NATIONAL ELECTRICITY CORPORATION LIMITED (SUDAN),

4X125 MW, KOSTI THERMAL POWER STATION.

VOLUME: II B.

TECHNICAL SPECIFICATIONS
FOR
SUPPLY OF CHEMICALS AND SUPERVISION
FOR CW TREATMENT SYSTEM.

SPECIFICATION NO.: PE-TS-250-156-A002.

BHARAT HEAVY ELECTRICALS LIMITED

POWER SECTOR

PROJECT ENGINEERING MANAGEMENT, PPEI BUILDING

NOIDA, INDIA.

CONTENTS

VOLUME-IIB & III

VOLUME-IIB

VOLUME-III

SECTION - A

(SCOPE OF ENQUIRY)

1.0 SCOPE OF ENQUIRY

1. 1 The intent of this specification is to cover supply of chemicals and monitoring instruments on "FOR" BHEL ROD GODOWN Chennai Port, Export Seaworthy packing and supervision of **CHEMICAL FOR CW TRETMENT SYSTEM** for **4X125 MW, KOSTI THERMAL POWER STATION, SUDAN** and determination of corrosion rates, scale deposition and bio-fouling at regular basis.

1. 2 The bidder under his scope of supply shall include other chemicals not specifically mentioned herein but deemed necessary to meet the guaranteed parameters addressed in the technical specification.

1. 3 General terms and conditions, instructions to the bidder & other attachments referred to elsewhere made part of this specification. The bidder shall be responsible for all governed by all requirements stipulated herein after.

1. 4 The items covered under this specification shall not be dispatched unless the same have been finally accepted and shipping release issued by BHEL/Customer.

1. 5 The bidder has to meet all the demonstration criteria at site within the quoted rate and weight of the chemicals.

SECTION - B

(PROJECT INFORMATION)

KOSTI 4 X 125 MW THERMAL POWER PLANT
UNIT-I COMPLETION : 29 months from Project Start Date
UNIT-II/III/IV COMPLETION :33/37/41 months from Project Start Date
PROJECT START DATE: 01-09-2006

PROJECT INFORMATION DATA

1.	**Owner**	NATIONAL ELECTRICITY CORPORATION, SUDAN
2.	**Project**	4 X ~~250~~ 300 MW RATING, CRUDE OIL FIRED THERMAL POWER PLANT
3.	**Owner's consultant**	Fichtner Gmbh & Co. KG
4.	**Location**	The Power Station site is located near Kosti (White Nile State), 310 km south of Khartoum at latitude 13.10 North and longitude 32.6 East at an elevation of 380 meters above sea level. The northern boundary of the plot is adjacent to the Rabak-Sinnar highway
5.	**Nearest Airport**	KHARTOUM
6.	**Nearest Port**	PORT-SUDAN
7.	**Access to site**	PORT-SUDAN → 850 km → KHARTOUM → 320 km → KOSTI

Meteorological data

A	**Altitude [Observatory]**	380 meters above sea level
B	**Ambient Conditions:**	
1.	Mean Maximum Ambient Air Temperature (in hottest month)	45 Deg.C
2.	Mean Minimum Ambient Air Temperature (in coldest month)	18 Deg.C
	Temperatures	
1.	Minimum [Annual Mean]	25 –30 deg C, 16 deg C lowest
2.	Maximum [Annual Mean]	40-45 deg C
C	**RELATIVE HUMIDITY**	Low to very low in most part of the year. Rising only during rainy season.
1.	Maximum Humidity	71% in Aug
2.	Minimum Humidity	26% in April
D	**RAINFALL**	
1.	Annual Mean	300 to 400 mm spread over 150 days. Approx.50 TO 60% rainfall in July & Aug.
2.	Maximum	Max recorded is 182 mm in Aug,04
E	**WIND DATA**	
1.	Max Wind Speed	170Kmph
2.	Prevailing Wind Direction	Wind direction is northern from May to September and it is southern in other months
3.	Any other features	Occasional dust storms in May and June

SECTION-C
SPECIFIC TECHNICAL REQUIREMENTS

1.0 GENERAL

CW Treatment System for 4x125 MW NEC Sudan TPS have been envisaged to control the circulating water chemistry to meet the system requirement as per the demonstration parameters indicated in the Technical Specification.
For this the dosing systems are already supplied. The details of which has been enclosed in the Technical Specification. The supplied dosing system may only be utilized by the supplier.

2.0 SCOPE OF SUPPLY

Broad scope of work of this package includes the following.

a) Supply of following chemicals to meet the system requirement as per demonstration parameters indicated in the Technical Specification for a period of 6 months (this 6 months period includes one initial start up of each unit) for normal run of all four units.

- Antiscalant
- Corrosion Inhibitor
- Bio-Dispersant

b) Monitoring gadgets, instruments and equipment required to show demonstration parameters.
c) Test racks (corrosion, scaling/deposit and bio-fouling) with coupons/test kits with mounting accessories.

Note: Bidder shall study the scheme, water analysis etc contained in the specification and offer/supply the most suitable chemical(s). Any other chemicals not indicated above but required to meet demonstration parameter are to be included by bidder in his scope. The chemicals proposed shall be non-toxic type and should meet international environmental regulation and confirmation in this respect shall be provided by bidder. Heavy metal based chemicals such as chromate, zinc etc are not applicable. Further the chemicals shall not have any deleterious affect on any component of the CW System. Organic polymer / organic phosphorous / organic phosphates based chemicals shall be used. Required documentation in support of the above shall be made available to BHEL/customer if required. The shelf life of the chemicals shall not be less than 1 year. The chemicals shall be supplied in sealed container/drum/carboys with export seaworthy packing.

3.0 SCOPE OF SERVICE

The bidder's scope also includes following services for scope under this specification:

1) Supervision of the treatment program for a period of 6 months at site.
2) Determination of corrosion rates, scale deposition and bio-fouling at regular intervals and review on regular basis and submit fortnightly reports to the BHEL.
3) Export Sea Worthy Packing for chemicals in sealed container/drum/carboys with proper marking as indicated in Technical Specification.

4.0 DEMONSTRATION:

a) Corrosion Rate
   i) On MS/CS < 3.0 mpy.
   ii) On SS (304) < 0.5 mpy.

b) Scaling < 15 mg/dm2/day.

c) Micro/Bio fouling conditions
   i) Total Viable Count (TVC) < $1x10^5$ Counts/ml
   ii) Sulphate reducing bacteria (SRB) < 1x105 Counts/100ml

5.0 EXCLUSIONS

a) 98% H2SO4 (@ 50 LPH dosing for four units shall be done by BHEL).
b) Hypochlorite solution [generated from brine based electro chlorination plant] (equivalent to 5 ppm chlorine) for half an hour once in shift of 8 hours, at the suction of the working CW pumps of one unit at a time to be done by BHEL.

6.0 DATA FOR COOLING TOWER (FOR DETAILS PLEASE REFER P&ID for CW and ACW Flow-PE-DG-292-165-N001, REV-4).

a. The Make up water for CW System for 4 cooling tower=1420 CuM/Hr.
b. Cycle of Concentration (COC)=4.
c. Recirculation Volume of one Cooling Tower is 16000 Cum/hr.
d. Total number of cooling tower=4
e. Storage/Holdup volume of cooling tower basin (common for all four units)=22000 CuM (Approx).
f. Temperature difference across cooling tower is 10 Deg C.
g. MOC of Condenser tube is SS (SA 249 TP 304).
h. Cooling Water System metallurgy shall be as per P&ID CW/ACW System (enclosed in Technical Specification).

7.0 DRAWING/DOCUEMNTS REQUIREMENT AFTER LOI:

After award of LOI, following drawing/documents shall be submitted by the bidder. However, any additional drawing/document if found necessary, the same shall be submitted by bidder without any commercial implication.

a) Technical data sheet including MSDS for chemical.
b) Log sheet.
c) Detailed operation and control philosophy.
d) Export Sea worthy packing details.

8.0 DRAWING/DOCUEMNTS REQUIRED ALONG WITH THE BID.

- Compliance certificate duly filled.
- Schedule of Declaration duly filled.
- Un-Price Schedule duly filled.
- Document required as per PQR.

