shall be shipped as single lengths with the ends capped. End caps are to be of the recessed type to enable the use of soft faced hooks, but still completely sealing the end and also protecting the weld.
All stainless steel piping must be packed separately in wooden crates. Any banding of bundles is to be with the same material.

8.1.3 Pipe Fittings, Flanges and Valves

All pipe fittings, flanges and valves up to 6", are to be packed in cases/crates. For items over 6", these may be fixed securely to a pallet base and enclosed in a crate, for protection. Where valves have actuators attached, rigidity must be ensured for the valve and actuator. The vulnerable parts of the actuator are to be completely protected within a wooden crate.

All stainless steel fittings, flanges and valves of all sizes, must be packed separately in wooden crates. Any strapping is to be with the same material.

8.1.4 Structural Steel

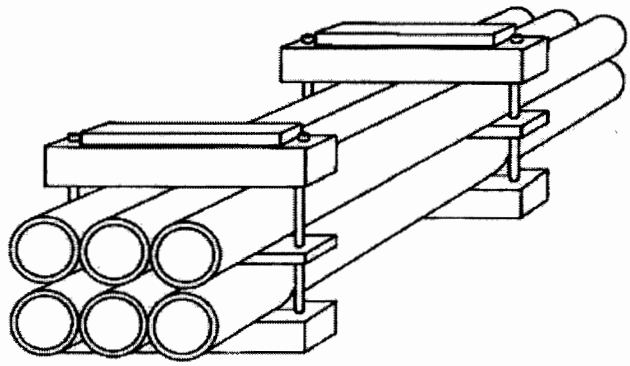
Structural Steel, reinforcing rods, bars, etc., should be packed in bundles of uniform length. Refer to articles 8.1.2, for strapping requirements. Bundle weight not normally to exceed 2,000 kg. Fabricated structures and structural steelwork, etc, should be bundled and packed using wooden beams and long bolting to secure the load.

8.2 Bundling – Packing Category I

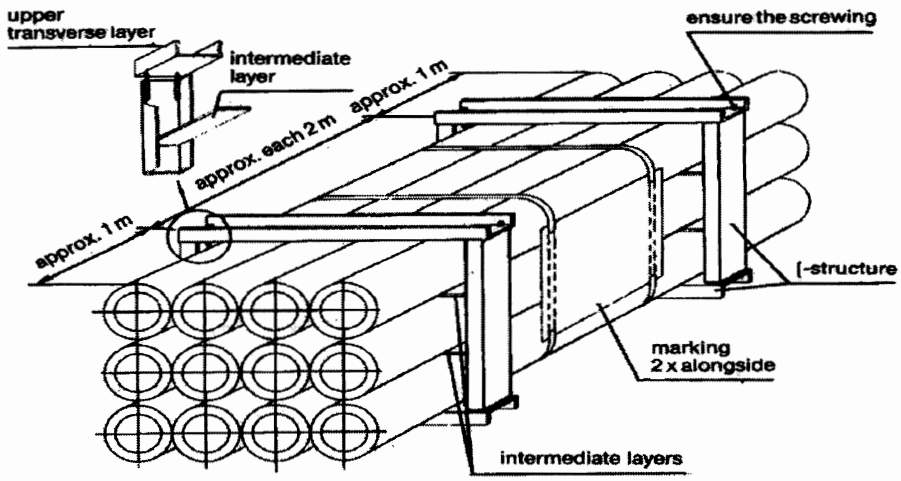
8.2.1 Type of Equipment

Equipment which is not subject to damage by corrosion or mechanical effect, i.e. pipes, piping, structural steel.

Packing category I



Bundling by U-shaped iron – packing category I A



8.2.2 Type of Construction

Bundling has to be effected

- By squared timber and threaded rods.
- With an intermediate layer (threaded on tightening bolts) according to the weight of the package.
- Wedge-shaped timbers must be added at the outer points of lower layer.
- Between the bolts a spacer must be nailed.
- The bolts must be secured (e.g. by locking nut).
- If single parts could protrude, an appropriate protection must be installed (flat iron or plates).
- Bundling with steel straps or PVC straps is not accepted.

8.3 Skids, Square Timber Constructions, Casings – Packing (Category II)

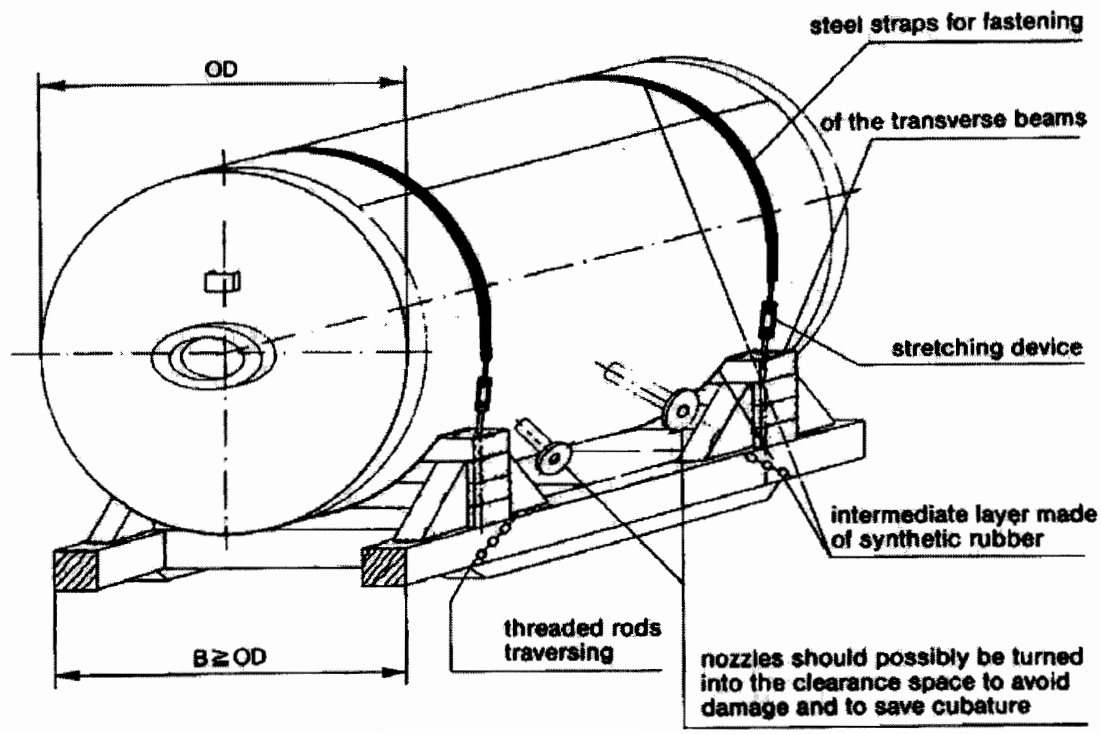
8.3.1 Type of Equipment

Voluminous apparatus, tanks and/or heavy pieces those are not vulnerable to mechanical or corrosive effects.

8.3.2 Type of Construction

- The construction skid can be made of wood or of metal.
- The fastening of the packages on the skid will be made by steel straps (flat iron) which have to be elastically lined, non-slip and securely bolted onto the skids.
- Flange openings have to be closed with gaskets and blind flanges or, if necessary, provided with cover.
- Skid constructions may not be less than the dimensions of the package in length or in width.
- Tanks and apparatus with their own support cradles must be supplied with an anti-slip lining.

PACKING CATEGORY-II



8.4 Packing of GOODS in Wooden Crates/Cases/Boxes

The construction of wooden crate/cases/boxes shall be as per the details indicated in clause 9.0 & Fig 1 to 11. Details indicated in the sketches for different categories Packing crates/boxes are only for a typical equipment considered for illustration.

8.4.1 Packing Category III

8.4.1.1 Type of Equipment

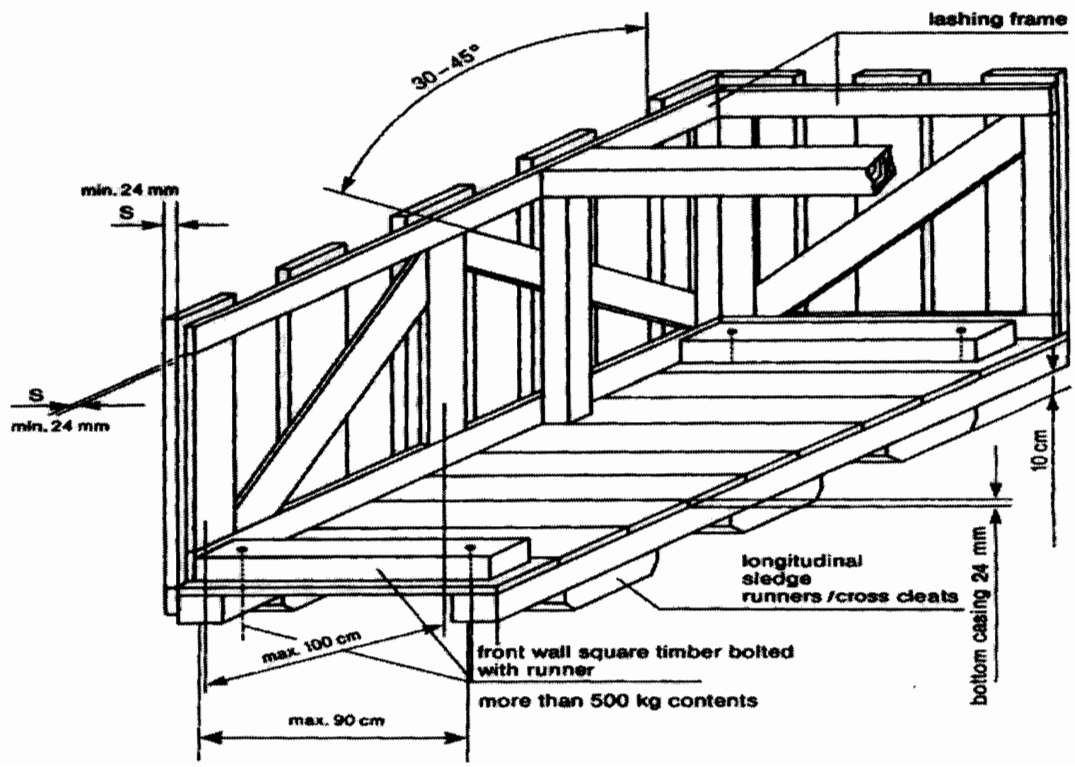
Fabricated equipment, which cannot be transported on cradles; frame-works, prefabricated piping and fittings, mechanical and electrical assemblies. *This type of packing is recommended where many parts of the equipment/component/assembly are not protruding out.*

8.4.1.2 Type of Construction

The equipment must be safely fastened to the bottom with bolts, possibly by the runners or to be spread in such a manner that no protruding parts are possible. For parts, sensitive to rainwater and/or debris, a protection has to be made by a foil cap.

If it is possible that single part could protrude through the front/back side wall, they shall be closed completely. The marking of the package shall be done on plywood plates at the prescribed sides.

Packing Category III



8.4.2 Cases with Lining – Packing Category IV

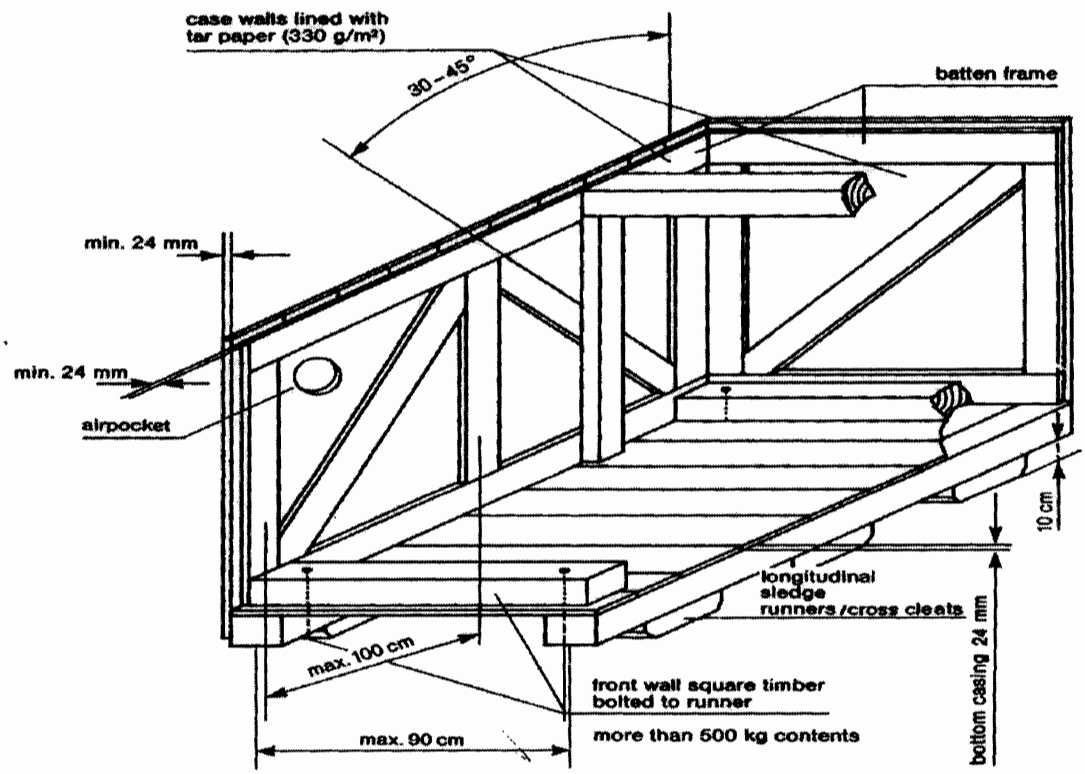
8.4.2.1 Type of Equipment

Recommended for equipment and mechanical parts Equipment sensitive to mechanical damage or parts and components that are particularly at risk of theft or loss; pumps, elbows, flanges, fittings, tools, erection materials, etc.

8.4.2.2 Type of Construction

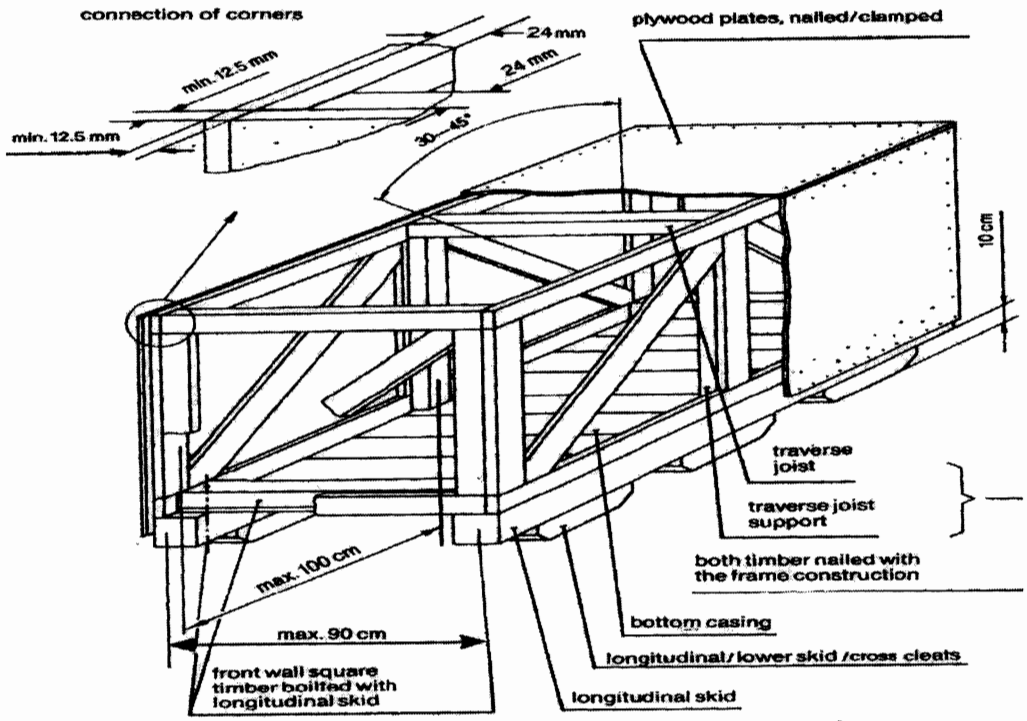
The same type of construction as article 8.4.1.2, but with all sides completely boarded without space between the boards. Sides to be provided with waterproof lining; fabric-reinforced waterproof tar paper or polyethylene-foils resistant to ultraviolet rays can be used. Polyethylene-foil shall be fixed under the lid cover to avoid penetration of water. At weights of more than 500 kg the longitudinal runner must be bolted to the front all square timber. For ventilation inside the case, an opening in the waterproof lining must be placed between the diagonal battens and diagonal joists.

Packing Category IV



8.4.3 Cases with Alternative Surface Materials

8.4.3.1 Plywood Box – Packing Category IV A



Case constructed of 5 layers of watertight, glued plywood with a total thickness of 12.5 mm. The frame must be constructed from minimum 24 mm timber or as per guide lines given above against clause 8.0, Fig 1 to 11 and must be suitable for the weight and nature of the parts to be packed. Planed square timber must be bolted with longitudinal skid and covered with diagonal joists. If applicable, construction of the cover and sides is to include diagonal bracing. Covers consisting of several layers of plywood are to be sealed with durable elastic putty or additional water-resistant sheets to be fixed.

8.4.4 Case with Barrier Material – Polyethylene Foil – Packing Category V

8.4.4.1 Type of Equipment

Sensitive equipment, simple electrical equipment, insulation materials, fire-resistant materials, with non-corrosion- guarantee for a period up to twelve (12) months.

8.4.4.2 Type of Construction

Preservation by welding in polyethylene-foil with addition of desiccants and if necessary, application of non-corrosive contact agents, otherwise, type of construction as indicated in article 8.4.2.2.
Additional marking:

- Case with desiccants.

8.4.5 Case with Barrier Material – Aluminium Compound Foil – Packing Category VI

8.4.5.1 Type of Equipment

Electrical equipment such as, switchboards, electric motors, sensitive equipment, with non-corrosion guarantee, for a period up to twelve (12) months.

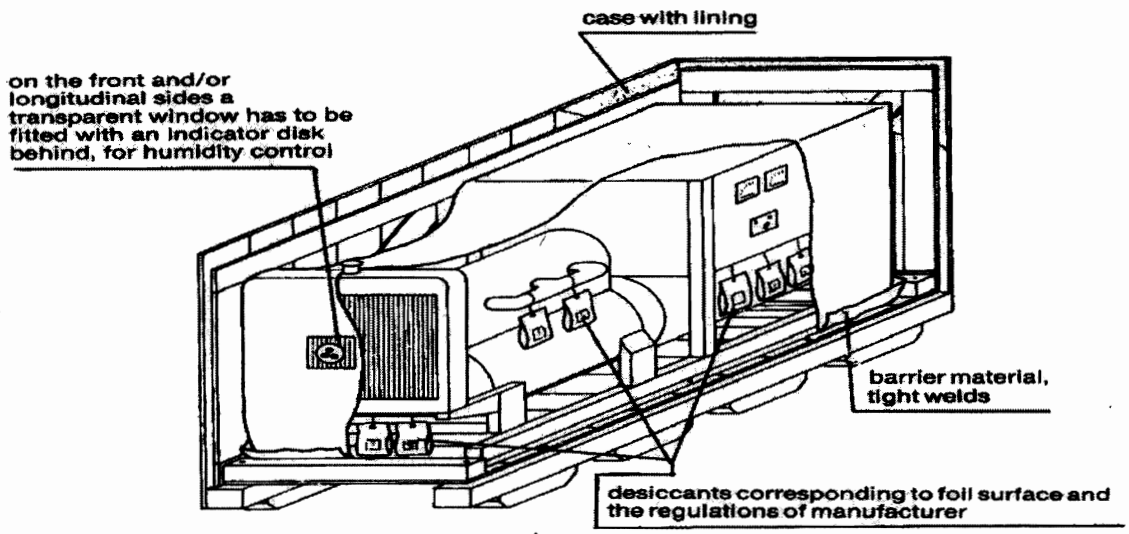
8.4.5.2 Type of Construction

Type of construction as indicated in article 8.4.2.2. Preservation by sealing an aluminium compound foil, with the addition of desiccants. Humidity indicators, if required and installed in the barrier wrapping, shall allow easy control from the outside.