9.00 Reference Documents

- **CLARIFIED WATER ANALYSIS FOR CW MAKE-UP-ANNEXURE-1.**
- **P&ID for CW Chemical Treatment- PE-VO-292-156-A012, REV-4.**
- **P&ID for CW and ACW Flow-PE-DG-292-165-N001, REV-4.**

NOTE-1: Bidder to use existing system/facilities like dosing system available at Sudan as per P&ID for CW Chemical Treatment- PE-VO-292-156-A012, REV-4.

NOTE-2: The bidder has to meet all the demonstration criteria at site within the quoted rate and weight of the chemicals.

ANNEXURE – I

CLARIFIED WATER ANALYSIS FOR CW MAKE-UP

PARAMETER	UNIT	MAX. LIMIT	MIN. LIMIT
Turbidity	NTU	20	20
Temperature	^{0}C	35	19
pH	-	8.9	7.8
Conductivity	µS/cm	780	140
Total hardness as $CaCO_3$	mg/l as $CaCO_3$	100	50
Total Alkalinity	mg/l as $CaCO_3$	166	70
P-Alkalinity	mg/l	15	Nil
Calcium as Ca	mg/l as Ca	30	20
Magnesium as Mg	mg/l as Mg	13.4	2.4
Sodium	mg/l as Na	10.15	---
Chloride	mg/l as Cl	14.18	4
Sulphate	mg/l as SO_4	16	7
Iron	mg/l as Fe	0.1	Nil
Nitrite	mg/l	0.001	0.007
Nitrates	mg/l	2.8	1.6
Copper	mg/l	Nil	Nil
Manganese	mg/l	0.01	Nil
Silica	mg/l	15	1
TSS	mg/l	10	10
TDS	mg/l	390	70
T. Coliform/100 ml	--	30	10
Total Count/5 ml	--	2100	200

NOTE:

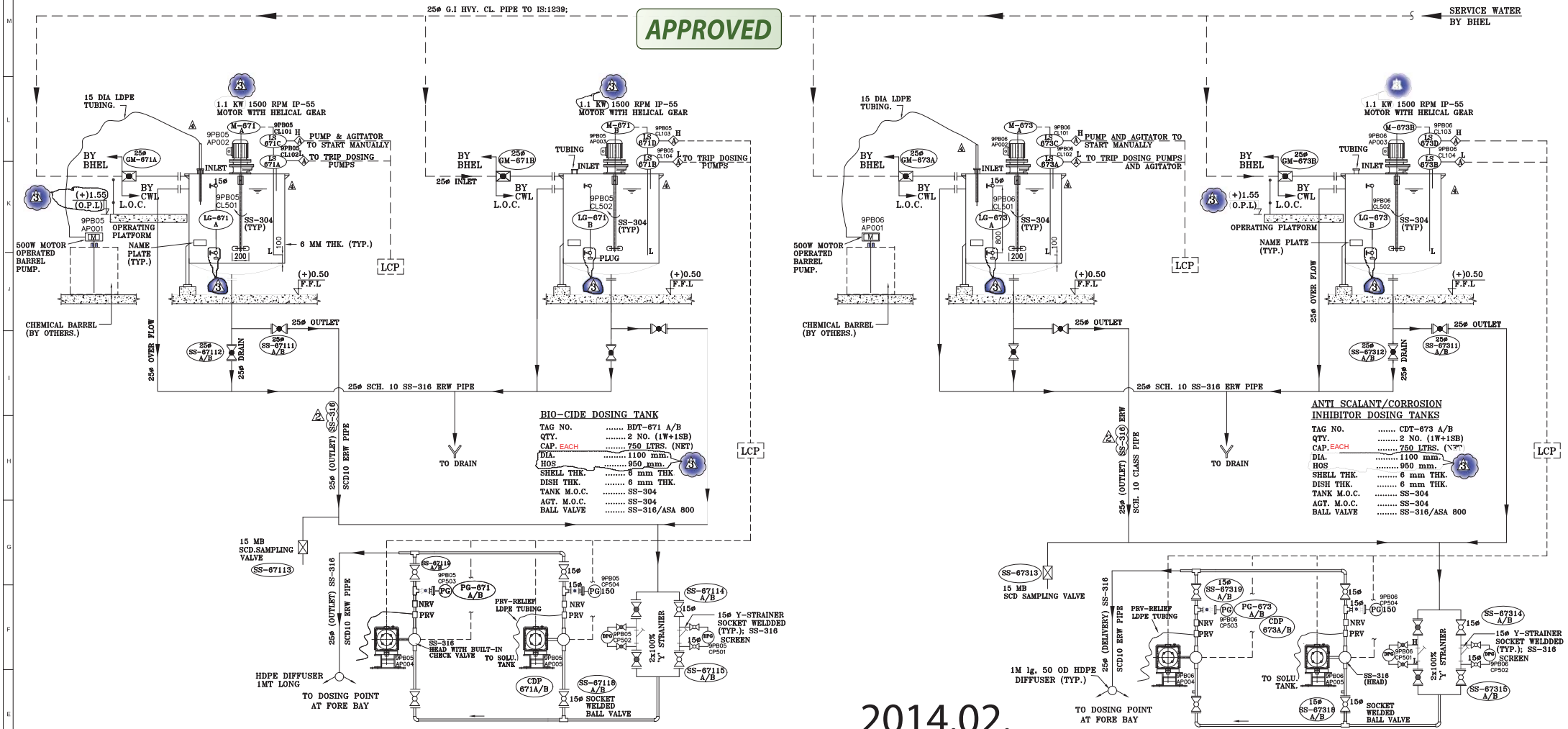
1) The CW Treatment Chemical shall be selected based on both Maximum and Minimum value as indicated in above Clarified water analysis.

2) The CW Water analysis shall be derived based on 4 COC.

3) For purpose of Design CW Make-up water analysis, the following shall be considered on the CLARIFIED WATER ANALYSIS FOR CW MAKE-UP given above:
   a) Alum dosing Rate of 70 ppm in clarified water.
   b) Poly Electrolyte (PE) Dosing Rate of 1 ppm in clarified water.
   c) Chlorine Dosing Rate of 2 ppm in clarified water.
   d) Hypochlorite solution [generated from onsite brine based Electro chlorination plant] (equivalent to 2 ppm chlorine) in clarified water.
   e) All sl no-3-a, 3-b, 3-c and 3-d are in BHEL scope of supply.

P&ID FOR CW CHEMICAL TREATMENT

APPROVED



BIO CIDE DOSING PUMPS

TAG NOS..... BDP-671 A/B
TYP ..... MECH. DIAPHRAGM PUMP
QTY ..... 2 NOS (1W+1SB)
CAP ..... 0 TO 30 LPH
HEAD ..... 40 MWC
ANTI SYPHON..... 1/2" SIZE;TO BE LOCATED
VALVE ..... AT DOSING END.
PUMP HEAD SS-316
BALL VALVE ..... SS-316; ASA 800
MOTOR ..... 0.37 K.W., 4 POLE
POWER ..... 415 V ±10%; 3 PHASE; 50 Hz±5%

ANTI SCALANT/CORROSION INHIBITOR PUMPS

TAG NOS..... CDP-673 A/B
TYP ..... MECH. DIAPHRAGM PUMP
QTY ..... 2 NOS (1W+1SB)
CAP ..... 0 TO 30 LPH
HEAD ..... 40 MWC
ANTI SYPHON..... 1/2" SIZE;TO BE LOCATED
VALVE ..... AT DOSING END.
PUMP HEAD SS-316
BALL VALVE ..... SS-316; ASA 800
MOTOR ..... 0.37 K.W., 4 POLE
POWER ..... 415 V ±10%; 3 PHASE; 50 Hz±5%

BHARAT HEAVY ELECTRICALS LTD
PROJECT ENGINEERING MANAGEMENT.

This approval status shall be interpreted as laid down in the contract and it shall not relieve the contractor from the contractual obligation.