Additional marking:

- Case with desiccants.

Packing Category V/VI



8.4.6 Double Case – Packing Category VII

8.4.6.1 Type of Equipment

GOODS which are of high sensitivity to shock, impact and vibration, for instance, special electrical equipment like computers, switchboards, laboratory instruments

8.4.6.2 Type of Construction

Case construction as indicated in article 8.4.2.2, with additional floating inner packing (case-in-case principle), padding corresponding to weight and sensitiveness. Preservation by sealing in aluminium compound foil with the addition of desiccants. The inner case has to be made of plywood or equivalent material with a thickness of 8-12 mm, depending on the weight of the GOODS to be packed. The inner buckles and/or frame borders have to be dimensioned so that the full stability of the inside case will be reached and no twisting is possible. The inner sides of the inside case will be lined with bituminous kraft paper on all sides (except bottom).

8.4.7 Cable Drum – Packing Category VIII

8.4.7.1 Type of Equipment

All type of cables, wires, ropes, hoses.

8.4.7.2 Type of Construction

For all type of cables refer clause no. 11.1. For other items (wires, ropes, hoses) new or practically new drums are to be used. Planking of the e drums by use of boards, thickness minimum 20 mm, with additional double steel strapping, nailed, and carefully preserved/ protected cable ends prior to packing.

8.4.8 Hazardous Materials – Packing Category IX

8.4.8.1 Type of Equipment

Hazardous materials according to the law are explosives, compressed gases, liquefied gases dissolved under pressure or deeply refrigerated, flammable liquids, flammable solids: substances liable to spontaneous combustion; substances which, on contact with water, emit flammable gases, oxidizing substances, organic peroxides, poisonous (toxic) and infectious substances; radioactive materials, corrosives, miscellaneous dangerous goods.

8.4.8.2 Type of Construction

Hazardous materials shall always be packed and documented separately from any other material. Selection of packaging materials, execution of packing and marking as well as documentation shall always be in compliance with the applicable laws and regulations. Any certificates required for transportation or for authorities to be supplied before shipment of the GOODS.

8.4.9 Wooden Floor as a Transport Support – Packing Category X

8.4.9.1 Type of Equipment

Any materials to be stuffed in containers or on flat racks and that are not stowed on standard pallets or otherwise suitably packed

8.4.9.2 Type of Construction

- Longitudinal internal square timbers bolted to the front wall runners, longitudinal skid.
- Maximum distance between longitudinal runners 90 cm (middle to middle of the runner).
- Full boarding of the floor.
- Attaching of lifting lugs and/or iron ropes for lifting/pulling the units off the transport equipment.
- If applicable, preservation of the equipment by sealing in polyethylene-foil or aluminium compound foil and the addition of desiccants.

8.5 Air Transport Packing

8.5.1 General

Certain types of material may have to be shipped by air from their country of origin. This means of transport will be exceptional, and will be used only:

- For GOODS, which are highly sensitive to shock or vibrations, such as computers, electronic instruments, or those of small dimensions and weight.
- For GOODS urgently required at the module yard(s) and/or jobsite.

8.5.2 Type of Packing

Depending on the goods to be packed, VENDOR may use one of the following types:

- A triple-corrugated cardboard container made with waterproofed glue and a barrier layer of polyethylene on the outsides to keep out humidity.
- Wooden/cardboard packing cases: the wood being used for the framework and base of the cases, waterproofed triple-corrugated cardboard being used for the sides and top. These cases are of the "Bell" type, and used for material of small or medium dimensions.
- For larger dimensions, plywood cases are acceptable. The timber characteristics, cross-sections and thickness will be systematically determined by the nature of the loads to be packed.

8.5.3 Dimensions

In order to optimize the existing transport facilities (passenger or cargo aircraft), the dimensions of:

- Triple-corrugated containers.
- Wooden/cardboard packing cases.
- Plywood cases.

Are to be adapted to pallets used for air transportation.

9.0 <u>Detailed specification for Wooden Crates/Boxes/Cases and other packing materials</u>

9.1 Technical specification for wood

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

9.2 Chemical Treatment of Wood:

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, planning, joint grooving, etc.

9.3 TYPE, DESIGN & DIMENSION OF WOODEN PACKING CASES:

9.3.1 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/crates shall be as per details given below and also given in figure 1 to 11.

9.3.1.1 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 dimensions of the load to be carried. The equipment shall be secured by fixing their base frame/plate with the help of bolt and nuts etc. to bottom frame of the wooden packing cases/crates. The equipment not provided with base frame/plate like cylindrical vessels, etc to be secured to the bottom frame of the wooden cases with "C" clamps fabricated from steel channels/ angle iron.

9.3.1.2 **TOP FRAME**

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

9.3.1.3 **END PANELS**

The dimension 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 500mm. Details of bracings shall be as per fig 5 to 9.

9.3.1.4 **Sling Plate**

To facilitate lifting of cases, longitudinal under slide boards shall be fixed. To avoid damage to the box while lifting sling plates shall be provided. Refer fig-11.

9.3.1.5 **Angle Iron Cleats**

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

9.3.1.6 **Other Requirements**

- The thickness of planks for top, bottom, side and end panels shall be at least 25mm. Planks used for this purpose shall be joined with each other by tongue and groove joint. The groove dimension shall be such that tongue fits tightly into groove to make the 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 up to 2400mm, proper jointing is permitted for planks for sheathing and diagonal bracings.
- Each equipment to be individually covered with double polyethylene petticoat. Sheet thickness of polythene 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 bituminized water proof craft paper. Wherever 2 pieces of kraft paper are used, joint shall have an overlap of minimum 20 mm.
- All the inner sides of the box shall be nailed with bitumen coated HESSIAN POLYTHYLENE 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, joint shall have an overlap of minimum 20 mm.
- For delicate equipment like control panels and switchgears, lighting panels and lighting transformers, suitable cushioning material like rubberised coir (min. 50 mm thick and 100 mm wide) shall be provided on their bottom support and the gap between the panel and casing

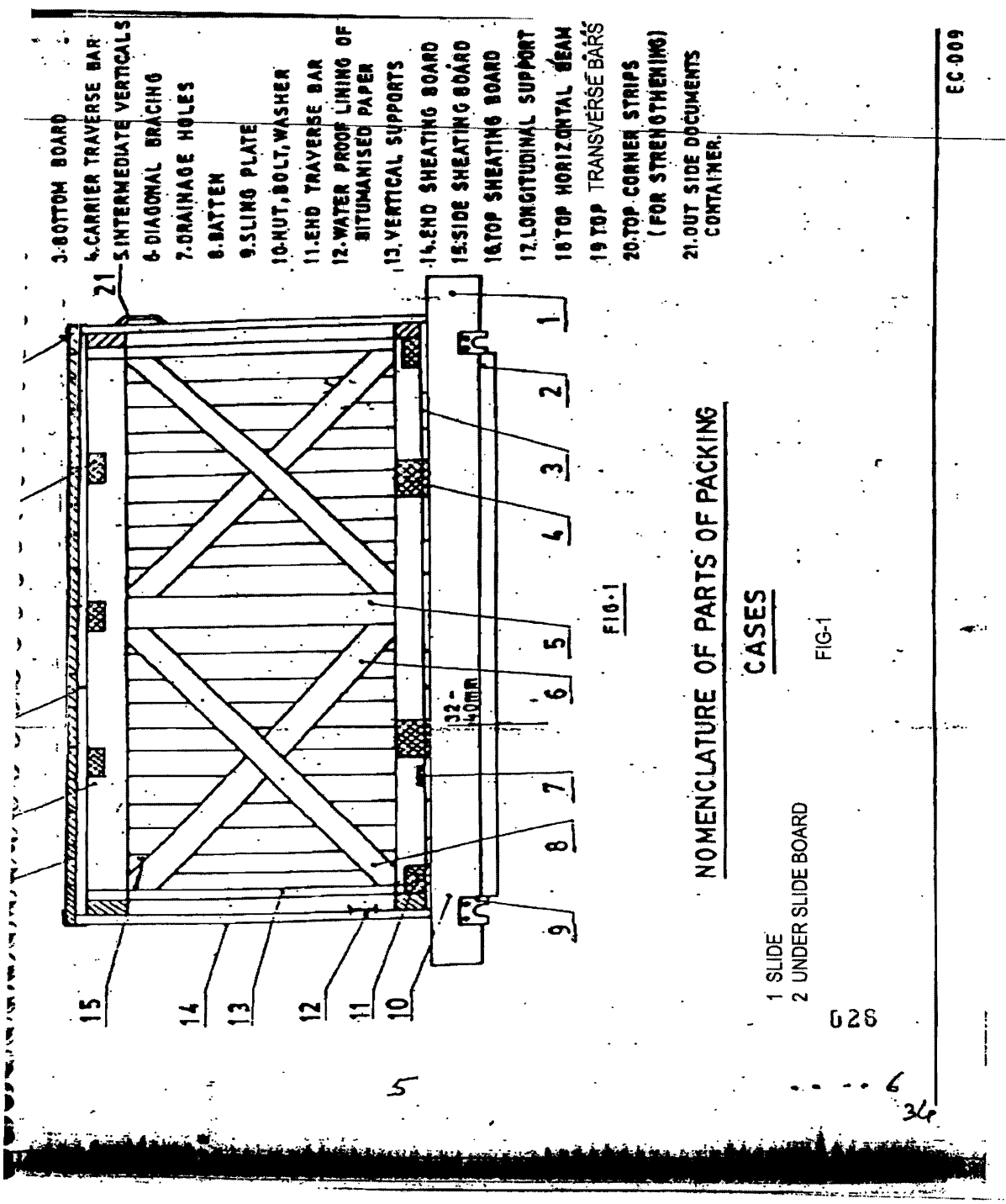
shall be filled with rubberized coir with distance between consecutive supports less than 500 mm (ref fig15). For other equipment suitable support from sides of the casing shall be provided.

- 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 and shall be separately packed and shipped as per packing instructions in clause 10.4.

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

- 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.

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


3.BOTTOM BOARD
4.CARRIER TRAVERSE BAR
5.INTERMEDIATE VERTICALS
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 TRANSVERSE BARS
20.TOP CORNER STRIPS (FOR STRENGTHENING)
21.OUT SIDE DOCUMENTS CONTAINER.
EC-009
F10-1
NOMENCLATURE OF PARTS OF PACKING
CASES
FIG-1
1 SLIDE
2 UNDER SLIDE BOARD
026

BOTTOM FRAME ARRANGEMENTS

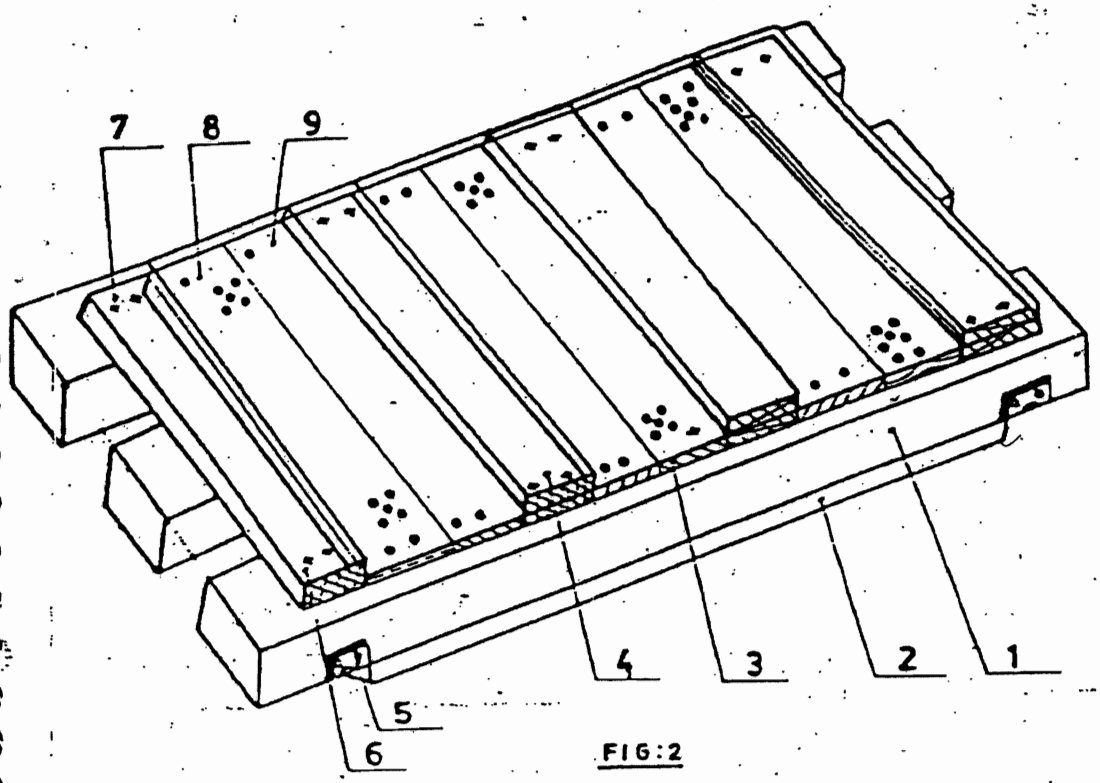


FIG:2

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 bar; 100 X 100 mm (minimum)

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

027

6

TOP FRAME ARRANGEMENT

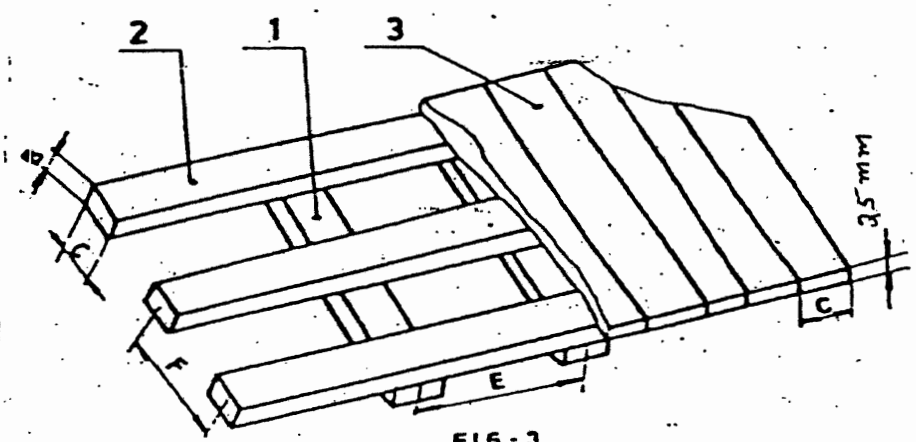
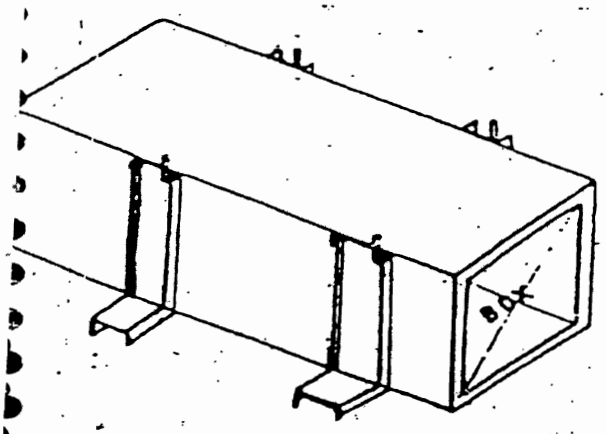


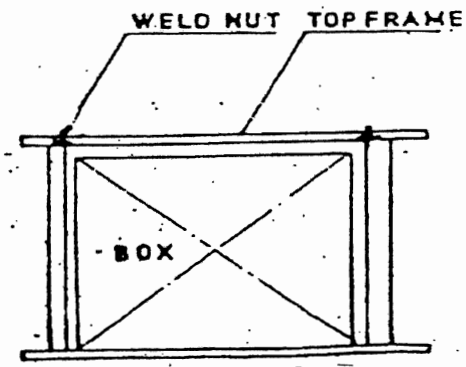
FIG-3

F : 700 t 1000 mm
E : 500 t 900 mm
: 30×100 mm.