APPROVAL CATEGORY AWARDED = I

CAT I - Approved
CAT II - Approved With Comments as Noted
CAT III - Not Approved
CAT IV - Reference Drawing

DEPARTMENT	MECHANICAL AUXILIARY
NAME: FALGUNI SAHA	

2014.02.14 18:13:41 +05'30'

NOTES:-

1. ALL DIMENSIONS ARE IN mm. AND LEVELS ARE IN METRES.
2. THIS DRAWING SHOULD NOT BE SCALED.
3. IF IN DOUBT, PLEASE ASK.
4. ALL NATURE OF CIVIL WORKS INCLUDING A/R TILE WORK IS BEYOND THE SCOPE OF THIS CONTRACT PACKAGE.
5. HDPE PIPE LINE SHALL CONFORM TO IS:4984;CL. 10kg/cm2;
6. SLIP ON FLAT FACE FLANGES SHALL CONFORM TO ANSI-B16.5 CL 150 #
7. LOCAL CONTROL PANEL FOR OPERATION & MONITORING SHALL BE RELAY BASED.

LEGEND

SS-D/F BALL VALVE ; ASA 800.		LEVEL SWITCH	LS
SS-SCD.BALL VALVE ; ASA 800.		LEVEL GAUGE	LG
G.M. GATE VALVE (NORMALLY OPEN) (SCREWED)		LEVEL LOW / HIGH ALARM	H A L
G.M. GATE VALVE (NORMALLY CLOSE) (SCREWED)		LIMIT OF CONTRACT	
SAMPLING POINT (LOCAL)		METERING PUMP	M
DRIVE MOTOR	M		
DRAIN TO WASTE		DIFFERENTIAL PRESSURE GAUGE	DPG
NRV			

IDENTIFICATION OF DRG. / PLAN / SECTION
08-03/C/S/M/E/12/00
MECHANICAL DRG.
ELECTRICAL DRG.
CLEWAT DRG. NO.
PLAN/SECTION NO.
STRUCTURAL DRG.
DRG. APPROVED BY PURCHASER.
JOB NO.

REV.No.	DETAILS REVISIONS	DATE
3	ANTI SCALANT/CORROSION INHIBITOR TANK; BIO-CIDE TANK	A067 (SH1&2)
2	G.A. OF CHEMICAL DOSING SYSTEM	A061
1	LAYOUT	A011
SL. NO.	DESCRIPTION	CLEWAT DRG. NO.
A	REVISED AS PER SITE COMMENTS	11/02/13
A	REVISED AS MARKED	02.11.09
A	REVISED AS PER BHEL COMMETNTS	26.08.09
A	REVISED AS PER BHEL COMMETNTS	18.08.09

CAUTION

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IN ITS QUEST TO SATISFY THE CUSTOMER, CLEAR WATER LTD. PURSUES CONTINUAL IMPROVEMENT IN THE QUALITY OF ITS PRODUCTS, SERVICES AND PERFORMANCE LEADING TO TOTAL CUSTOMER SATISFACTION AND BUSINESS GROWTH THROUGH DEDICATION, COMMITMENT AND TEAM WORK OF ALL EMPLOYEES.

QUALITY OBJECTIVES

- CUSTOMER SATISFACTION BY IMPROVING DELIVERY / COMPLETION PERIOD & RESPONSE.
- QUALITY OF SUPPLIES BY IMPROVING SUB-VENDOR PERFORMANCE.
- CAPABILITY OF HUMAN RESOURCES BY UPGRADING SKILL AND COMPETENCE.

RRB/08-03D(11)/ DT.

CUSTOMER:	NATIONAL ELECTRICITY CORPORATION (NEC) THE REPUBLIC OF THE SUDAN
PROJECT:	CW-TREATMENT PLANT 4X125 MW KOSTI THERMAL POWER STATION
CONSULTANT: FICHTNER	Fichtner GmbH & Co. KG Stuttgart, Germany
	BHARAT HEAVY ELECTRICALS LTD. POWER SECTOR PROJECT ENGINEERING MANAGEMENT NEW DELHI -INDIA
ORIGINATOR: CLEWAT	TURNKEY CONTRACTOR :- CLEAR WATER LTD. B-14/1, OKHLA INDUSTRIAL AREA PHASE-II, NEW DELHI-110020 PHONE :-26386477 & 26386095 E-MAIL :-clearwater@bol.net.in. FAX :-26384061

DRN	DGN	CHKD.	DATE
BHARTI			

CWL DRG. NO. 08-03/C/M/12 SCALE 1:50

JOB NO. 08-03

TITLE:- CHEMICAL DOSING SYSTEM
P & I DIAGRAM FOR CHEMICAL DOSING SYSTEM

BHEL DRAWING. NO. PE-VO-250-156-A012 REV. 04

SHEET-1 OF 1

P&ID FOR CW AND ACW FLOW

UNIT PREFIX IDENTIFIER

1	–	UNIT –1
2	–	UNIT –2
3	–	UNIT –3
4	–	UNIT –4
90	–	COMMON SYSTEM FOR PLANT(ALL UNITS)
91	–	COMMON SYSTEM FOR UNIT–1 & UNIT–2
92	–	COMMON SYSTEM FOR UNIT–3 & UNIT–4

SYSTEM IDENTIFIER

PAB	–	CW SYSTEM
PCA	–	ACW CLEANING SYSTEM
PCB	–	ACW SYSTEM
PCC	–	ACW PUMP
PGC	–	EQUIPMENT COOLING SYSTEM(
PAH	–	CONDENSER ONLOAD TUBE CLEANING SYSTEM
PBJ	–	COOLING TOWER
PAR	–	CW MAKE UP SYSTEM
PEB	–	BLOW DOWN COOLING WATER SYSTEM

EQUIPMENT IDENTIFIER

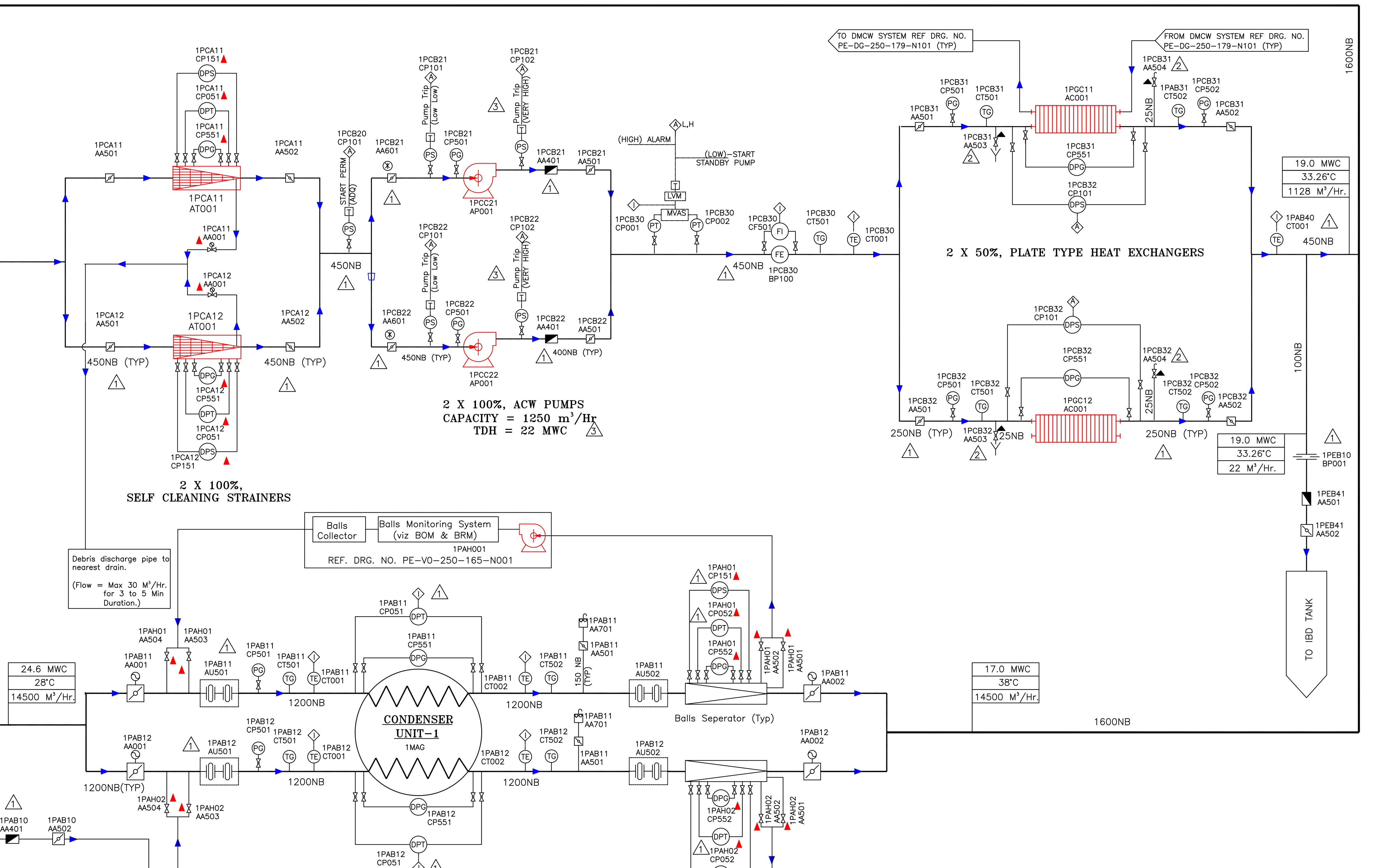
AA	–	VALVE
AC	–	PLATE HEAT EXCHANGER
AP	–	MAIN PUMP
AT	–	SELF CLEANING STRAINER
AU	–	RE JOINTS
BP	–	PRESSURE BREAKING ORIFICE
CF	–	FLOW MEASUREMENT
CL	–	LEVEL MEASUREMENT
CP	–	PRESSURE/DIFF. PRESSURE MEASUREMENT
CT	–	TEMP. MEASUREMENT

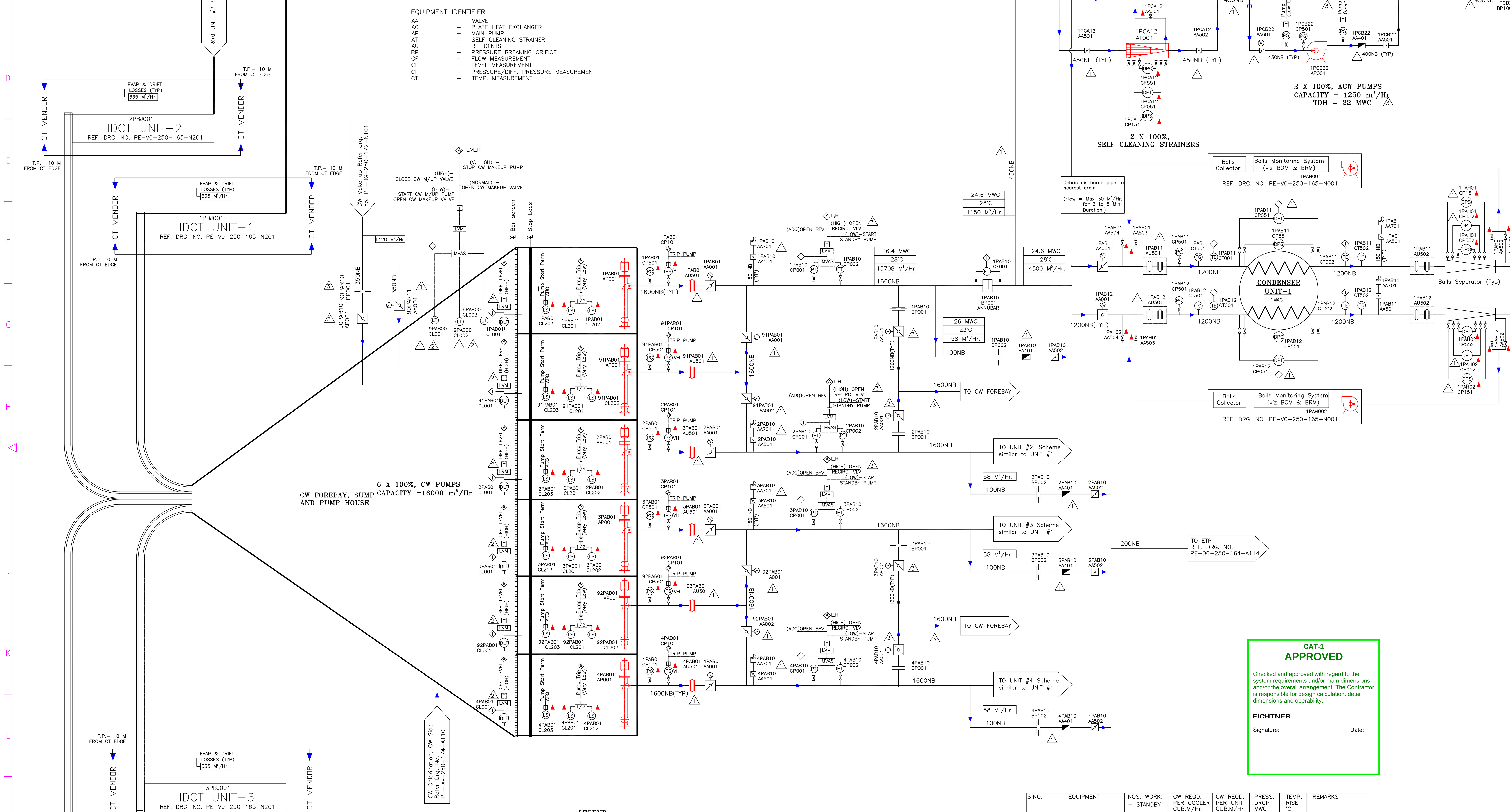
EQUIPMENT\DEVICE TYPE IDENTIFIER

001 TO 099	–	MOTORISED OPERATION
401 TO 499	–	NRVS
501 TO 599	–	MANUAL OPERATION
601 TO 699	–	MANUAL OPERATION(WITH LIMIT SWITCH
701 TO 799	–	RELIEF VALVES

INSTRUMENT TYPE IDENTIFIER

001 TO 049	–	ANALOG TRANSMITTERS
051 TO 099	–	DIFFERNTIAL PR. TRANSMITTERS
101 TO 149	–	SWITCHES (BINARY SIGNALS)
151 TO 199	–	DIFFERENTIAL PR. SWITHCES(BINARY SIGNALS)
500 TO 549	–	LOCAL GAUGES
551 TO 599	–	DIFFERENTIAL PR. GAUGES





NOTES: ⚠1

1. DESIGN PRESSURE : 5.0 Kg/sq.cm (g) FOR C.W.SYSTEM,
   DESIGN PRESSURE : 7.5 Kg/sq.cm (g) FOR A.C.W.SYSTEM,
   DESIGN CW INLET TEMP. TO CONDENSER = 28 °C
   DESIGN ACW INLET TEMP. TO PHE'S = 36 °C
   DESIGN MECHANICAL TEMPERATURE : 50 °C

2. MATERIALS OF CONSTRUCTION :
A). PIPING UPTO & INCLUDING 150Nb SHALL BE CARBON STEEL ERW, IS:1239 (MEDIUM GRADE)
B). PIPING 200 Nb AND ABOVE SHALL BE CARBON STEEL (IS:2062), ROLLED AND WELDED CONFORMING TO IS:3589.
C). MATERIALS OF CONSTRUCTION FOR BUTTERFLY VALVES AND GATE/ GLOBE/ CHECK VALVES/ ARV's SHALL BE AS PER CW/ ACW DESIGN PHILOSOPHY (REFER DOC. NO. PE–DC–250–165–N101).

3. ALL PRESSURE TAPPINGS & ROOT VALVES TO BE OF 15 Nb.

4. CW SYSTEM : 150 NB SIZE DRAIN & VENT VALVES SHALL BE PROVIDED AS REQD. AS PER LAYOUT.
   ACW SYSTEM : 50 NB SIZE DRAIN & VENT VALVES SHALL BE PROVIDED FOR PIPE SIZES 400 NB & ABOVE. 25 NB DRAIN & VENT VALVES SHALL BE PROVIDED FOR PIPE SIZES UPTO 350 NB AS PER LAYOUT REQUIREMENTS.