1 - Treverse Bers
2 - Horizontal Boans
3 - Top Board

ARRANGEMENT OF C-CLAMPS AROUND CASES





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ARRANGEMENT OF DIAGONAL BRACING AND HORIZONTAL SUPPORT

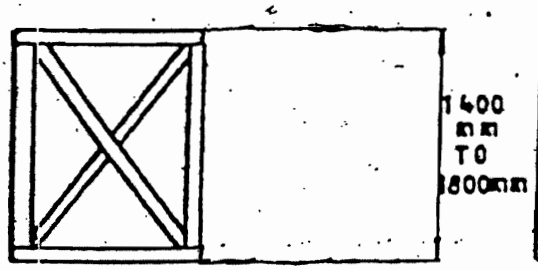


FIG:6

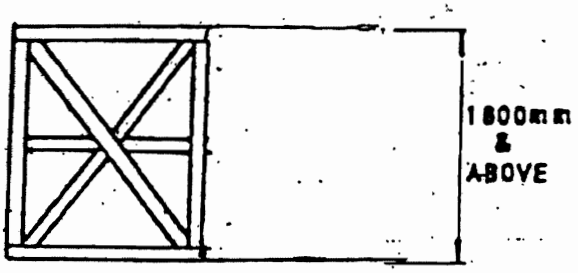


FIG:8

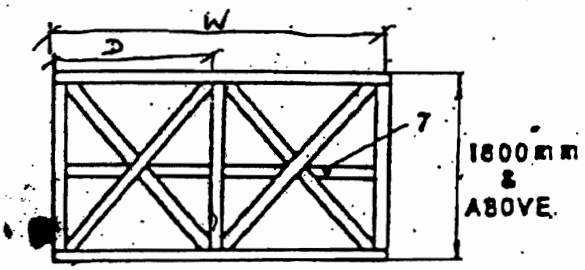


FIG:9

7- Middle Horizontal Support

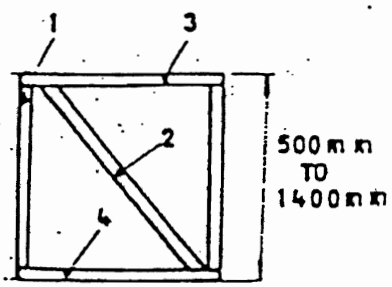


FIG:5

1- Vertical Support

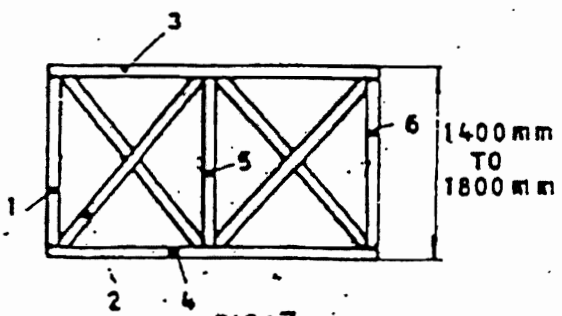
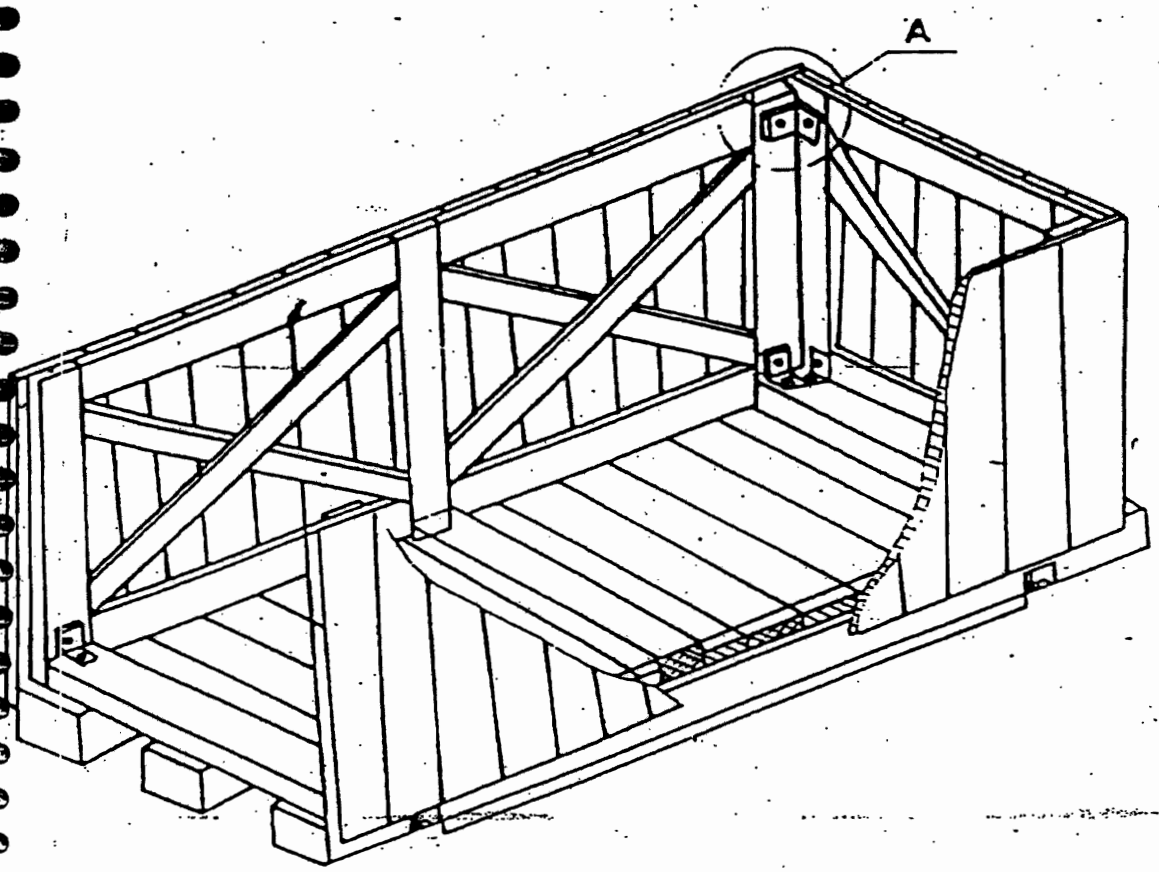


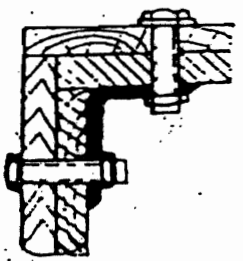
FIG:7

1, 5, 6 - Vertical Support

029

ARRANGEMENT OF PACKING CASE





DETAIL-A

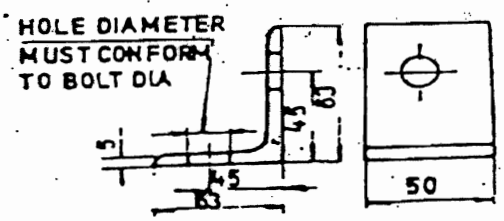


FIG:10

030

ARRANGEMENT OF SLING PLATE ON CASES

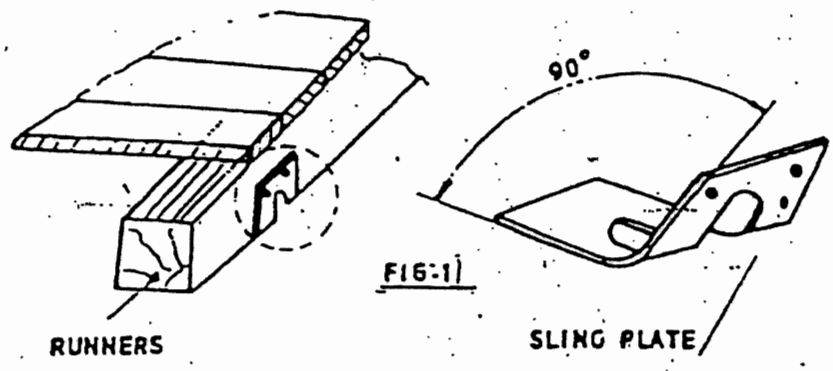


FIG:1

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TABLE-1

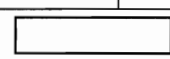
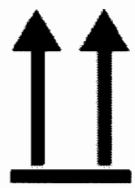
LOADS	LENGTHS OF SLIDES						
	600	800	1000	1200	1300	1500	2000
	Cross section b x c						
500	50 X 100	50 X 100	50 X 100	50 X 100	75 X 100	75 X 100	100 X 100
800	50 X 100	50 X 100	75 X 100	75 X 100	75 X 100	75 X 100	100 X 100
1000	75 X 100	75 X 100	75 X 100	100 X 100	100 X 100	100 X 110	100 X 150
1500	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	150 X 150

Table-2

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

INDICATION MARKS ON CASES/BOXES/CRATES

Designation	Symbol	Explanation
Fragile, Handle with care		The symbol should be applied to easily broken cargoes. Cargoes marked with this symbol should be handled carefully and should never be tipped over or slung.
Use no hooks		Any other kind of point load should also be avoided with cargoes marked with this symbol. The symbol does not automatically prohibit the use of the plate hooks used for handling bagged cargo.
Top		The package must always be transported, handled and stored in such a way that the arrows always point upwards. Rolling, swinging, severe tipping or tumbling or other such handling must be avoided.
Keep away from heat (solar radiation)		Compliance with the symbol is best achieved if the cargo is kept under the coolest possible conditions. In any event, it must be kept away from additional sources of heat. It may be appropriate to enquire whether prevailing or anticipated temperatures may be harmful.
Protect from heat and radioactive sources		Stowage as for the preceding symbol. The cargo must additionally be protected from radioactivity.
Sling here		The symbol indicates merely where the cargo should be slung, but not the method of lifting. If the symbols are applied equidistant from the middle or center of gravity, the package will hang level if the slings are of identical length. If this is not the case, the slinging equipment must be shortened on one side.
Keep dry		Cargo bearing this symbol must be protected from excessive humidity and must accordingly be stored under cover. If particularly large or bulky packages cannot be stored in warehouses or sheds, they must be carefully covered with tarpaulins.

Center of gravity		This symbol is intended to provide a clear indication of the position of the center of gravity. To be meaningful, this symbol should only be used where the center of gravity is not central. The meaning is unambiguous if the symbol is applied onto two upright surfaces at right angles to each other.
No hand truck here		The absence of this symbol on packages amounts to permission to use a hand truck on them.
Stacking limitation		The maximum stacking load must be stated as "... kg max.". Since such marking is sensible only on packages with little loading capacity, cargo bearing this symbol should be stowed in the uppermost layer.
Clamp here		Stating that the package may be clamped at the indicated point is logically equivalent to a prohibition of clamping anywhere else.
Temperature limitations		According to regulations, the symbol should either be provided with the suffix "...°C" for a specific temperature or, in the case of a temperature range, with an upper ("...°C max.") and lower ("...°C min.") temperature limit. The corresponding temperatures or temperature limits should also be noted on the consignment note.
Do not use forklift truck here		This symbol should only be applied to the sides where the forklift truck cannot be used. Absence of the symbol on other sides of the package amounts to permission to use forklift trucks on these sides.
Electrostatic sensitive device		Contact with packages bearing this symbol should be avoided at low levels of relative humidity, especially if insulating footwear is being worn or the ground/floor is nonconductive. Low levels of relative humidity must in particular be expected on hot, dry summer days and very cold winter days.

Do not destroy barrier		A barrier layer which is (virtually) impermeable to water vapor and contains desiccants for corrosion protection is located beneath the outer packaging. This protection will be ineffective if the barrier layer is damaged. Since the symbol has not yet been approved by the ISO, puncturing of the outer shell must in particular be avoided for any packages bearing the words "Packed with desiccants".
Tear off here		This symbol is intended only for the receiver.

FIG-12

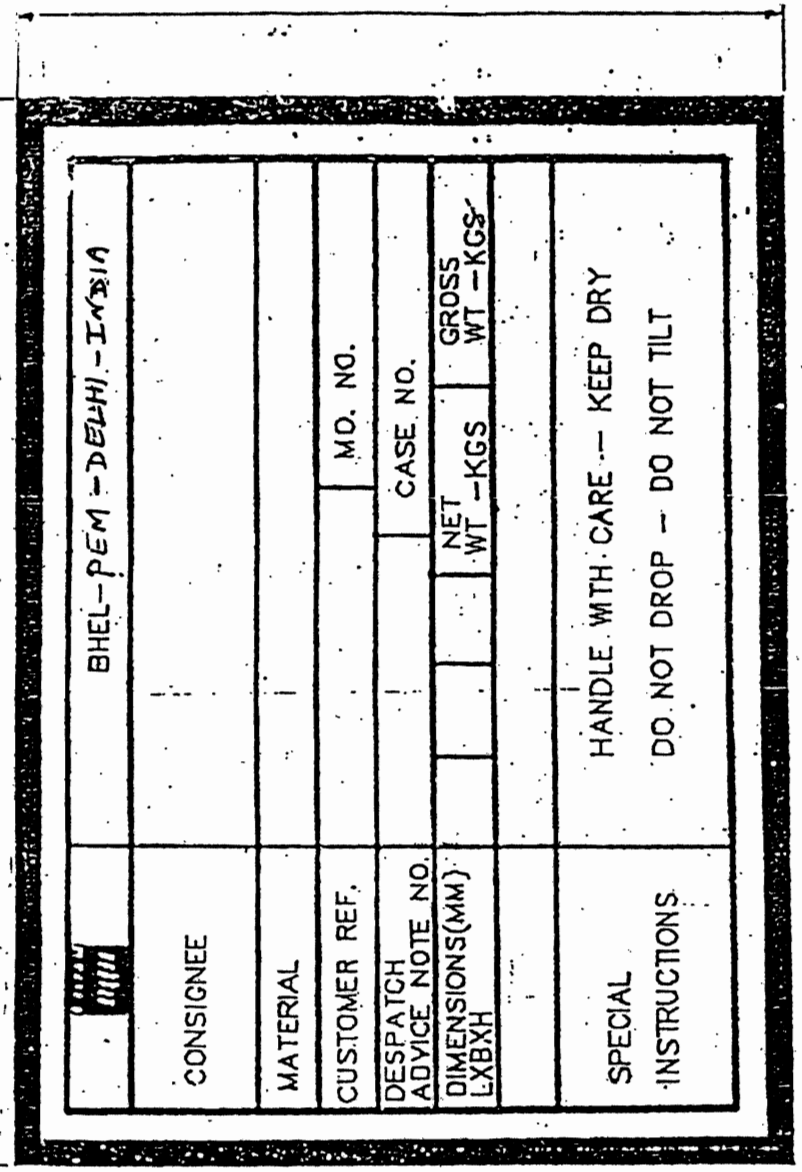
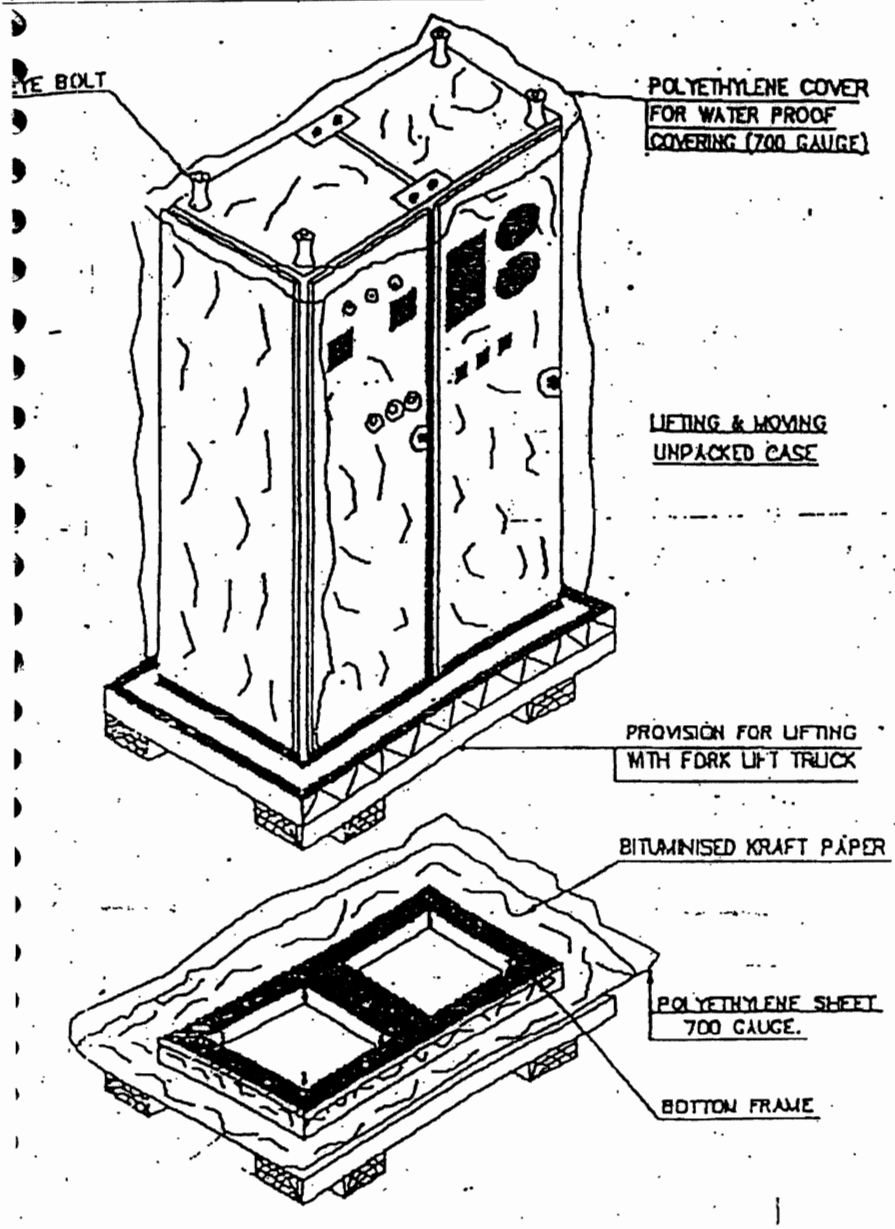


FIG-13: MARKING PLATE



FIGURE–14

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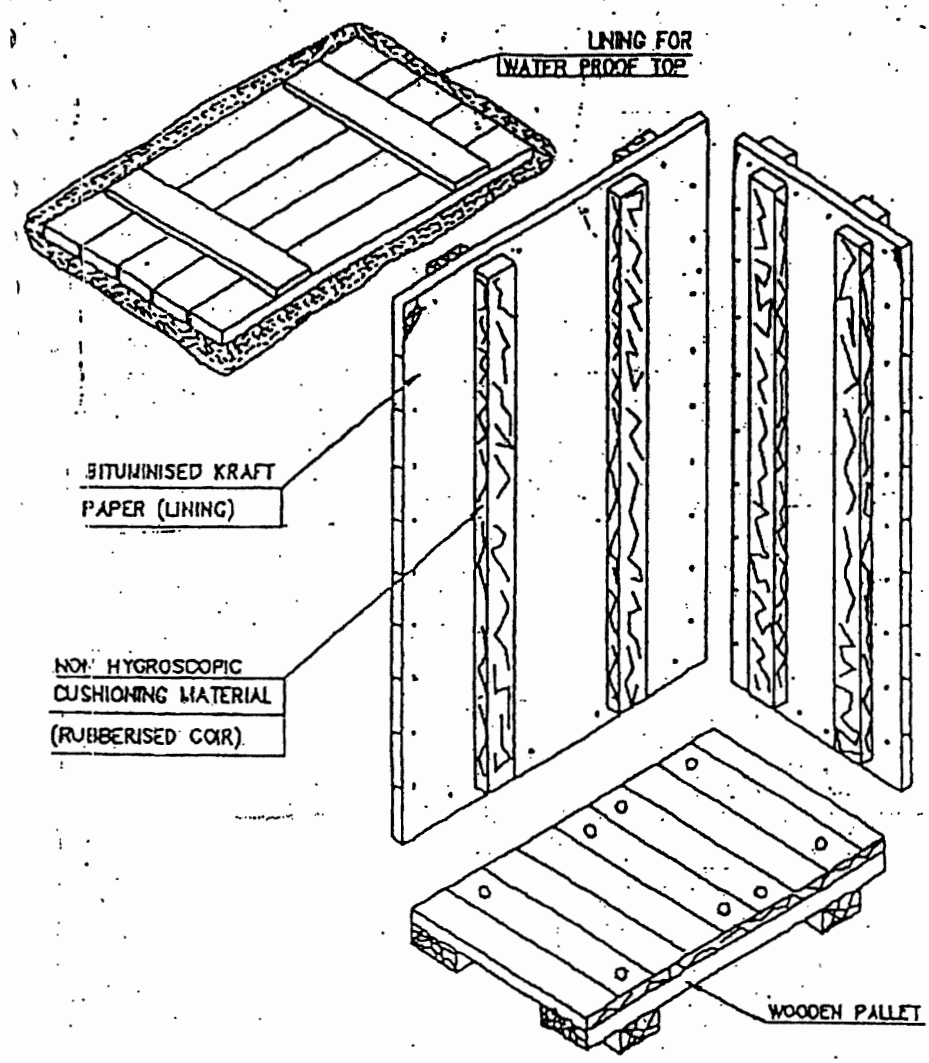

FIGURE-15

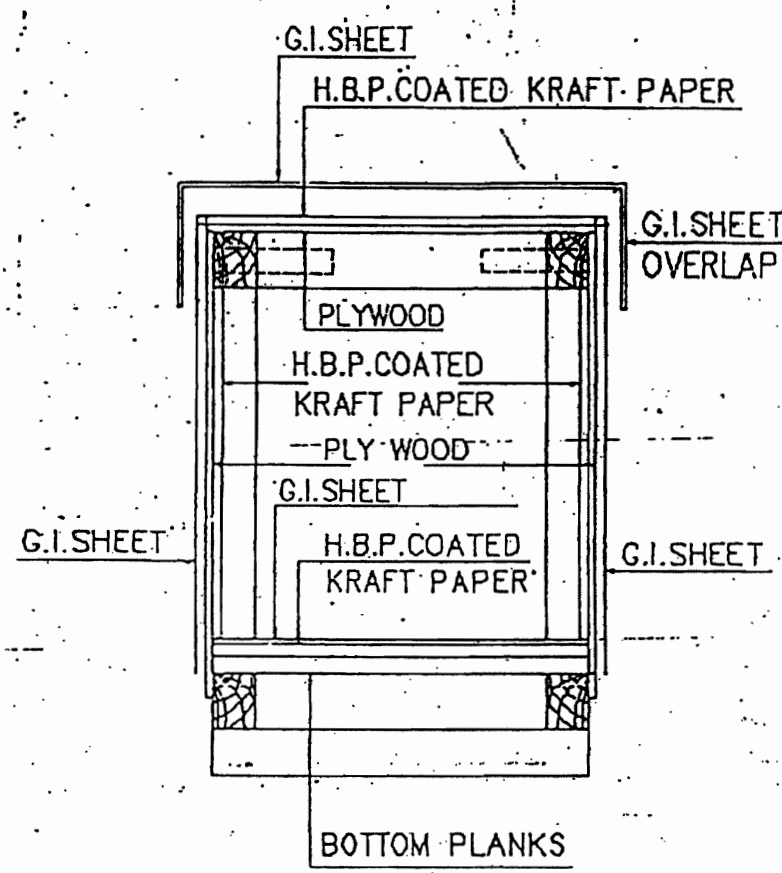

FIG-16 : CLOSED PACKING CASE WITH G.I.SHEET SHOWING LAYERS OF PACKING MATERIALS.

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10.0 TYPICAL PACKING DETAILS/PROCEDURE FOR MECHANICAL ITEMS

10.1 INSULATION MATERIAL (MINERAL WOOL MATTRESSES)

This specification covers the requirements of seaworthy packing and marking for bonded mineral (rock) wool mattresses having metallic hexagonal wire netting as facing on one or both sides.

10.1.1 TYPE OF CONSTRUCTION

Mattress shall be packed in Polythene (of 0.2 mm thickness) all around and sealed to prevent moisture absorption during transit and storage. Further it shall be wrapped with Bitumen coated Polythene bonded/lined Hessian and stitched and then packed in 5 ply DFC carton box.

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 direct contact with the material inside the package. The quantity of silica gel shall be enough for storage period of one year. However, it shall not be less than 4 gms per litre volume of case subject to minimum of 400 gms per case.

Each mattress as well as the packages shall be serial numbered. Also, printed sheets indicating the nominal thickness, density and wire netting details (i.e. material and size) shall be placed below the wire netting.

Following details shall be legibly written on the packages. The details shall also be typed on a sheet of paper & kept in a sealed Polythene cover, inside the packages

a) Project Name
b) Purchase Order No.
c) Sl. No. of package
d) Size of mattress (Thickness x Length x Width)
e) Density
f) Wire netting material and size
g) Weight of the package

10.2 INSULATION MATERIAL (ALUMINIUM COIL)

Heavy Gauge Aluminium Coil Packaging are done by Eye-to-Sky packaging or by Eye to eye packaging as per the proven practice being followed by manufacturer of Aluminium sheets.

10.2.1 Type of construction for Eye to Sky packaging

a. Strapping of coil with polyester strap around circumference at one place.

b. Putting paper I. D. Edge protector.

c. Wrapping the coil with VCI stretch film after putting silica gel bags (4 nos.) Inside the coil.

d. Wrapping the coil with HDPE film.

e. Covering the coil including its build up & bore with masonite / particle board.

f. Putting metallic I. D on coil.

g. Putting O.D edge protector (paper) on coil.

h. Putting circumferential polyester strap (3 nos.) & eye polyester strap (4 nos.).

i. After placing the coil on coil tilter ply wood (10mm thick) of suitable size along with wooden pallet is to be put at the bottom side of the coil.

j. Coil is to be tilted to eye-to-sky position.

k. Final strapping with metallic strap to unit coil and skid at 2 places with top cover of plywood.

l. Fixing the coil with wooden blocks at 4 corners.

m. Labeling 2 nos.(one metallic & one adhesivetype) For specification, net wt. & gross wt.

10.2.2 Type of construction for Eye to Eye packaging

a. Strapping of coil with polyester strap around circumference at one place.

b. Putting paper I. D. Edge protector.

c. Wrapping the coil with VCI stretch film after putting silica gel bags (4 nos.) Inside the coil.

d. Wrapping the coil with HDPE film.

e. Covering the coil including its build up & bore with masonite / particle board.

f. Putting metallic I. D on coil.

g. Putting O.D edge protector (paper) on coil.

h. Putting circumferential polyester strap (3 nos.) & eye polyester strap (4 nos.).

i. Placing of coil on wooden skid Coil is to be tilted to eye-to-sky position.

j. Final strapping of coil and skid at 2 places with steel strap. Fixing the coil with wooden blocks at 4 corners.

Labeling 2 nos.(one metallic & one adhesive type) For specification net wt. & gross wt.

10.3 Packing Procedure for Online Tube Cleaning System and accessories

This procedure is applicable for the shipment of Onload Tube Cleaning System and accessories by sea.

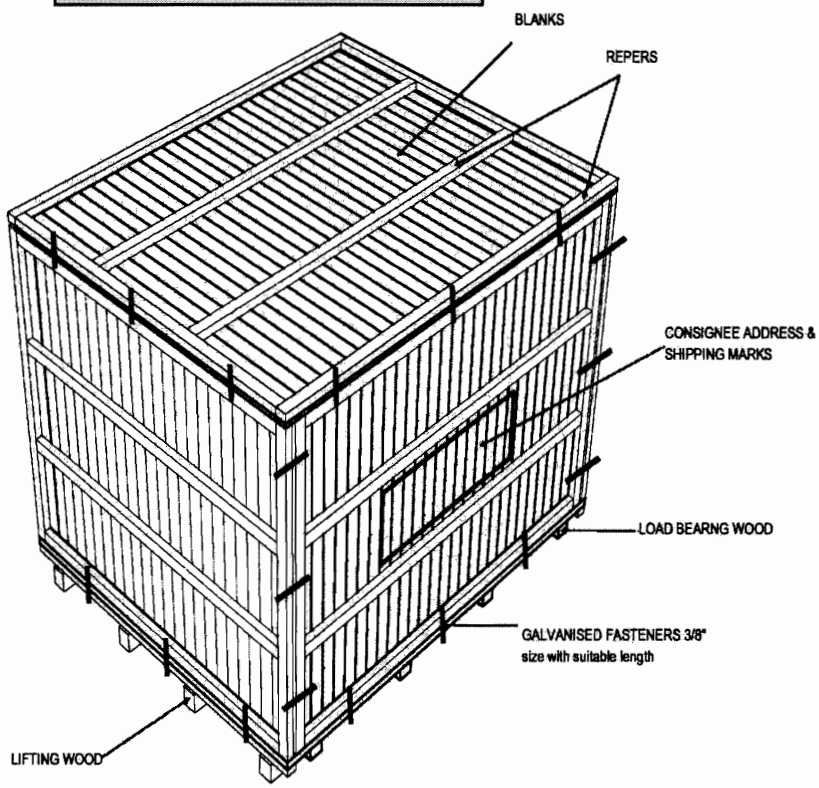
10.3.1 Packing details:

- The Packing case shall be made of treated rubber wood. The design of the case shall be as per Annexure IIIA & IIIB.
- The Equipments shall be placed on the wooden base of the Packing case and fastened if required to arrest the movement of the same.
- Equipment shall be covered by Polythene sheet and inside wall surfaces of the wooden cases also shall be covered by polythene sheet.
- All Nozzles shall be closed with plywood dummies.
- All electrical components assembled or loose shall be covered with polythene sheets along with silica gel pack.
- Silica gel desiccants shall be kept inside each case in sufficient quantities in order to absorb the moisture.

- Thermocol packing shall be made for glass items like Ball vessel sight glass, Vpiece
- sight glass & pressure gauge.
- Silica gel desiccants shall be kept inside of each case to absorb the moisture.
- A Packing list covered in a polythene envelope shall be fixed inside and outside of each packing case.
- Shipping marks and consignee address shall be painted on the outer surface of the case.
- All handling instruction required for the case like top, sling, rain, handle with care etc, shall be marked on the case as per the symbol attached.
- Machined surface will be applied with Anti rust oil and covered by polyurethane sheet to protect from external oxidation.
- All valves will be closed with dummies to protect the internals and placed in the wooden case which will covered by polyurethane sheet.

MODEL: FASTNERS TYPE (BASE, SIDE &TOP ATTACHED WITH BOLT, NUT & WASHER)

This Type of case to be used for following items:
1. BALL SEPERATOR
2. BALL COLECTOR SKID



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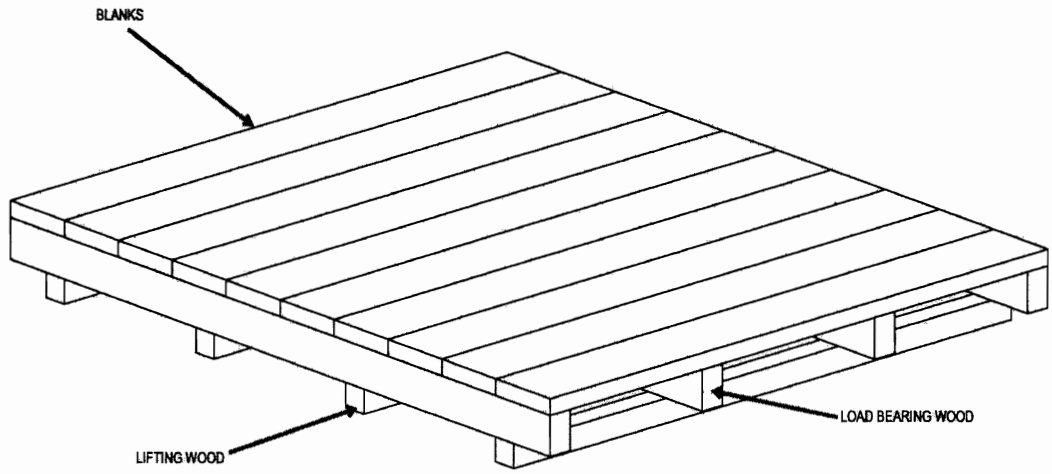
BASE FRAME



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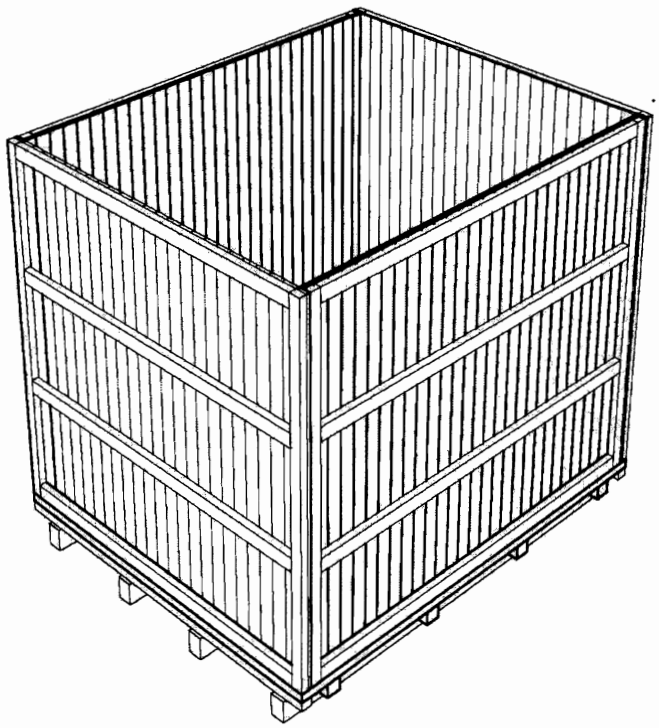
MODEL: FASTNERS TYPE - WITHOUT TOP



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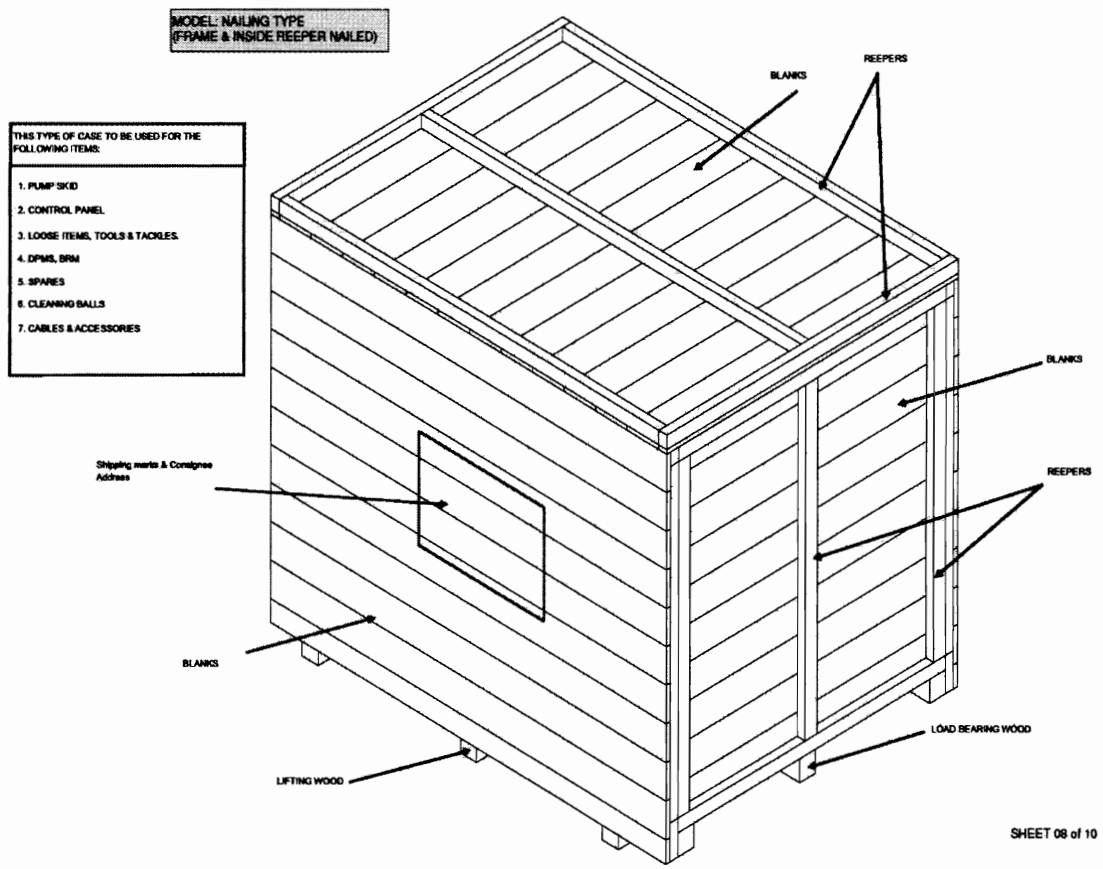
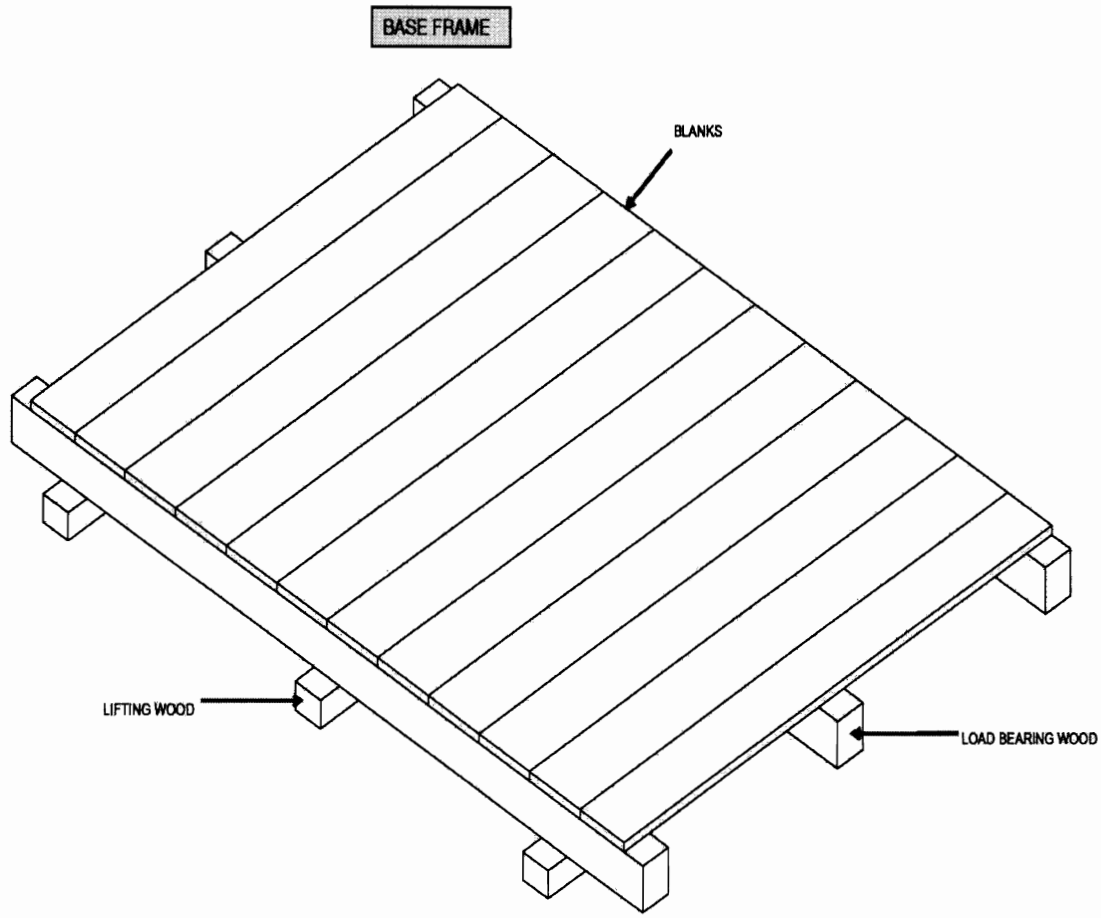

MODEL: NAILING TYPE
(FRAME & INSIDE REEPER NAILED)
THIS TYPE OF CASE TO BE USED FOR THE FOLLOWING ITEMS:
1. PUMP SKID
2. CONTROL PANEL
3. LOOSE ITEMS, TOOLS & TACKLES.
4. DPMS, BRM
5. SPARES
6. CLEANING BALLS
7. CABLES & ACCESSORIES
BLANKS
REEPERS
BLANKS
REEPERS
Shipping marks & Consignee Address
BLANKS
LOAD BEARING WOOD
LIFTING WOOD
SHEET 08 of 10



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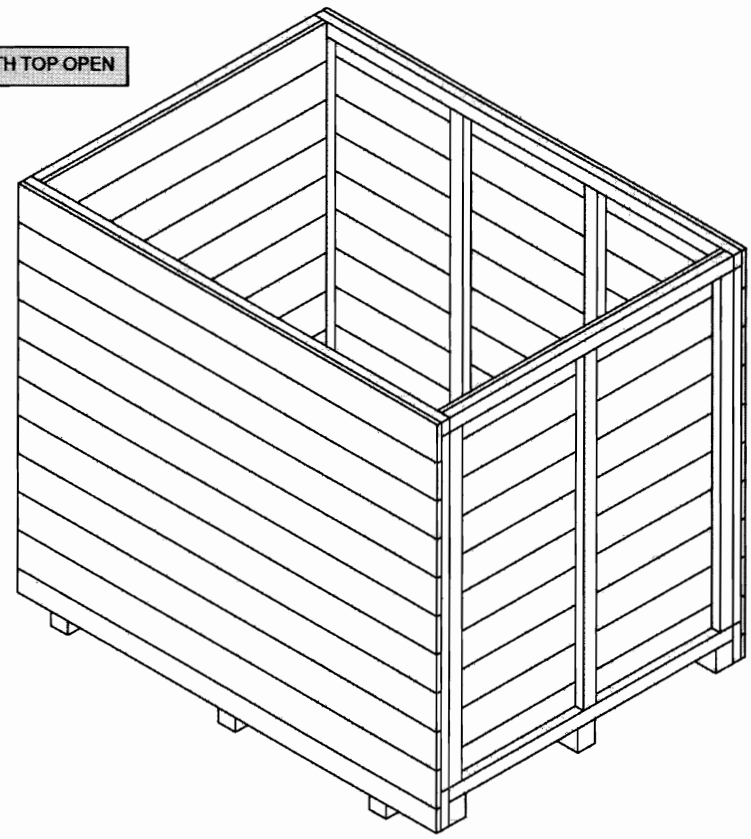
NAILING TYPE MODEL WITH TOP OPEN



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10.4 PACKING OF LOOSE ITEMS

Loose mechanical, electrical and C&I items e.g. valves, fittings, pressure/temperature gauges/switches, circuit breakers, relays etc shall be individually wrapped using polyethylene sheets/U foam/ thermocol sheets/air bubble sheets depending upon the items 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 shall be paid to relays, instruments etc for arresting the movements of their operating mechanism during transportation.