5. INSTRUMENTS MARKED ▲ THUS SHALL BE SUPPLIED ALONGWITH THE EQUIPMENTS.

6. R.E.JOINT AT CONDENSER INLET & OUTLET SHALL BE COMPENSATING/TIE TYPE

7. AIR RELEASE VALVES (150 Nb) SHALL BE PROVIDED, IF REQUIRED AS PER SURGE STUDIES.

8. PAINTING/PROTECTION – PIPES:
8.1 INTERNAL SURFACE (FOR PIPE DIA ABOVE 1000 mm)
   A). SURFACE CLEANING BY WIRE BRUSH.
   B). APPLICATION OF ONE COAT OF EPOXY RESIN BASED RED OXIDE PRIMER FOLLOWED BY ADEQUATE NO. OF FINISH COATS OF COAL TAR EPOXY PAINT TO ACHIEVE TOTAL DFT OF 125 TO 150 MICRONS.
8.2 EXTERNAL SURFACE – OVERGROUND PIPING
   A) SURFACE CLEANING BY WIRE BRUSH.
   B) PAINTING SHALL BE AS PER PAINTING SCHEDULE PE–DC–250–100–A999.
8.3 CW PIPE BURIED PORTION COMING UNDER RAIL OR ROAD SHALL BE EITHER CONCRETE ENCASED OR CULVERTS SHALL BE PROVIDED.
8.4 CW & ACW BURRIED PIPING SHALL BE PROTECTED AS UNDER (AS PER IS–10221)
   – SURFACE CLEANING BY WIRE BRUSH
   – APPLY THREE COATS OF COALTAR/ PRIMER/ ENAMEL CONFORMING TO AWWA C–203/ IS 10221.
   – APPLY THREE LAYERS OF TAPE COMPRISING OF COALTAR. APPLICATION OF TAPE SHALL CONFORM TO AWWA C–203/ IS 10221 (APPENDIX–B) WITH TOTAL THICKNESS OF TAPE AS 4 TO 6 MM.

9. DETAILS SHOWN FOR CONDENSER OF UNIT–1 ARE TYPICAL, DETAILS FOR CONDENSER OF OTHER UNITS SHALL BE SIMILAR.

10. PROCESS PARAMETERS

DESIGN HEAD AVLB
DESIGN TEMP.
DESIGN FLOW

10.1 PARAMETERS INDICATED ARE AT DESIGN CONDITIONS.
10.2 HEAD IDICATED IS WRT FGL(RL 411.5M), WITH WATER LEVEL AT RL 410.9M(AVG. OF MIN & MAX. W.L.)

11. THE KKS TAG FOR ROOT VALVES OF THE INSTRUMENT SHALL BE IDENTIFIED WITH COMPONENET KEY KA01,KA02 etc eg. FOR DPT 1PAB11CP051 TAG NO. OF ROOT VALVE AT UPSTREAM(HIGH SIDE) OF DPT SHALL BE 1PAB11CP051KA01 AND TAG NO. OF ROOT OF AT DOWNSTERAM(LOW SIDE) OF DPT SHALL BE 1PAB11CP051KA02

12. REFERENCE DOCUMENTS:
   A) CW/ ACW SYSTEM DESIGN PHILOSOPHY AND SYSTEM WRITEUP – DOC. NO. PE–DC–250–165–N101.
   B) PLANT WATER P&ID – DRG. NO. PE–DG–250–172–N101.
   C) PLANT WATER SYSTEM DESIGN PHILOSPOHY – DRG. NO. PE–DG–250–172–N101
   D) P&ID OF CONDENER ONLOAD TUBE CLEANING SYSTEM – DRG NO. PE–V0–250–165–N001
   E) P&ID OF SELF CLEANING STRAINER – – DRG NO. PE–V0–250–165–N101
   F) G.A. OF COOLING TOWER –DGR NO. PE–V0–250–165–N201

CAT-1
APPROVED

Checked and approved with regard to the system requirements and/or main dimensions and/or the overall arrangement. The Contractor is responsible for design calculation, detail dimensions and operability.

FICHTNER

Signature: Date:

S.NO.	EQUIPMENT	NOS. WORK. + STANDBY	CW REQD. PER COOLER CUB.M/Hr.	CW REQD. PER UNIT CUB.M/Hr	PRESS. DROP MWC	TEMP. RISE °C	REMARKS
1	CONDENSER	1 + 0	14500	14500	6.0	10.0	–
2	PLATE HEAT EXCHANGERS	2 + 0	575	1150	10.0 ⚠1	5.26	–

PIPE SIZES OF CS MATL.

NB	OD	THICK.
15	21.8	2.6
25	34.2	3.2
40	48.8	3.2
50	60.8	3.6
65	76.6	3.6
80	89.5	4.0
100	115.0	4.5
150	166.5	4.8
200	219.1	6.0
250	273.0	6.0
300	323.9	6.0
350	355.6	6.0
400	406.4	6.0
450	457.0	6.0
500	508.0	6.0
600	610.0	6.0
700	711.0	8.0
1200	1219	10.0
1600	1626	16.0 ⚠2

LEGEND

- MOTOR OPERATED BUTTERFLY VALVE
- MANUAL BUTTERFLY VALVE
- NON RETURN VALVE
- GLOBE VALVE
- REDUCER/EXPANDER
- ORIFICE PLATE
- (PG) PRESSURE GAUGE
- (PS) PRESSURE SWITCH
- (PT) PRESSURE TRANSMITTER
- (PH) PH ANALYSER
- (DPG) DIFFERENTIAL PRESS. GAUGE
- (DPS) DIFFERENTIAL PRESS. SWITCH
- (DPT) DIFFERENTIAL PRESS. TRANSMITTER
- (LS) LEVEL SWITCH
- (LT) LEVEL TRANSMITTER
- (FI)(FE) BYPASS TYPE ROTAMETER
- (DLT) DIFFERENTIAL LEVEL TRANSMITTER
- (TE) TEMPERATURE ELEMENT
- (TG) TEMPERATURE GAUGE
- (A) ALARM
- (I) INDICATION OWS(DCS)
- (T) TIMER
- (FI) ANNUBAR
- ORIFICE PLATE
- R.E. JOINT (STD.)
- R.E. JOINT (COMPENSATING/TIE TYPE)
- HORIZONTAL PUMP
- VERTICAL PUMP
- AIR RELEASE VALVES
- OTHER SCOPE DEMARCATIONS WITHN BHEL UNITS VIZ HWR., HYD., PEM(MAX), ETC.

REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD
04	21.01.08	SC	AS	AK	03	1.11.07	SC	AS	AK	02	17.08.07	SC	AS	AK	01	31.01.07	SC	AS	AKT
01	PIPE THICKNESS OF 1600Nb CW PIPE REVISED TO 16mm, DUE TO NON AVAILABILITY OF 14mm PLATE AT SITE.				01	MIN. RECICULATION VALVE FOR CWPUMP ADDED FOR EACH UNIT. DRAWING REVISED IN LINE WITH DISCUSSIONS DURING DRM#7 AT DELHI, FROM 29/10/2007 TO 2/11/2007				01 / 02	DIFFERNTIAL LEVEL TRANSMITTER ADDED INLINE WITH THE RESOLUTIONS DURING MEETING FROM 17TH 20TH JULY 2007. / VENTS AND DRAINS FOR PHEs INDICATED				01	REVISED IN LINE WITH KTPS COMMENTS VIDE REF.7018-A02-BHELH/NCEH-T-006 DATED 23/10/2006			