The construction of wooden packing cases shall be as per clause 9.3.1 retaining its all features concerning strength of the box. The construction of wooden packing case for 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. 25mm thickness and 100 mm width shall be nailed to inner surfaces of bottom and 4 sides of the boxes.

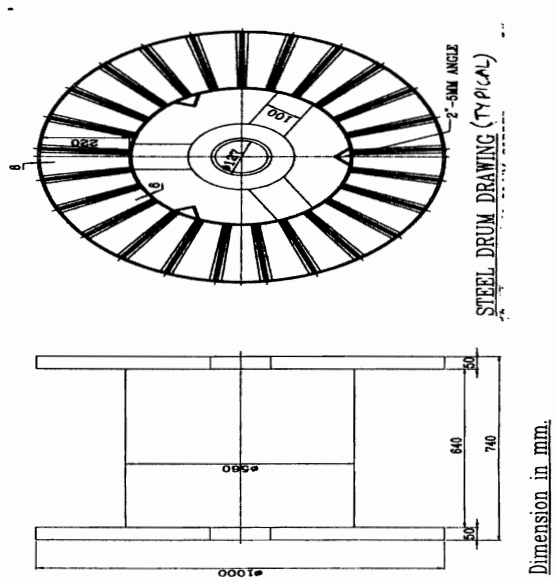
11.0 PACKING OF ELECTRICAL ITEMS

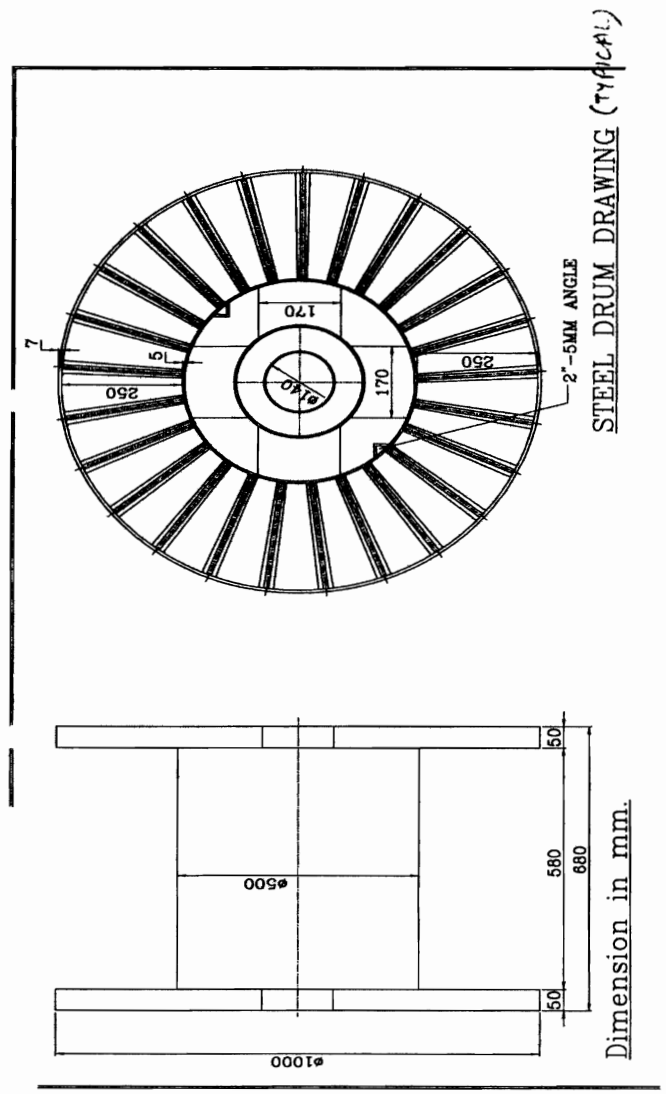
11.1 CABLES

11.1.1 Type of Equipment
All type of cables..

11.1.2 Type of Construction

New or practically new cable drums made of steel and painted with epoxy resin paint are to be used. Cable ends are carefully protected before packing. Over the cables polyethylene sheet shall be wrapped and then sealed properly. Cable drum can be put in wooden crates for ease in transportation and handling. (Wooden cable drum is also acceptable, however vendor to furnish constructional details for approval).


STEEL DRUM DRAWING (TYPICAL)
2"-5MM ANGLE
100
220
640
740
50
50
Dimension in mm.



11.2 PACKING OF CABLE TRAYS & ACCESSORIES AND CABLE TRAY SUPPORT MATERIAL

11.2.1 Cable trays can be packed in wooden boxes as per fig 1 to 11 or in steel boxes. Details of steel box construction is as indicated below.

1) All Dimensions are in "mm" unless otherwise stated.
2) Packing Box shall be fabricated using 50x50x6mm MS Angle, 50x3mm Flat, 2.5 mm thick C Channel, 1mm & 1.6mm Thick sheet.
3) Finish of Packing Box Shall be Galvanized.
4) Angle & Channel Section forming part of the Main frame shall be welded thoroughly with each other to give a rigid structure.
5) Sheet Section and Flat section shall be bolted/ Riveted/ Welded suitably to the Main frame stated in '4' above.

6) Welding Portion on galvanized surfaces shall be painted with Zinc Rich Paint.

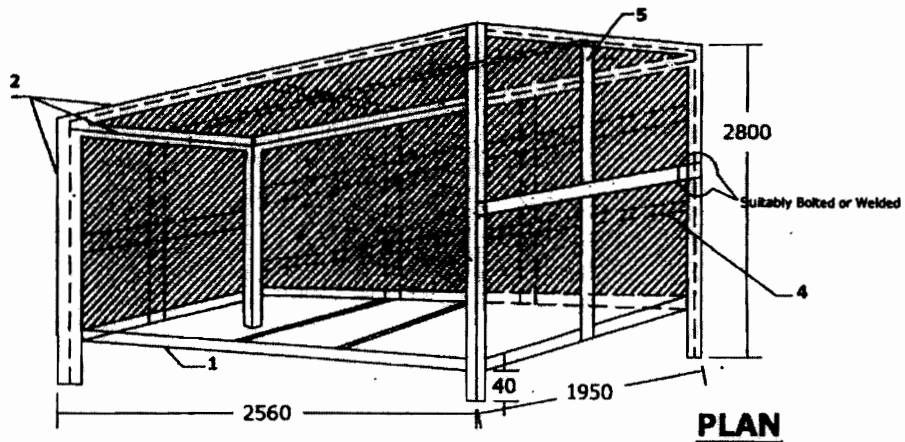
7) Dispatch details such as consignor/consignee address, contract and case details, 'country of origin, port of delivery, stacking instructions shall be written on one of the side of boxes. An anodized aluminium plate as per details and specifications given in page 3 of 5 shall be provided on the boxes

8) One copy of packing slip wrapped in polythylene bag covered with suitable aluminium .packing slip holder to be nailed on the external surface of the box. One more copy 9f the packing Slip wrapped in polythylene bag to be kept inside the box at the prominent place.

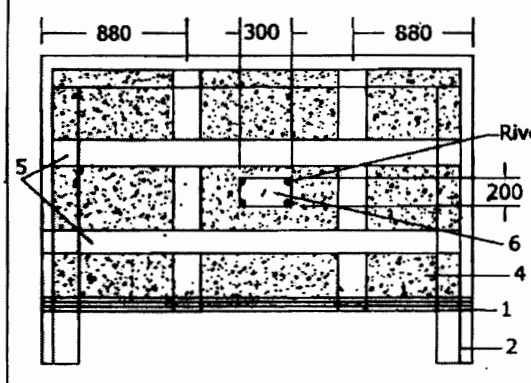
9) **INDICATION MARKS ON THE BOXES:** Markings shall be provided on the boxes indicating position of Boxes for handling, storage and nature of consignment. For guidelines referred page 4 of 5. The ink issued for this purpose as well as for marking dispatch instruction shall be indelible/non-washable marking ink.

10) Each item as mentioned in BOQ shall be packed & supplied as a set comprising of required numbers of associated fasteners & hardware etc

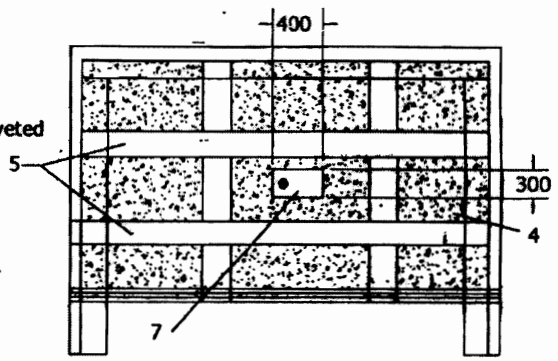
STEEL PACKING (TYPICAL DETAILS)



PLAN



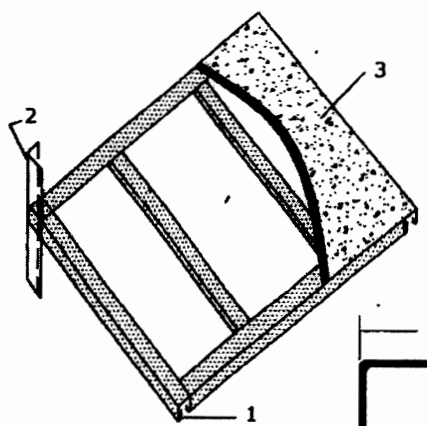
FRONT SIDE OF BOX



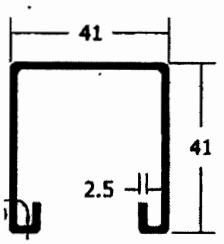
BACK SIDE OF BOX

Note:

1. "C" Channel to be used on Bottom Frame.
2. 50x50x6 Angle to be used Vertically on four sides of the Box and Horizontally on four sides on the top Frame.
3. 1.6mm thick sheet (plain) on Bottom Plate.
4. 1.0mm thick sheet to cover top & four sides of BOX.
5. 50x3 Flat as additional cross members to be used Horizontally & Vertically on top & Four Sides of Box.
6. Anodised Alluminium Plate for Marking.
7. Hinged Inspection Window.



BOTTOM FRAME ARRANGEMENT



DETAILS OF "C" CHANNEL

11.3 PACKING FOR STATION LIGHTING SYSTEM

Aspects of packing specific to equipments / items of station lighting system are given here. All other instructions / aspects as per the main specification of export packing which are not covered here shall also be applicable.

11.3.1 For LIGHTING TRANSFORMER, DISTRIBUTION BOARDS, LIGHTING PANELS,

a) Construction of packing case for LIGHTING DIATRIBUTION BOARDS, LIGHTING PANELS, TRANSFORMER . shall be EITHER as per FIGURE 1,2,3,5,6,7,8,9,10,11 OR FIGURE 14,15,16.
b) Each Panel/Transformer shall be individually covered with double polythene sheet of thickness 175 microns minimum.
c) All the 6 inner surfaces of packing shall be nailed with bitumen coated hessian polythene craft paper. Wherever 2 pieces of craft paper are used, the joint shall have minimum overlap of 20mm.

For the top frame it shall be project on all sides by 100mm and shall be nailed on sides .

d) The gap between the panels and packing case shall be filled with rubberized coir of thickness 50mm minimum and width 100mm. The distance between two consecutive supports of rubberized coir shall be less than 500mm.
e) Silica get packed in cotton bags shall be placed at different positions inside the packing.
f) Packing case shall be finally covered with GI sheet of thickness 0.4mm minimum.

11.3.2 For LUMINARIES, RECEPTACLES. EMERGENCY LIGHT, 240/24V TRANSFORMER, CEILING FAN, SWITCH BOARDS, FLEXIBLE CONDUIT, WIRES, EARTH WIRE. JUNCTION BOXES, ERECTION COMMIOSSIONING SPARES, RECOMMENDED SPARES , ERECTION MATERIAL AND CONSUMBALES

a) Construction of packing case for THE ABOVE MATERIAL shall be as per FIGURE 1to11.
b) Items placed inside the case shall be covered with double polythene sheet of thickness 175 microns minimum.
c) All the 6 inner surfaces of packing shall be nailed with bitumen coated hessian craft paper. wherever 2 pieces of craft paper are used, the joint shall have minimum overlap of 20mm. For the top frame it shall be project on all sides by 100mm and shall be nailed on sides.
d) Silica get packed in cotton bags shall be placed at different positions inside the packing.

11.3.3 For CONDUIT PIPE

As per international practice pipes are shipped in open bundles with metal strapping. Packing as per attached figure A shall be provided which is described as following:

a) Each bundle shall be wrapped with 2 layers of 175 microns thick polythene sheet.
b) Then bundle will be wrapped with bitumen coated hessian craft paper.
c) Bundle shall be strapped with steel straps.
d) An anodized aluminium packing description plate as per Figure No. 13 shall be provided.

11.3.4 For POLES

Poles will be wrapped with 2 layers of minimum 175 microns thick polythene sheet and then with bitumen coated hessian craft paper, packed as per Figure – C i.e. bundling.

11.3.5 For STRUCTURAL STEEL

Structural steel will be different sizes and shapes. Hence it will be packed as per Figure No. B and described as following :

a) Each bundle shall be wrapped with 2 layers of 175 microns thick polythene sheet.
b) Then bundle will be wrapped with bitumen coated hessian craft paper.
c) Bundle shall be strapped with steel straps.
d) An anodized aluminium packing description plate as per Figure No. 13 shall be provided.

PACKING PROCEDURE FOR CONDUIT PIPE

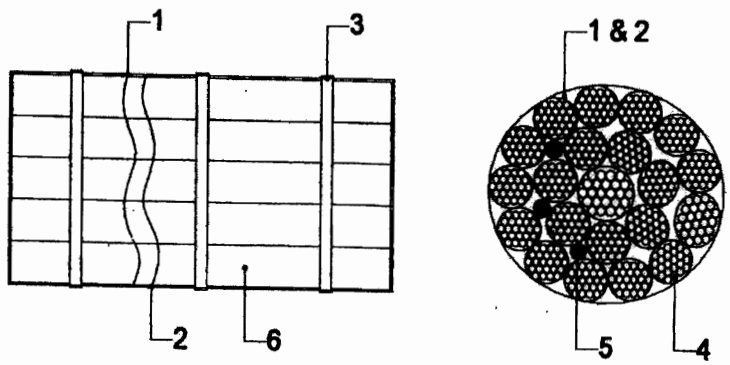


FIGURE "A"

1) LAYER OF BITUMEN COATED HESSIAN KRAFT PAPER.
2) LAYER OF POLYTHENE SHEET.
3) METAL STRAPPING.
4) CONDUIT PIPES.
5) SILICA GEL POUCHES.
6) BUNDLES OF CONDUIT PIPES.

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PACKING PROCEDURE FOR STRUCTURAL STEEL

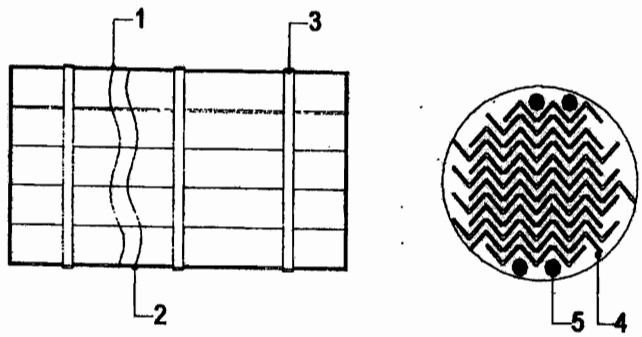
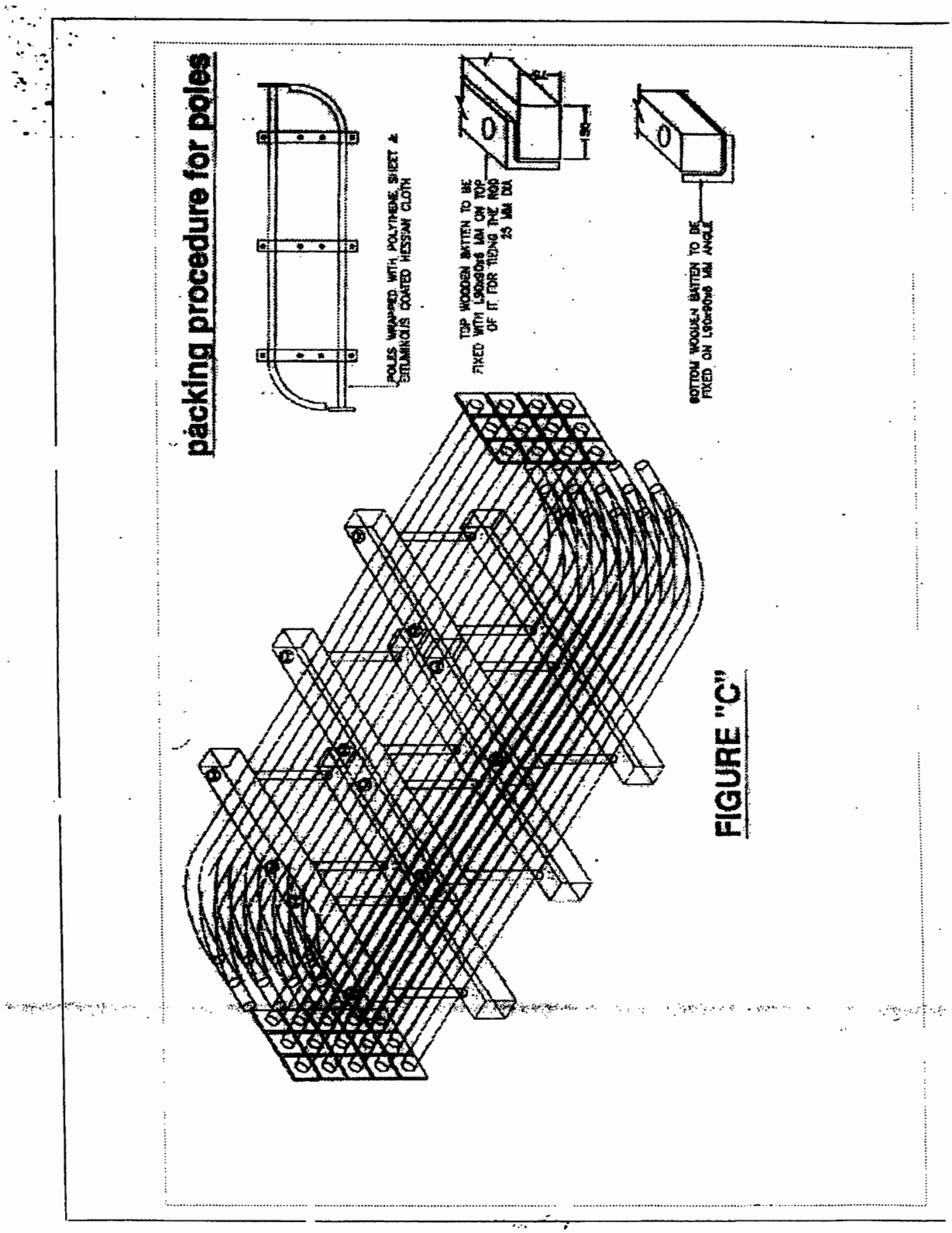


FIGURE "B"

1) LAYER OF BITUMEN COATED HESSIAN KRAFT PAPER.
2) LAYER OF POLYTHENE SHEET.
3) METAL STRAPPING.
4) STRUCTURAL STEEL.
5) SILICA GEL POUCHES.


packing procedure for poles
POLES WRAPPED WITH POLYTHENE SHEET & SYNTHETIC COATED HESSIAN CLOTH
TOP WOODEN BATTEN TO BE FIXED WITH L50x50x6 MM ON TOP OF IT FOR TYING PVC ROD 25 MM DIA
BOTTOM WOODEN BATTEN TO BE FIXED ON L50x50x6 MM ANGLE
FIGURE "C"

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11.4 PACKING FOR DC BATTERY

The packing procedure for seaworthy packing of DC Battery is defined below, which is capable of withstanding impacts, compression, vibration, toppling, sea water spray, prevention against rust, temperature and extreme atmospheric conditions. Aspects of packing specific to equipments / items of DC Battery are given here. All other instructions / aspects as per the main specification of export packing which are not covered here shall also be applicable.

The packing procedure consists of various stages namely primary packing, cushioning, securing, desiccant, outside packing box, Runners/ sliders/ transverse bars of plywood, etc., provided for each movement.

a) The packing boxes shall be made up of plywood boxes (thickness 9mm min.) with blocks at the bottom of the box for provision for handling the boxes using the forklift. The packing boxes sizes are generally standardized to half-euro size (capable of handling equipment's weight).

b) Rubberized coir of 25mm thickness shall be provided as cushioning material at the bottom and thermocole of 20mm shall be provided inside on all four sides. Other than this polyethylene film wrap or cover also will be provided. Left out spaces to be filled with rubberized coir/ thermocol to get cushioning effect.

c) Silica gel in dust free air permeable cotton/paper bag shall be placed in the packing boxes for storage period of 1 year as per IS 304 (1979)

d) While packing the cells, transit caps (polypropylene) of red and blue shall be used for big size cells for ensuring that cells does not get damaged during the transport due to vibrations etc.

e) The battery accessories shall be packed with suitable precautions as follows:

i) Copper connectors shall be packed after making bunches with lead wire seals to avoid misplacement.
ii) Hardware items shall be packed in polyethylene bags (Thickness ≥ 0.175mm) with item slip
iii) Battery rack shall be packed in dismantled condition, wrapped with polyethylene sheet
iv) For Ni-Cd type battery, electrolyte in solid form for dry cells shall be packed in cans with KOH, LiOH being packed separately.
f) Galvanized Steel straps are provided for binding the packing box sides.
g) The handling instructions shall be marked in indelible/ non-washable ink, indicating the upright position.

11.5 PACKING OF SERVICE TRANSFORMERS(OIL FILLED) & ACCESSORIES

This instruction is applicable for packing of transformers (oil filled), its accessories and components so as to ensure safe delivery to end user. Aspects of packing specific to equipments / items of transformers(oil filled) are given here. All other instructions / aspects as per the main specification of export packing which are not covered here shall also be applicable.

11.5.01 PACKING DETAILS :

a Items shall be packed in case / crates as per the shipping list.
b All fragile items and small items shall be packed in cases and to be marked as "Fragile, handle with care Fragile items".
c Fragile accessories are to be first packed in their original boxes (VENDOR's packing). Very

small / delicate items such as glass thermometer, door keys shall be packed in separate box.

d In case original box is found damaged, suitable alternate box or packing method using felt or foam sheet and polythene wrap to be used.

e These boxes are then placed in identified wooden boxes. Inside of such boxes are lined with a layer of polythene sheet, packing wool / grass and another layer of polythene sheet before placing the boxes. All boxes are then wrapped with this polythene sheet before closing the box. Fragile items shall not be placed loose, one above the other inside the case.

f All wiring cables, connection flats of non-ferrous materials, CTs, valves bellows shall also be packed.

g Items like CTs, Oil communicating bushings, insulators, wired equipments and housings such as RTCC Panel, M. Box, Drive Mechanism, thermometers, gauges shall be wrapped in polythene from all around.

h Buchholz relay and OSR relay openings will be blanked using covers, before putting them in the box

i Items shall be carefully lowered and arranged inside the crate / case and each item shall be locked from all sides in such a way to avoid its movement in any way. Wooden stoppers and separators shall be provided for this and nailed to the crate / case wood.

j Wooden planks and batons in contact with fragile items shall be provided with kit foam at the locations of contact.

k Oil communication bushings shall be packed in separate case on V or U shape wooden felted supports, as in case of condenser bushings.

l While placing and arranging the items inside the crates / cases, these shall be verified for correctness and then the packing note shall be signed. The cover top of the crate / case shall then be closed.

m The main equipment like transformer tank shall be packed suitably to prevent any damage during transit / storage. Support structures like frame, header supports etc. shall be crated. Conservator headers shall also be crated. Radiators pipe work and other instruments & components shall be packed in cases. All the cases shall be lined with polythene from inside.

11.6 ALTERNATIVE PACKING CASES FOR CONTROL PANELS AND SWITCH GEARS

For Control and switch gear 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 at least 25 mm. Width of the plank shall be at least 125mm and that of binding and jointing planks shall be at least 100mm.

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

Diagonal bracings shall be as per cl 9.3.1.3 and all other requirements shall be as per clauses 9.3.1.4 to 9.3.1.6.

12.0 Containerization

As required by BHEL, the VENDOR shall stuff the GOODS into 20 or 40 foot containers (dry, open top, flat racks, etc.).
The maximum inside dimensions of containers are to be considered:

- 40 foot containers: 11.80 m x 2.20 m x 2.05 m
- 20 foot containers: 5.80 m x 2.20 m x 2.05m
-

The present definition of containerization is valid for sea containers only. Vendor to check the size of containers before start of packing of equipment.

12.1 Protection of Cases/Crates

Since shipping containers are in general not water tight, packing in contact with the floor of the container shall be raised in order to prevent it from being damaged by the accumulation of water.

12.2 Mechanical Constraints

The mechanical constraints for "general use" closed containers are of a different nature (height of "stacking" being limited inside the containers), the packing for the GOODS may be of a lighter structure. However, it is necessary that the packing be appropriate so as to protect the GOODS on site during the storage period, as required after discharging of the GOOD'S from the containers.

Note:

It is the responsibility of the VENDOR to ensure that the cases/crates are stowed, secured and fastened inside the container. The VENDOR will take all necessary precautions to conform to the maximum weight allowed and the centre of gravity of the container. The securing and fastening of the cases/ crates can be carried out by nailing timbers on the bottom or on the vertical sides of the container.

13.0 Other Services to be provided by Vendor

In addition to the packing and shipping documents, VENDOR must also carry out the following services, which shall be included in his quotation:

Carriage of VENDOR's sub-contracted equipment and material, which must be re-grouped in VENDOR's or PACKER's workshops, whilst waiting for packaging.

BHEL reserves the right to postpone the shipping of the GOODS. In this event, any storage and insurance costs during the first ninety (90) days shall be borne by the VENDOR.

Loading, including lifting, securing, lashing, and stowing, of all cases, crates, or packages onto means of transportation such as, but not limited to, trailers, containers, etc.

14.0 Responsibilities and Guarantees

VENDOR is responsible for the choice of category for packing according to the transport facilities used, and on the basis of the present document. In case of doubt or disagreement regarding the choice, VENDOR must inform BHEL prior to packing and await BHEL's approval. All phases of packaging, marking, loading, etc. will be subject to BHEL inspection.

BHEL reserves the right to reject the packing when the packing does not conform to these instructions and/or when the packing does not ensure perfect protection of the GOODS.
VENDOR is responsible for the weights and dimensions declared, and the marking of the packages.

The documents must be in strict conformity with the packing contents.
The packing specified in these "Packing, Marking and Shipping Instructions" is guaranteed for a twelve (12) months storage period after delivery on site.

VENDOR is responsible for providing storage recommendation adapted to the GOODS. According to this guarantee, VENDOR is held responsible in the event of goods becoming

useless, damaged or broken, as a result of poor packing and/or stowing, or due to corrosion, subsequent to insufficient or inadequate protection. All direct or indirect costs resulting thereof, will be back-charged to VENDOR.

VOLUME – III

DATASHEETS – B/C

CLAUSE NO.	BIDDER'S NAME	
2.00.00	**SCHEDULE OF GUARANTEED AND OTHER TECHNICAL PARTICULARS**	
2.01.00	**Lift Particulars**	
	(i) — Load carrying capacity of the lift in Kgs.	
	(ii) - Type of loading for which the lift is designed	
	(iii) — Type of lift.	
	(iv) - Speed (Meter/sec.)	
	(v) Travel (metres)	
	(vi) Floors served by the lift	
	(vii) Landing Entrances:	
	(a) No. size and type of doors	
	(b) Method of operation of doors	
	(viii) Size of lift well	
	(ix) Car dimensions	
	(a) Internal size of the lift car	
	(b) External size of the car platform	
	(x) Weight of car	
	(xi) Construction, design and finish of lift car	
	(xii) Car entrances:	
	(a) No. of size & type of door	

CLAUSE NO.	BIDDER'S NAME		
		(b) Method of operation	
	(xiii)	Arrangement for light/an inside the lift car	
	(xiv)	Indicators (details to be furnished)	
	(xv)	Method of lift control (in details)	
	(xvi)	Details of counterweight	
	(xvii)	Weight of counterweight	
	(xviii)	Particulars of fan and light	
3.00.00	**~~LIFT~~ ~~DRIVE~~ ~~UNIT~~**		
	(i)	Diameter of sheave in mm	
	(ii)	Width of sheave in mm	
	(iii)	Type of grooving	
	(iv)	Speed of suspension ropes in the car in m/sec.	
	(v)	No. of suspension ropes of car	
	(vi)	Speed of suspension ropes in the car in m/sec.	
	(vii)	Standard to which the suspension ropes conform	
	(viii)	Type of construction of suspension ropes.	
	(ix)	No. of strands in the ropes	
	(x)	No. of wires per strand of the rope	
	(xi)	Breaking strength of the rope	

CLAUSE NO.	BIDDER'S NAME	
	(xii) Safety factor of ropes	
	(xiii) Name of rope manufacturer	
	(xiv) Ratio of gearing	
	(xv) Brake drum & coupling diameters in mm	
	(xvi) Worm shaft size, at coupling, in mm	
	(xvii) Travel of car, after the brake is applied, in mm.	
4.00.00	**MOTOR AND DRIVE DETAILS (V3 F DRIVE)**	
	(i) Manufacturer	
	(ii) Type	
	(iii) Rating KW	
	(iv) Enclosures	
	(v) Speed r.p.m.	
	(vi) Voltage	
	(vii) Frequency	
	(viii) Class of insulation	
	(ix) Efficiency %	
	(x) Full load current in amps.	
	(xi) Temperature rise at full load above the ambient temperature of 50 deg. C.	
	(xii) Full load starting current in amps.	
	(xiii) Stalling current	
	(xiv) Frequency of starts	

CLAUSE NO.	BIDDER'S NAME	
	(xv) Maximum variation in frequency	
	(xvi) Maximum variation in voltage	
	(xvii) Combined maximum variation in voltage & frequency	
	(xviii) Break down torque	
	(xix) Starting time	
	(xx) Stalling time	
5.00.00	CONTROL PANEL	
	(i) Manufacturer of the control panel	
	(ii) Type/Construction	
	(iii) Working voltage	
	(iv) Rated current in amps.	
	(v) Type of protection against overload	
	(vi) Type of control	
	(vii) Type of protection against under voltage & phase reversed	
	(viii) Type of time delay mechanism used	
	(ix) System for control & operation (enclosed write up)	
	(x) Enclosure	
	(xi) Particulars of switch fuse unit	
	(xii) Particulars of Contractor	

CLAUSE NO.	BIDDER'S NAME	
	(xiii) Particulars of Electronic components	
6.00.00	**SAFETY GEAR**	
	(i) Type	
	(ii) Operation	
	(iii) Distance travelled from start to stop.	
7.00.00	**TERMINAL STOPPING DEVICE**	
	(i) Normal type and operation	
	(ii) Extreme type and opeeration	
8.00.00	**BUFFERS**	
	(i) No. of buffers used	
	(ii) Type of buffer	
	(iii) If the buffer is spring type	
	(a) Diameter of spring in mm	
	(b) Maximum compression undeer extreme condition in mm.	
	(c) No. of spring coils	
	(d) Sectional dimensions in mm.	
	(iv) If oil type buffer in used	
	(a) Diameter of buffer in mm.	
	(b) Stroke in mm.	

CLAUSE NO.	BIDDER'S NAME	
9.00.00	**GUIDES**	
	(i) For lift car	
	No. of guides, type, sectional dimensions & weight.	
	(ii) For counterweights	
	No. of guides, type, sectional dimensions & weights.	
10.00.00	**PARTICULARS OF SELECTORS** (If applicable)	
	(i) Manufacturer	
	(ii) Type	
	(iii) Enclosure	
	(iv) Voltage Rating	
	(v) Current Rating	
	(vi) Type of limit switch	
	(vii) Contract Rating	
	(viii) Coil voltage	
11.00.00	**TOTAL WEIGHT OF THE LIFT CAR WITHOUT PAYLOAD**	
12.00.00	**TOTAL WEIGHT OF THE COUNTERWEIGHT**	
13.00.00	**DETAILS OF PAINTINGS & FINISH**	
14.00.00	**ELECTRICAL LOAD DETAILS**	
	(i) List of all motors and their rated KW.	
	(ii) Total connected load in KW.	

CLAUSE NO.	BIDDER'S NAME	
	(iii) Anticipated simultaneous maximum load at any time in KW.	
	(iv) Single line diagram of the electrical supply system	
15.00.00	**HEAVIEST PIECE OF EQUIPMENT TO BE LIFTED**	
	(i) Name	
	(ii) Length in mm	
	(iii) Width in mm	
	(iv) Height in mm	
	(v) Weight in Kg.	
16.00.00	**DETAILS OF POWER & CONTROL CABLES AS PER RELEVANT IS**	
17.00.00	**BRAKE**	
	(i) Type	
	(ii) Voltage	
	(iii) Ciass of Insulation	
	(iv) Make	
18.00.00	**POWER CABLES**	
	(i) Manufacturer	
	(ii) Type	
	(iii) Voltage grade	
	(iv) Size & No. of cores	
	(v) Type of insulation	
	(vi) Current rating	

CLAUSE NO.	BIDDER'S NAME	
	(vii) Armoured/Unarmoured	
	(viii) Applicable standard	
	(ix) Conductor (Cu/Al.)	
19.00.00	**CONTROL CABLES**	
	(i) Manufacturer	
	(ii) Type	
	(iii) Voltage grade	
	(iv) Size & No. of cores	
	(v) Type of insulation	
	(vi) Current rating	
	(vii) Armoured/Unarmoured	
	(viii) Standard Applicable	
20.00.00	**TRAILING CABLES**	
	(i) Manufacturer	
	(ii) Type	
	(iii) Voltage grade	
	(iv) Size & No. of cores	
	(v) Type of insulation	
	(vi) Type of sheathing	
	(vii) Applicable standard	

DB3

POWER AND CONTROL CABLES

Clause No.	POWER AND CONTROL CABLES		
			(Bidder's Name)
	POWER AND CONTROL CABLES (Use separate sheet for each type and size of cables)		
1.00.00	Make	.....	.....
1.02.00	Country of Manufacturer	.....	.....
1.03.00	Type & designation	.....	.....
1.04.00	Applicable standard	.....	.....
1.05.00	Cable size & no. of cores	.....	.....
1.06.00	Rated voltage	.....	.....
1.07.00	Catalogue attached as Annexure No.	.....	.....
1.08.00	Continuous current rating for max. conductor temperature	.....	.....
	a) When laid in air at an ambient temperature of 50 deg. C	.....	.....
	b) When buried in soil having thermal resistivity of 150 deg.C cm/n at a depth of 1000 mm at ground ambient temperature of 40 deg. C	.....	.....
1.09.00	Short circuit withstand capacity and duration for	.....	.....
	a) Conductor	.....	.....
	b) Screen	.....	.....
	c) Armour	.....	.....
1.10.00	Conductor	.....	.....
	a) Material	.....	.....
	b) Nominal cross section area in sq. mm	.....	.....

Clause No.	POWER AND CONTROL CABLES	
		..... (Bidder's Name)
	c) Shape of conductor	....
	d) DC resistance at 20°C (Maxm.)	....
1.11.00	Insulation	
	a) Material	....
	b) Nominal thickness (in mm)	....
	c) Type of curing (for XLPE)	....
1.12.00	Metallic screen (wherever applicable)	
	a) Material	....
	b) Type	....
	c) Short Ckt. (KA) & Period (Sec.)	
1.13.00	Material & Type of Inner sheath	....
1.14.00	Armour material & shape	....
1.15.00	Outer sheath material & type	....
1.16.00	Over all dia of cable (in mm)	....
1.17.00	Guaranteed value of minimum oxygen index of outer sheath	....
1.18.00	Maximum acid-gas generation by weight (%) of outer sheath	....
1.19.00	Smoke Density rating of outer sheath	....

DB4

CABLING EARTHING AND LIGHTNING PROECTION

Clause No.	CABLING EARTHING AND LIGHTNING PROTECTION	..... (Bidder's Name)	
	CABLE SUPPORT SYSTEM		
1.00.00	**Cable Trays, Fittings & Accessories**		
1.01.00	Makers, Name, Country of manufacturer	.....	.....
1.02.00	Type & Material of cable tray	.....	.....
2.00.00	**Conduit Pipes & Accessories**		
2.01.00	Maker's Name and Country of manufacture	.....	.....
2.02.00	Material	.....	.....
2.03.00	Class of duty	.....	.....
2.04.00	Type of Coating	.....	.....
2.05.00	Applicable Standard	.....	.....
3.00.00	**Junction Boxes**		
3.01.00	Maker's Name and Country of manufacture	.....	.....
3.02.00	Material	.....	.....
3.03.00	Applicable Standard	.....	.....
3.04.00	Degree of Protection	.....	.....
4.00.00	**Cable Glands**		
4.01.00	Maker's Name and Country of manufacture	.....	.....
4.02.00	Type of cable gland	.....	.....
4.03.00	Applicable Standard	.....	.....
4.04.00	Material	.....	.....

Clause No.	CABLING EARTHING AND LIGHTNING PROTECTION		
		..... (Bidder's Name)	
5.00.00	**Cable lugs & Terminals**		
5.01.00	Maker's Name & Country of Manufacturer	.....	.....
5.02.00	Material	.....	.....
5.03.00	Applicable Standard		
	(i) HT	.....	.....
	(ii) LT	.....	.....
6.00.00	**Earthing System**		
	Equipment earthing		
	i) Material	.....	.....
	ii) Size	.....	.....
	iii) Applicable Standard	.....	.....
7.00.00	**Lightning Protection System**		
	i) Applicable Standard	.....	.....
	ii) Size & material for Air termination and down conductor	.....	.....
8.00.00	**Cable Jointing/Termination Kits**		
	(a) Maker's Name & Country of Manufacturer	.....	.....
	(b) Type of System		
	(i) Termination H.T./L.T.	.....	.....
	(ii) Joints H.T./L.T.	.....	.....
	(c) Outdoor/Indoor	.....	.....

Clause No.	CABLING EARTHING AND LIGHTNING PROTECTION
	..... (Bidder's Name)
9.00.00	**Cable Tray Support System** (a) Maker's Name, Country of Manufacturer (b) Type & Material of cable tray support system (c) Catalogue and indicative sketch attach as annexure No.