JOB NO. 250
STATUS CONTRACT
DISTRIBUTION
TO
No. OF

KOSTI, THERMAL POWER STATION 4 X 125 MW
NATIONAL ELECTRICITY CORPORATION (NEC)
THE REPUBLIC OF SUDAN

FICHTNER — Fichtner GmbH & Co. KG, Stuttgart, Germany

BHARAT HEAVY ELECTRICALS LTD
DELHI, INDIA

DEPT CODE: M

	NAME	SIGN	DATE
DRN	SC		13/10/06
DESN	AS		13/10/06
CHD	AKT		13/10/06
APPD	PKK		13/10/06

TITLE

P&ID CW AND ACW SYSTEM

DEPT. SCALE: SCALE
SIGN
DATE

BHEL DRAWING NO.
PE-DG-250-165-N101

SHEET 1 OF 1 REV. 04 SHEET

EXPORT SEAWORTHY PACKING

1.0 SCOPE:

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

2.0 TECHNICAL SPECIFICATION OF WOOD :

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

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

3.0 TYPE, DESIGN & DIMENSION OF WOODEN PACKING CASES :

3.1 PACKING OF EQUIPMENTS :

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

3.1.1 BOTTOM FRAME :

The construction of bottom frame shall be as per fig. 2. The No. of slides / runners for bottom frames shall be selected depending upon the weight and overall dimension of the load to be carried. The equipment shall be secured by fixing their base frame/plate with the help of bolt & nuts etc to the bottom frame of the wooden packing cases. The equipment not provided with the base

frame/plate like cylindrical vessels etc. to be secured to the bottom frame of the wooden case with 'C' clamps fabricated from steel channels/angle irons.

3.1.2 TOP FRAME :

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

3.1.3 END PANELS :

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

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

3.1.4 SLING PLATE :

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

3.1.5 ANGLE IRON CLEATS :

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

3.1.6 OTHER REQUIREMENTS:

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

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

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

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

- **All the inner sides of the box shall be nailed with bitumen coated hessian polyethylene kraft paper. For top frame it shall project on all side by 100mm**

and shall be nailed on sides. Wherever 2 pieces of kraft paper are used, the joint shall shall have an overlap of minimum 20mm.

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

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

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

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

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

3.1.7 *ALTERNATIVE PACKING CASES FOR CONTROL PANELS AND SWITCHGEARS*

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

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

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

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

3.2 *PACKING OF LOOSE ITEMS :*

Loose mechanical, electrical and C&I items eg valves, fittings, pressure/temperature gauges/switches, circuit breakers, relays etc shall be individually wrapped using polyethylene sheets/U foam/thermocole sheets/air bubbled sheets depending upon the item and then packed in wooden boxes. The left out spaces and top of the boxes shall be filled with rubberised coir to get

proper cushioning effect. Special attention is to be paid to relays, instruments etc for arresting the movement of their operating mechanisms during transportation.

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

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

4.0 *MOISTURE ABSORBER:*

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

5.0 *INDICATION MARKS ON THE BOXES:*

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

6.0 *DESPATCH DETAILS:*

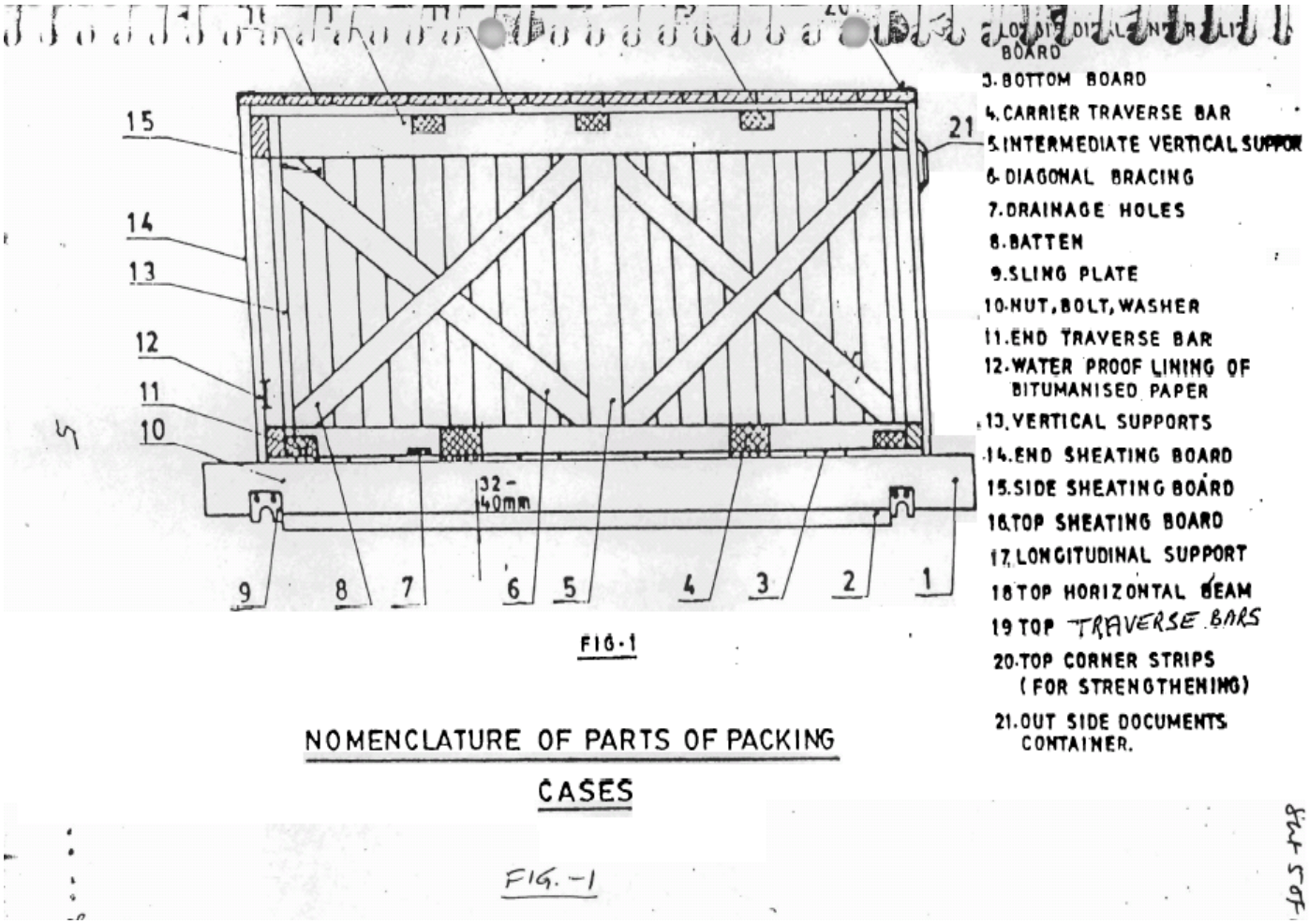
External front and rear sides of the boxes to be planed for writing instructions.

Despatch details such as consignor/consignee address, contract and case details, country of origin , port of delivery, stacking instructions shall be written on one of the side of boxes. An anodised aluminium plate as per details and specifications given in fig 13 shall be provided on one side of the boxes.