DB6

MOTORS

Clause No.	MOTORS		
		.....	.....
			(Bidder's Name)
	MOTORS (To be filled in for each type & rating)		
1.00.00	Manufacturer & country of origin	.....	.....
2.00.00	Equipment	.....	.....
3.00.00	(a) Motor type (Squirrel cage/ slipring/DC etc.)	.....	.....
	(b) Type of duty	.....	.....
4.00.00	Frame size & type designation	.....	.....
5.00.00	Applicable standard to which motor confirms	.....	.....
6.00.00	(a) Whether motor is flame proof	Yes/No	Yes/No
	(b) If yes, the gas group to which it conforms as per IS:2148	.....	.....
7.00.00	Standard rating at 50°deg.C ambient temperature	.....	.....
8.00.00	Max. power input to the driven equipment at design duty point (KW)	.....	.....
9.00.00	Max. power input to the driven equipment over entire operating range. (KW) (For HT motors only)		
	(i) At rated speed	.....	.....
	(ii) At 103% speed	.....	.....
10.00.00	Rated voltage & frequency	.....	.....
11.00.00	Stator winding insulation		
	(a) Class & type	.....	.....
	(b) Tropicalized	.....	.....
	(c) Temperature rise over specified ambient of 50°C	.....	.....

Clause No.	MOTORS		
		..... (Bidder's Name)	
12.00.00	Direction of rotation as viewed from non-driving end	.....	.....
13.00.00	Full load current at rated voltage & frequency	.....	.....
14.00.00	Power factor at rated load	.....	.....
15.00.00	Starting current at		
	100% voltage	.....	.....
	Min. permissible starting voltage	.....	.....
16.00.00	Torques (kg-meter) at		
	(a) Starting	.....	.....
	(b) Pull-up	.....	.....
	(c) Pull-out	.....	.....
	(d) Rated torque	.....	.....
	(e) Accelerating torque at Min. permissible voltage	.....	.....
17.00.00	Number of permissible starts from hot condition	.....	.....
18.00.00	Paint Shade	.....	.....
19.00.00	Type of construction of rotor	.....	.....
20.00.00	Rotor insulation	.....	.....
21.00.00	Enclosure		
	(a) Type of enclosure and method of cooling	.....	.....
	(b) Degree of protection	.....	.....
22.00.00	Rated speed	.....	.....
23.00.00	Efficiency at design duty point (without -ve tolerance) & 100% full load	.....	.....

Clause No.	MOTORS		
		..... (Bidder's Name)	.....
24.00.00	Power factor at design duty point	.....	.....
25.00.00	Type of mounting	.....	.....
26.00.00	Type of terminal box for stator leads	.....	.....
27.00.00	Bearing type		
	(i) DE	.....	.....
	(ii) NDE	.....	.....

S. No.	Description	Data to be filled by successful bidder
A.	**General**	
1	Manufacturer & country of origin	
2	Motor type	
3	Type of starting	
4	Name of the equipment driven by motor & Quantity	
5	Maximum Power requirement of driven equipment	
6	Rated speed of Driven Equipment	
7	Design ambient temperature	
B.	**Design and Performance Data**	
1	Frame size & type designation	
2	Type of duty	
3	Rated Voltage	
4	Permissible variation for	
5	a Voltage	
6	b Frequency	
7	c) Combined voltage & frequency	
8	Rated output at design ambient temp (by resistance method)	
9	Synchronous speed & Rated slip	
10	Minimum permissible starting voltage	
11	Starting time in sec with mechanism coupled	
12	a) At rated voltage	
13	b) At min starting voltage	
14	Locked rotor current as percentage of FLC (including IS tolerance)	
15	Torque	
	a) Starting	
	b) Maximum	
16	Permissible temp rise at rated output over ambient temp & method	
17	Noise level at 1.0 m (dB	
18	Amplitude of vibration	
19	Efficiency & P.F. at rated voltage & frequency	
	a) At 100% load	
	c) At 75% load	

S. No.	Description	Data to be filled by successful bidder
	c) At starting	
C.	**Constructional Features**	
1	Method of connection of motor driven equipment	
2	Applicable Standard	
3	DOP of Enclosure	
4	Method of cooling	
5	Class of insulation	
6	Main terminal box	
	a) Type	
	b) Power Cable details (Conductor, size, armour/unarmour)	
	c) Cable Gland & lugs details (Size, type & material)	
	d) Permissible Fault level (kArms & duration in sec)	
7	Space heater details (Voltage & watts)	
8	Flame proof motor details (if applicable)	
	a) Enclosure	
	b) suitability for hazardous area	
	i Zone	O / I / II
	ii Group	IIA / IIB / IIC
9	No. of Stator winding	
10	Winding connection	
11	Kind of rotor winding	
12	Kind of bearings	
13	Direction of rotation when viewed from NDE	
14	Paint Shade & type	
15	Net weight of motor	
16	Outline mounting drawing No (To be enclosed as annexure)	
D.	**Characteristic curves/ drawings** (To be enclosed for motors of rating ≥ 55KW)	
	a) Torque speed characteristic	
	b) Thermal withstand characteristic	
	c) Current vs time	
	d) Speed vs time	

VOLUME – III

SCHEDULES

TECHNICAL DEVIATION / PRE-BID CLARIFICATION SCHEDULE

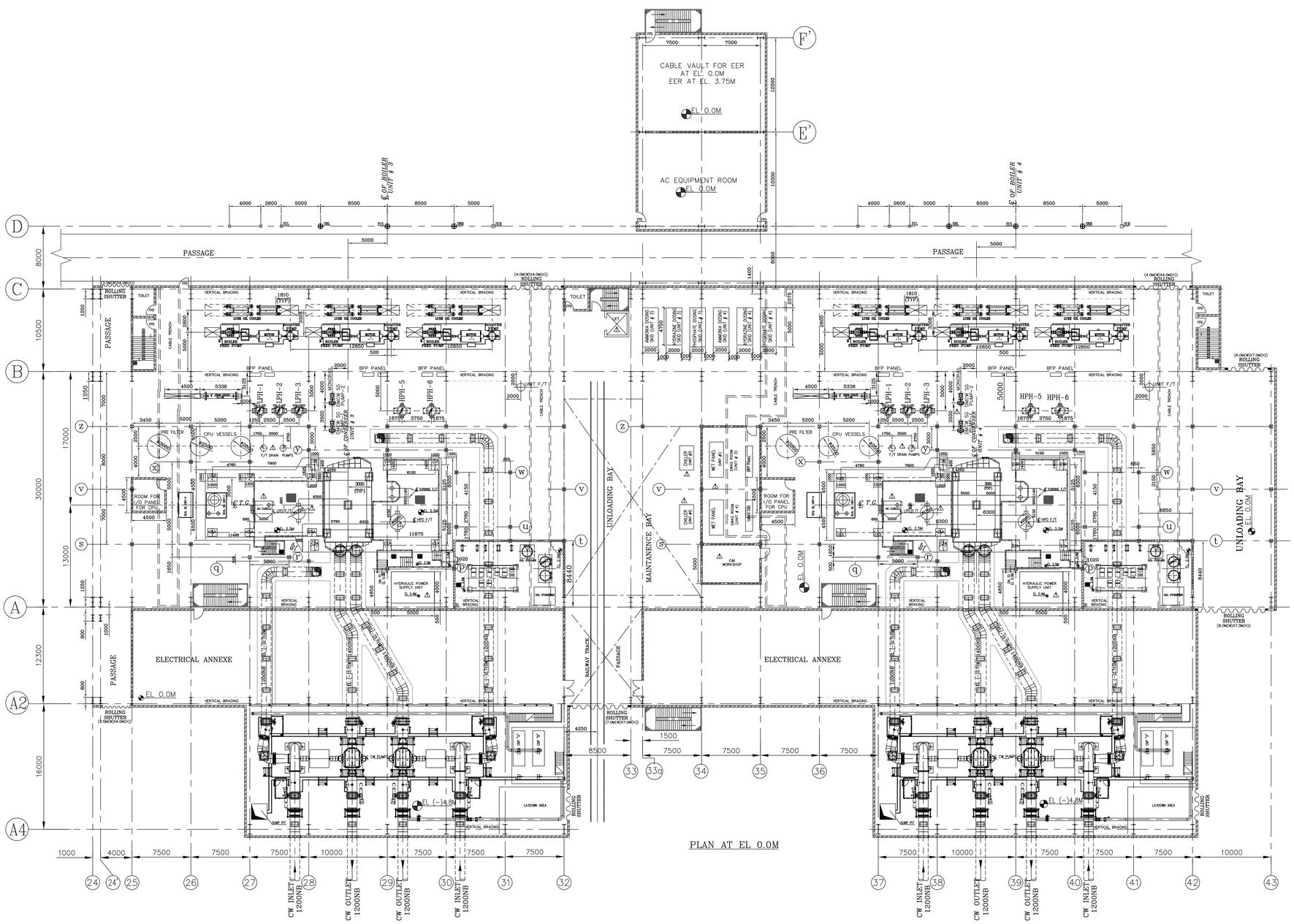
S. No.	Section/Clause/ Page No.	Description of Deviation/Pre-Bid Clarification	Reason/Clarification Required

The bidder hereby certifies that above mentioned are the only deviations from the technical specification for the subject package.

SIGNATURE : _____
NAME : _____
DESIGNATION : _____
COMPANY : _____
DATE : _____

COMPANY SEAL

NORTH



PLAN AT EL 0.0M

LEGEND:

- CHEQUERED PLATE FLOORING
- REMOVABLE CHEQUERED PLATE
- GRATED FLOORING
- REMOVABLE GRATING
- CONCRETE BLOCK
- CUT OUTS
- HAND RAILING
- BRICK WALL
- STAIRS
- ROLLING SHUTTER

ABBREVIATIONS:–

T.G.	TURBO GENERATOR
HPH	HIGH PRESSURE HEATER
LPH	LOW PRESSURE HEATER
CPU	CONDENSATE POLISHING UNIT
CBP	CONDENSATE BOOSTER PUMP
CL	CENTERLINE
HPDDFT	HIGH PRESSURE DRAIN FLASH TANK
F/T	FLASH TANK
DG	DIESEL GENERATOR
GT	GENERATOR TRANSFORMER
CW P/H	COOLING WATER PUMP HOUSE
LP	LOW PRESSURE
UAT	UNIT AUXILARY TRANSFORMER
SWAS	STEAM AND WATER ANALYSIS SYSTEM
BFP	BOILER FEED PUMP
I/O	INPUT / OUTPUT
FPD	FIRE PROTECTION DOOR
FD	FORCED DRAUGHT
GR	GAS RECIRCULATION
EER	ELECTRONIC EQUIPMENT ROOM
BOD	BOTTOM OF DUCT
ST	STATION TRANSFORMER
DIA	DIAMETER
PEM	PROJECT ENGINEERING MANAGEMENT
TRY	TRICHY
GA	GENERAL ARRANGEMENT
DN	DOWN
JOP	JACKING OIL PUMP
EOP	EMERGENCY OIL PUMP
AOP	AUXILIARY OIL PUMP
EL	ELEVATION
HWR	HARDWAR
BPL	BHOPAL
HYD	HYDERABAD

NOTES

1. ALL DIMENSIONS ARE IN MM AND LEVELS ARE IN METRE UNLESS OTHERWISE STATED.
2. ALL ELEVATIONS ARE REFFERED TO (+)0.0M, WHICH CORRESPONDS TO 0.00M LEVEL OF FINISHED FLOOR LEVEL OF EXISTING TG BUILDING.
3. FOR TG COLs & FLOOR FRAMING REFER CIVIL DRGs SEPARATELY.
4. ALL CIVIL DETAILS SUCH AS DOORS/WALLS/CLADINGS/OPENINGS/TOILETS/STAIRCASES ETC. ARE INDICATIVE ONLY & FOR EXACT DETAILS REFER CIVIL/ARCHITECTURE DRAWINGS.
5. CW PIPING/PIT SHOWN IS TENTATIVE ONLY.

REFERENCE DRGS:–

1. PLOT PLAN	PE–DG–323–100–M001(PEM)
2. MAIN EQUIPMENT PLAN	PE–DG–323–100–M002(PEM)
3. D.C.JET CONDENSER	5151–MC–30.00.10 (GEA)
4. GA OF DRAIN COOLER	1–162–01–70011–C152(HWR)
5. OIL ROOM ARRANGEMENT	0–13100–B2004 (HWR)
6. GA & FOUNDATION DETAILS OF BFP SET	HY–DG–18000–57215 (HYD)
7. GA OF UNIT FLASH TANK	(BPL)
8. LP HEATER No. # 1	0–162–18–70111 C152 (HWR)
9. LP HEATER No. # 2	0–162–22–70066 C152 (HWR)
10. LP HEATER No. # 3	0–162–26–70052 C152 (HWR)
11. GA OF HP HEATER # 5	BP–DG–323–149–0001 (BPL)
12. GA OF HP HEATER # 6	BP–DG–323–149–0003 (BPL)
13. GA OF HP FLASH TANK	(BPL)
14. GA OF LP FLASH TANK	(BPL)

PROGRESSIVE PRINT
DATED 29.11.2011

REV	DATE	ALTD	CHD	APPD

REV	DATE	ALTD	CHD	APPD
01	11.07.2011	A/VJ	BKA/SCC	AJ
01	ORG. UPDATED IN LINE WITH MOM WITH CUSTOMER.			
02	ORG. UPDATED IN LINE WITH INTER DEPTT./ UNITS REQUIREMENT.			
03	ORG. GENERALLY REVISED & MARKED AS △ THUS			

CONTRACT DRAWING NO.	BH–TSH–PE–M–23091
CUSTOMER	PEEGT MINISTRY OF ELECTRICITY SYRIAN ARAB REPUBLIC
JOB No. 323	2 X 200 MW TISHREEN THERMAL POWER PLANT EXTENSION PROJECT DAMASCUS, SYRIA
STATUS CONTRACT	
DISTRIBUTION	
TO	
No.OFT	

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

DEPT CODE		NAME	SIGN	DATE
M	DRN	NITIN	SD/–	06.08.2010
	DESN	IMRAN/VJ	SD/–	06.08.2010
	CHD	HRD/BKA	SD/–	06.08.2010
	APPD	A.JOSHI	SD/–	06.08.2010

TITLE: TG HALL EQUIPMENT LAYOUT PLAN AT 0.0M

MPL	C	MSE	I	MAX	E	DEPT.	SCALE 1:200	DRAWING No.
						SIGN		PE–DG–323–100–M003
						DATE		SHEET 1 OF 1 REV 1

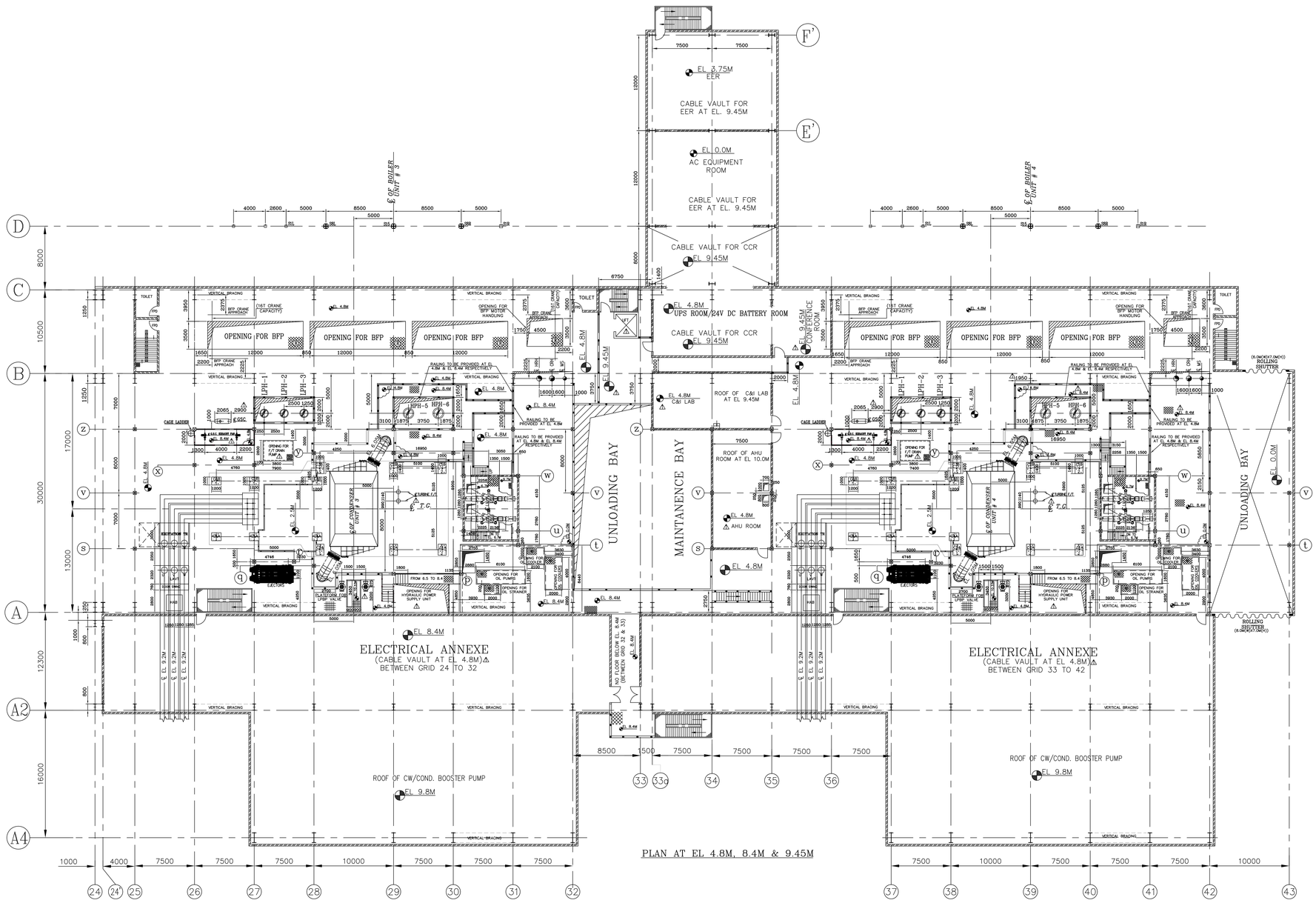
SIZE–A0

COMPUTER FILE NAME: 323_100_M003_R1

DRAWING No. PE-DG-323-100-M004

FIRST ANGLE PROJECTION

NORTH



LEGEND:

- CHEQUERED PLATE FLOORING
- REMOVABLE CHEQUERED PLATE
- GRATED FLOORING
- REMOVABLE GRATING
- CONCRETE BLOCK
- CUT OUTS
- HAND RAILING
- BRICK WALL
- STAIRS
- ROLLING SHUTTER

ABBREVIATIONS:–

T.G.	TURBO GENERATOR
HPH	HIGH PRESSURE HEATER
LPH	LOW PRESSURE HEATER
CCR	COMMON CONTROL ROOM
CBP	CONDENSATE BOOSTER PUMP
CL	CENTERLINE
HPDFT	HIGH PRESSURE DRAIN FLASH TANK
F/T	FLASH TANK
DG	DIESEL GENERATOR
GT	GENERATOR TRANSFORMER
CW P/H	COOLING WATER PUMP HOUSE
LP	LOW PRESSURE
AHU	AIR HANDLING UNIT
SWAS	STEAM AND WATER ANALYSIS SYSTEM
BFP	BOILER FEED PUMP
I/O	INPUT / OUTPUT
FPD	FIRE PROTECTION DOOR
EL	ELEVATION
IV	INTERCEPTOR VALVE
EER	ELECTRONIC EQUIPMENT ROOM
BOD	BOTTOM OF DUCT
SP	SEGREGATED PHASE
DIA	DIAMETER
PEM	PROJECT ENGINEERING MANAGEMENT
TRY	TRICHY
GA	GENERAL ARRANGEMENT
DN	DOWN
TR	TRANSFORMER
MS	MAIN STEAM
HRH	HOT REHEAT
CRH	COLD REHEAT
HWR	HARDWAR
BPL	BHOPAL
HYD	HYDERABAD
LAVT	LIGHTNING ARRESTOR & VOLTAGE TRANSFORMER
NG	NEUTRAL GROUNDING
HAB	HOT AIR BLOWER

NOTES

1. ALL DIMENSIONS ARE IN MM AND LEVELS ARE IN METRE UNLESS OTHERWISE STATED.
2. ALL ELEVATIONS ARE REFFERED TO (+)0.0M, WHICH CORRESPONDS TO 0.0OM LEVEL OF FINISHED FLOOR LEVEL OF EXISTING TG BUILDING.
3. FOR TG COLs & FLOOR FRAMING REFER CIVIL DRGs SEPARATELY.
4. ALL CIVIL DETAILS SUCH AS DOORS/WALLS/CLADINGS/OPENINGS/TOILETS/STAIRCASES ETC. ARE INDICATIVE ONLY & FOR EXACT DETAILS REFER CIVIL/ARCHITECTURE DRAWINGS.