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

7.0 *INSPECTION:*

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



FIG·1

NOMENCLATURE OF PARTS OF PACKING CASES

FIG.-1

BOTTOM FRAME ARRANGEMENTS

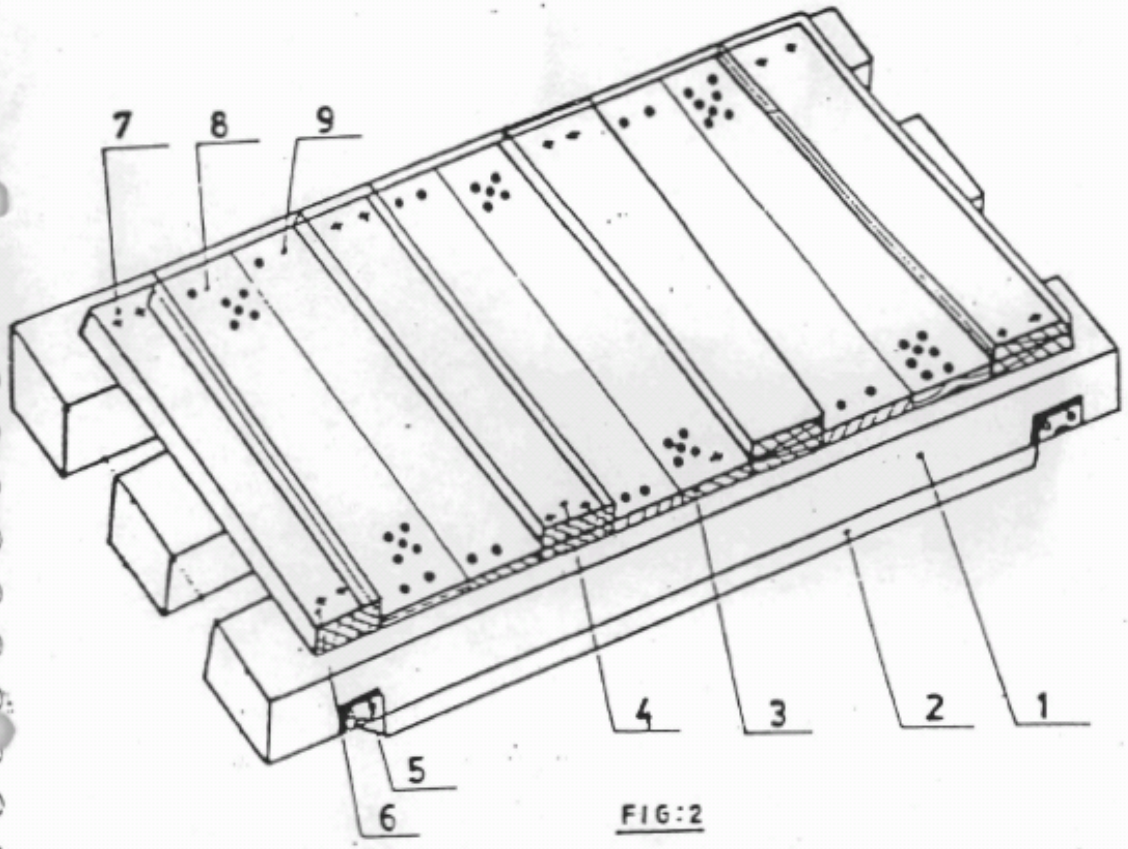
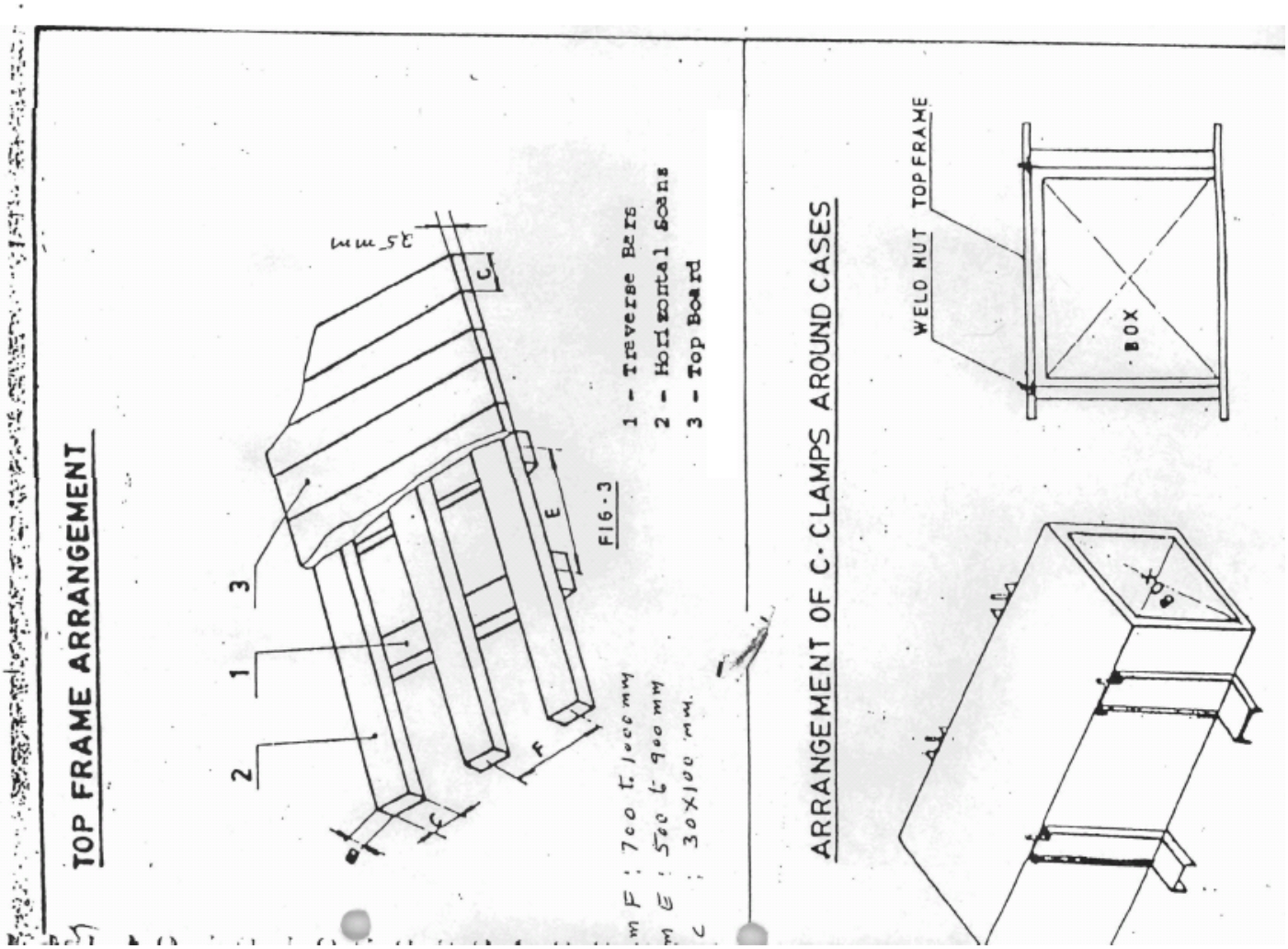


FIG:2

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

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


TOP FRAME ARRANGEMENT
1 - Treverse Bars
2 - Horizontal Beams
3 - Top Board
FIG-3
ARRANGEMENT OF C-CLAMPS AROUND CASES
WELD NUT TOP FRAME
BOX

ARRANGEMENT OF DIAGONAL BRACING AND HORIZONTAL SUPPORT

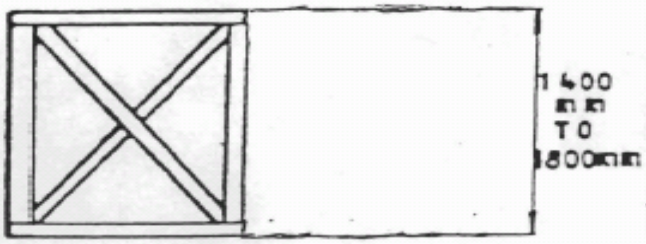


FIG: 6

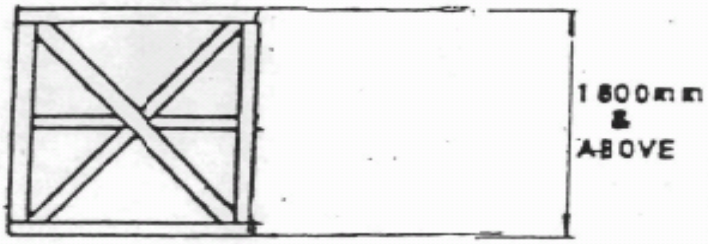


FIG: 8

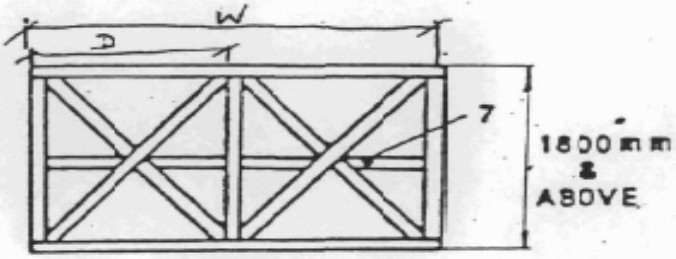


FIG: 9

7- Middle Horizontal Support

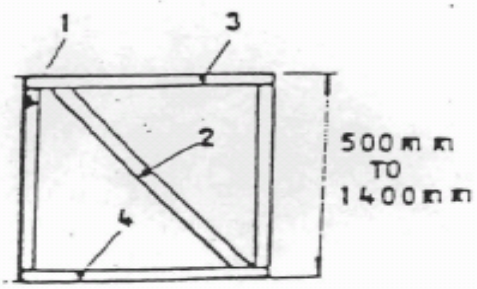


FIG: 5.