REFERENCE DRGS:–

1. PLOT PLAN	PE-DG-323-100-M001(PEM)
2. EQUIPMENT LAYOUT PLAN AT 0.0M	PE-DG-323-100-M003(PEM)
3. EQUIPMENT LAYOUT PLAN AT 13.2M	PE-DG-323-100-M005(PEM)
4. D.C.JET CONDENSER	5151-MC-30.00.10 (GEA)
5. GLAND STEAM CONDENSER	0-162-05-70008C152 (HWR)
6. VALVE ROOM ARRANGEMENT	0-13100-B2005 (HWR)
7. OIL ROOM ARRANGEMENT	0-13100-B2004 (HWR)
8. GA OF HP FLASH TANK	(BPL)
9. GA OF LP FLASH TANK	(BPL)
10. LP HEATER No. # 1	0-162-18-70111 C152 (HWR)
11. LP HEATER No. # 2	0-162-22-70066 C152 (HWR)
12. LP HEATER No. # 3	0-162-26-70052 C152 (HWR)
13. GA OF HP HEATER # 5	BP-DG-323-149-0001 (BPL)
14. GA OF HP HEATER # 6	BP-DG-323-149-0003 (BPL)
15. GA OF EJECTORS	(GEA)
16. CROSS SECTION OF TG HALL	PE-DG-323-100-M007(PEM)

PROGRESSIVE PRINT
DATED 29.11.2011

REV	DATE	ALTD	CHD	APPD

No.OFF	REV	DATE	ALTD	CHD	APPD
	01	11.07.2011	M.V.U	BKA/SDC	MJ
	01	ORG. UPDATED IN LINE WITH MOM WITH CUSTOMER.			
	02	ORG. UPDATED IN LINE WITH INTER DEPTT./ UNITS REQUIREMENT.			
	03	ORG. GENERALLY REVISED & MARKED AS △ THUS			

CONTRACT DRAWING No.	BH–TSH–PE–M–23092
CUSTOMER	PEEGT MINISTRY OF ELECTRICITY SYRIAN ARAB REPUBLIC
JOB No. 323	2 X 200 MW TISHREEN THERMAL POWER PLANT EXTENSION PROJECT DAMASCUS, SYRIA
STATUS CONTRACT	
DISTRIBUTION	
TO	

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

DEPT CODE		NAME	SIGN	DATE
M	DRN	NITIN	/SD–	06.08.2010
	DESN	IMRAN/VJ	/SD–	06.08.2010
	CHD	HRD/BKA	/SD–	06.08.2010
	APPD	A.JOSHI	/SD–	06.08.2010

TITLE
TG HALL EQUIPMENT LAYOUT PLAN AT 4.8M, 8.4M & 9.45M

MPL	C	MSE	I	MAX	E	DEPT.	SCALE 1:200	DRAWING No.
						SIGN		PE–DG–323–100–M004
						DATE		SHEET 1 OF 1 REV 1

SIZE–A0

COMPUTER FILE NAME: 323_100_M004_R1

DRAWING No. PE-DG-323-100-M005

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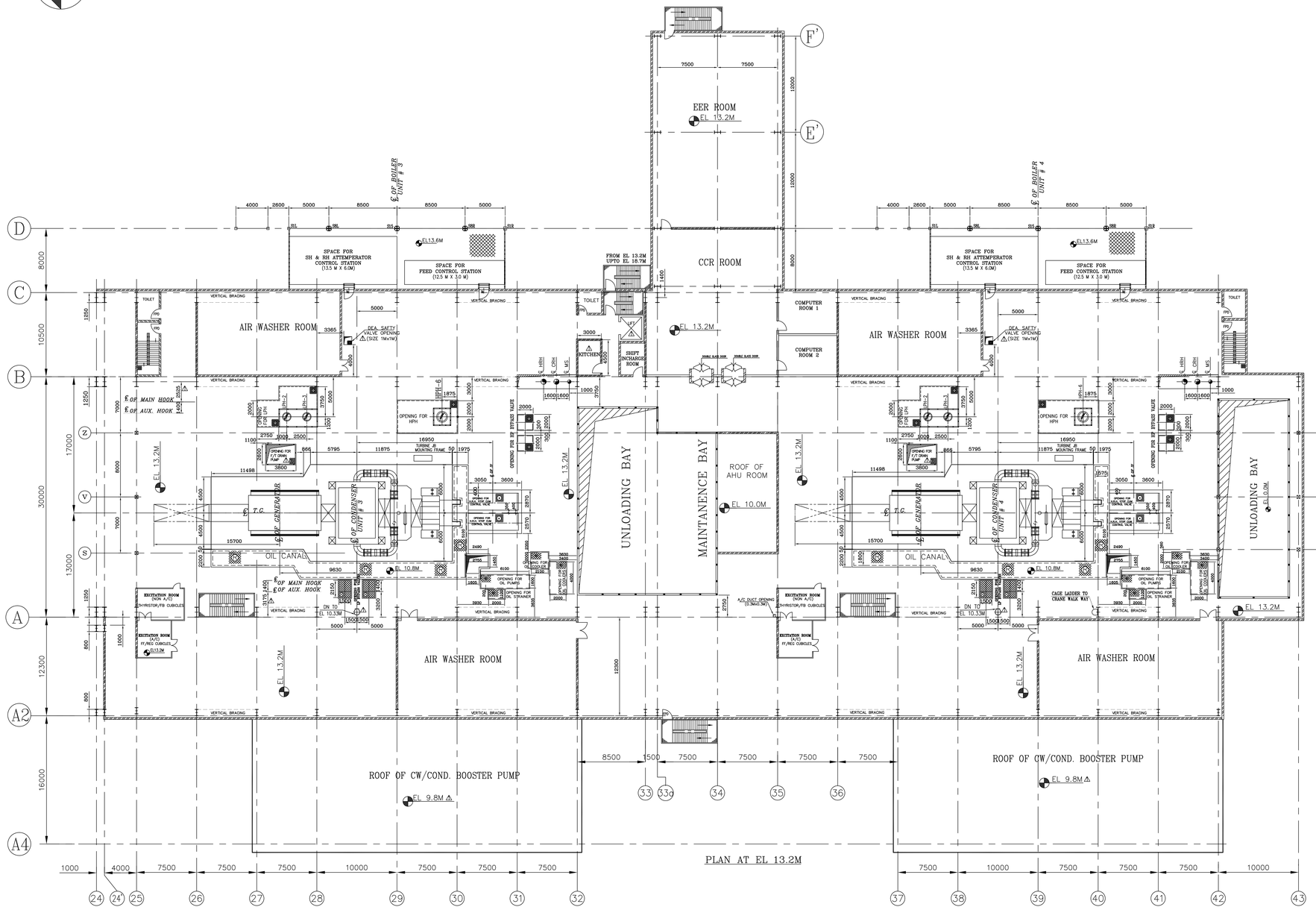

LEGEND:

- CHEQUERED PLATE FLOORING
- REMOVABLE CHEQUERED PLATE
- GRATED FLOORING
- REMOVABLE GRATING
- CONCRETE BLOCK
- CUT OUTS
- HAND RAILING
- BRICK WALL
- STAIRS

ABBREVIATIONS:–

T.G.	TURBO GENERATOR
HPH	HIGH PRESSURE HEATER
LPH	LOW PRESSURE HEATER
CCR	COMMON CONTROL ROOM
CBP	CONDENSATE BOOSTER PUMP
CL	CENTERLINE
SH	SUPERHEATER
RH	REHEATER
AUX	AUXILIARY
TG	TURBO GENERATOR
CW P/H	COOLING WATER PUMP HOUSE
LP	LOW PRESSURE
AHU	AIR HANDLING UNIT
DEA	DEAERATOR
FPD	FIRE PROTECTION DOOR
EL	ELEVATION
EER	ELECTRONIC EQUIPMENT ROOM
DIA	DIAMETER
PEM	PROJECT ENGINEERING MANAGEMENT
TRY	TRICHY
GA	GENERAL ARRANGEMENT
DN	DOWN
MS	MAIN STEAM
HRH	HOT REHEAT
CRH	COLD REHEAT
HWR	HARDWAR

NOTES

1. ALL DIMENSIONS ARE IN MM AND LEVELS ARE IN METRE UNLESS OTHERWISE STATED.
2. ALL ELEVATIONS ARE REFFERED TO (+)0.0M, WHICH CORRESPONDS TO 0.00M LEVEL OF FINISHED FLOOR LEVEL OF EXISTING TG BUILDING.
3. FOR TG COLs & FLOOR FRAMING REFER CIVIL DRGs SEPARATELY.
4. ALL CIVIL DETAILS SUCH AS DOORS/WALLS/CLADINGS/OPENINGS/TOILETS/STAIRCASES ETC. ARE INDICATIVE ONLY & FOR EXACT DETAILS REFER CIVIL/ARCHITECTURE DRAWINGS.

REFERENCE DRGS:–

1. PLOT PLAN	PE-DG-323-100-M001(PEM)
2. EQUIPMENT LAYOUT PLAN AT 4.8M & 8.4M	PE-DG-323-100-M004(PEM)
3. EQUIPMENT LAYOUT PLAN AT 0.0M	PE-DG-323-100-M003(PEM)
4. VALVE ROOM ARRANGEMENT	0-13100-B2005 (HWR)
5. OIL ROOM ARRANGEMENT	0-13100-B2004 (HWR)
6. PROPOSITION OUTLINE	0-131-00-P4400 (HWR)
7. FOUNDATION PLAN	0-131-00-B2153 (HWR)
8. CROSS SECTION OF TG HALL	PE-DG-323-100-M007(PEM)

PROGRESSIVE PRINT
DATED 29.11.2011

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REV	DATE	ALTD	CHD	APPD
01	11.07.2011	A/VJ	BKA/SCC	AJ
01	ORG. UPDATED IN LINE WITH MOM WITH CUSTOMER.			
02	ORG. UPDATED IN LINE WITH INTER DEPTT./ UNITS REQUIREMENT.			
03	ORG. GENERALLY REVISED & MARKED AS △ THUS			

CONTRACT DRAWING No.	BH-TSH-PE-M-23093
CUSTOMER	PEEGT MINISTRY OF ELECTRICITY SYRIAN ARAB REPUBLIC
JOB No. 323	2 X 200 MW TISHREEN THERMAL POWER PLANT EXTENSION PROJECT DAMASCUS, SYRIA
STATUS CONTRACT	
DISTRIBUTION	
TO	
No.OF	

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

DEPT CODE		NAME	SIGN	DATE
M	DRN	NITIN	SD/–	06.08.2010
	DESN	IMRAN/VJ	SD/–	06.08.2010
	CHD	HRD/BKA	SD/–	06.08.2010
	APPD	A.JOSHI	SD/–	06.08.2010

TITLE: TG HALL EQUIPMENT LAYOUT PLAN AT 13.2M

MPL	C	MSE	I	MAX	E	DEPT.	SCALE 1: 200	DRAWING No.
						SIGN		PE-DG-323-100-M005
						DATE		SHEET 1 OF 1 REV 1

SIZE-A0

COMPUTER FILE NAME: 323_100_M005_R1

DRAWING No. PE-DG-323-100-M006

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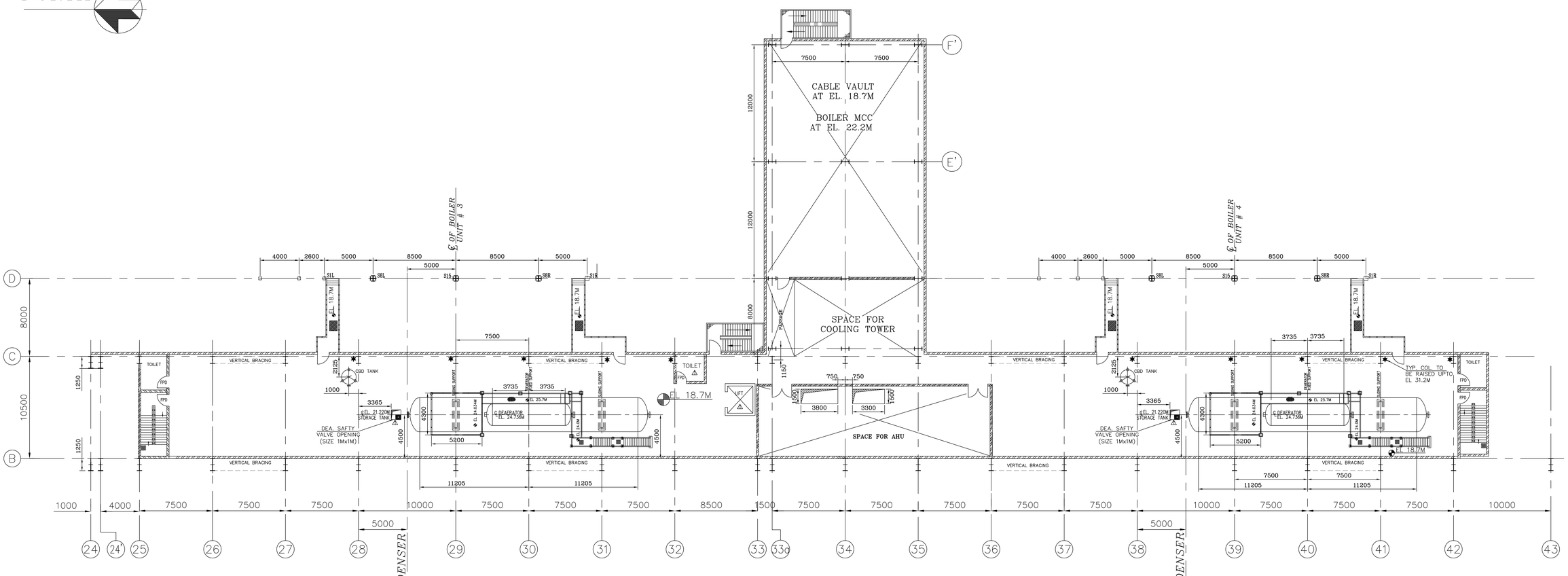
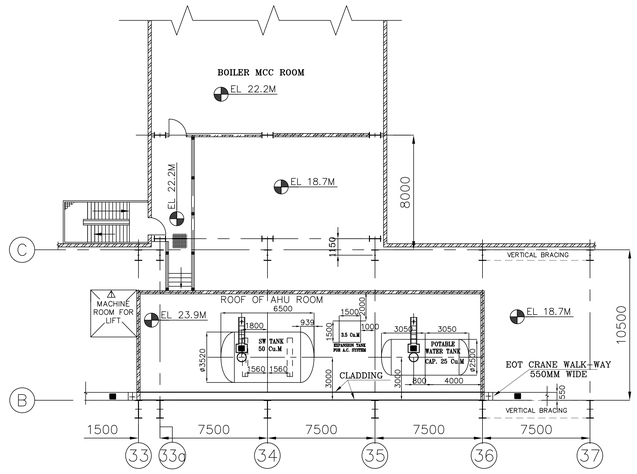


PLAN AT EL 18.7M



PLAN AT EL 23.9M

PROGRESSIVE PRINT
DATED 29.11.2011

ABBREVIATIONS:–

DEA	DEAERATOR
MCC	MOTOR CONTROL CENTRE
CL	CENTERLINE
AHU	AIR HANDLING UNIT
FPD	FIRE PROTECTION DOOR
EL	ELEVATION
CBD	CONTINUOUS BLOW DOWN
GA	GENERAL ARRANGEMENT
DN	DOWN
PEM	PROJECT ENGINEERING MANAGEMENT
HYD	HYDERABAD
EOT	ELECTRIC OVERHEAD TRAVERSER
SW	SERVICE WATER
CuM	CUBIC METRE
TYP	TYPICAL
COL	COLUMN

LEGEND:

- CHEQUERED PLATE FLOORING
- REMOVABLE CHEQUERED PLATE
- GRATED FLOORING
- REMOVABLE GRATING
- CONCRETE BLOCK
- CUT OUTS
- HAND RAILING
- BRICK WALL
- STAIRS

REFERENCE DRGS:–

1. PLOT PLAN	PE-DG-323-100-M001(PEM)
2. EQUIPMENT LAYOUT PLAN AT 13.2M	PE-DG-323-100-M005(PEM)
3. CROSS SECTION OF T.G. HALL	PE-DG-323-100-M007(PEM)
4. GA OF SPRAY CUM TRAY DEAERATOR	1-163-10-11318 (HYD)

NOTES

1. ALL DIMENSIONS ARE IN MM AND LEVELS ARE IN METRE UNLESS OTHERWISE STATED.
2. ALL ELEVATIONS ARE REFFERED TO (+)0.0M, WHICH CORRESPONDS TO 0.00M LEVEL OF FINISHED FLOOR LEVEL OF EXISTING TG BUILDING.
3. FOR TG COLs & FLOOR FRAMING REFER CIVIL DRGs SEPARATELY.
4. ALL CIVIL DETAILS SUCH AS DOORS/WALLS/CLADINGS/OPENINGS/TOILETS/STAIRCASES ETC. ARE INDICATIVE ONLY & FOR EXACT DETAILS REFER CIVIL/ARCHITECTURE DRAWNGS.

REV	DATE	ALTD	CHD	APPD

REV	DATE	ALTD	CHD	APPD
01	11.07.2011	A/VJ	BKA/SDC	AJ
01	ORG. UPDATED IN LINE WITH WOM WITH CUSTOMER.			
02	ORG. UPDATED IN LINE WITH INTER DEPTT./ UNITS REQUIREMENT.			
03	ORG. GENERALLY REVISED & MARKED AS △ THUS			

CONTRACT DRAWING No.	PH-TSH-PE-M-23094
CUSTOMER	PEEGT MINISTRY OF ELECTRICITY SYRIAN ARAB REPUBLIC
JOB No. 323	2 X 200 MW TISHREEN THERMAL POWER PLANT EXTENSION PROJECT DAMASCUS, SYRIA
STATUS CONTRACT	
DISTRIBUTION	
TO	
No.OFT	

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

DEPT CODE		NAME	SIGN	DATE
M	DRN	NITIN	SD/–	06.08.2010
	DESN	NARAYAN.VJ	SD/–	06.08.2010
	CHD	HRD/BKA	SD/–	06.08.2010
	APPD	A.JOSHI	SD/–	06.08.2010

TITLE: TG HALL EQUIPMENT LAYOUT PLAN AT 18.7M

MPL	C	MSE	I	MAX	E	DEPT.	SCALE 1:150	DRAWING No.
						SIGN		PE-DG-323-100-M006
						DATE		SHEET 1 OF 1 REV 1

SIZE-A0

COMPUTER FILE NAME: 323_100_M006_R1