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

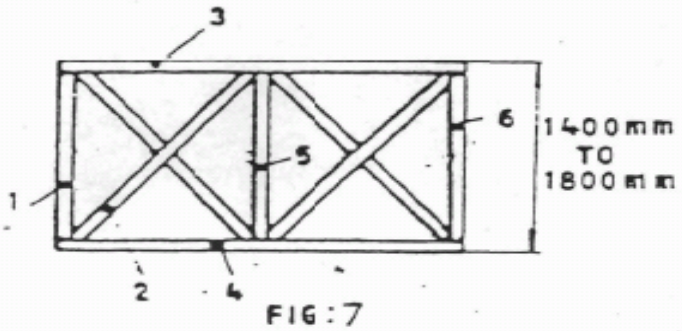
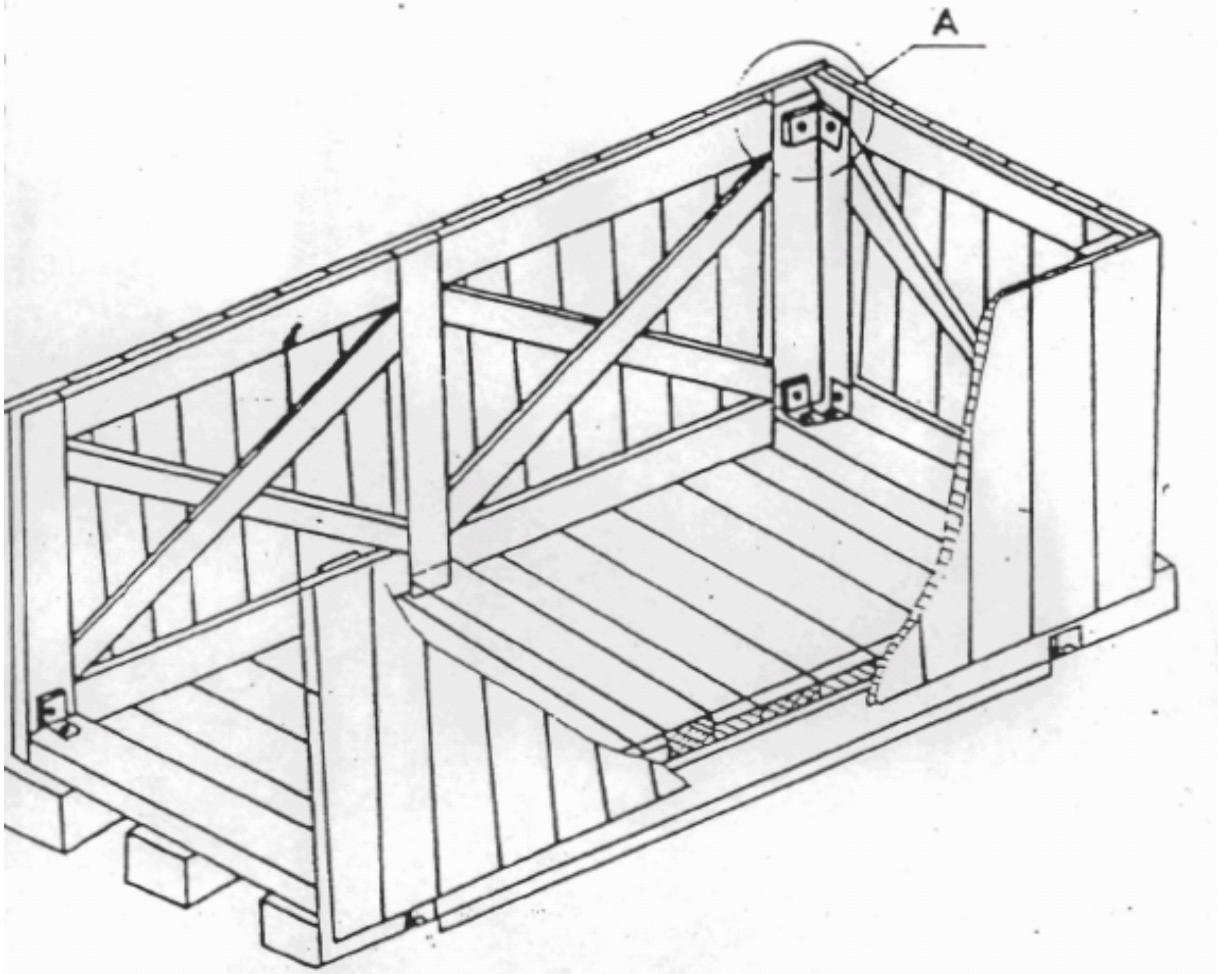


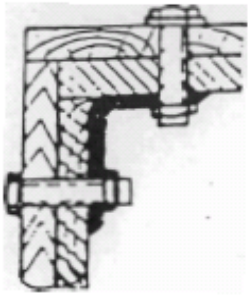
FIG: 7

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

The dimensions of various items shall be as Table-2

ARRANGEMENT OF PACKING CASE





DETAIL-A

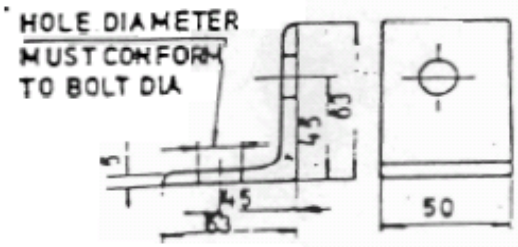


FIG:10

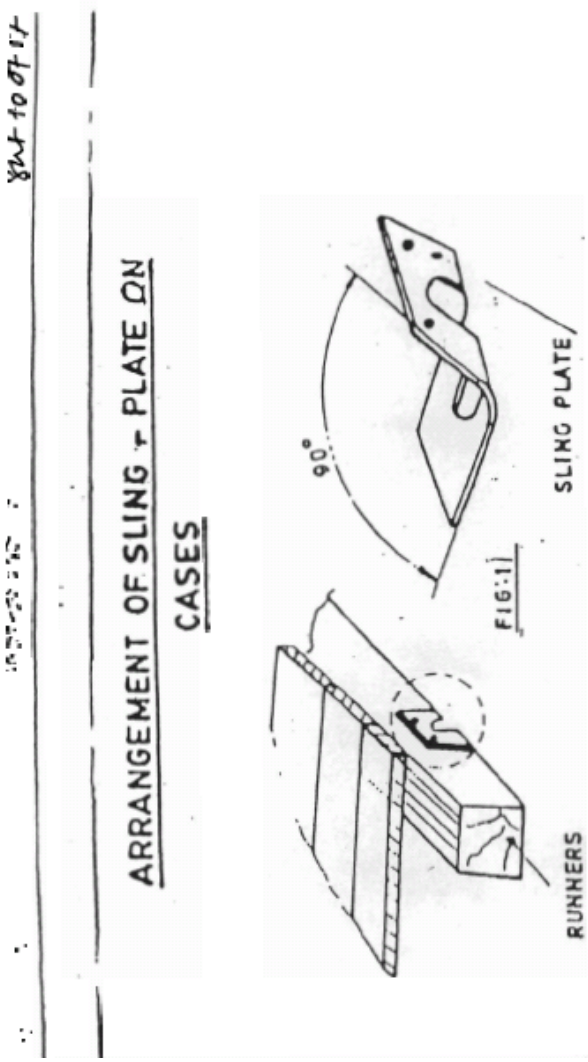

ARRANGEMENT OF SLING PLATE ON CASES
90°
SLING PLATE
RUNNERS
FIG:1

Table I

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

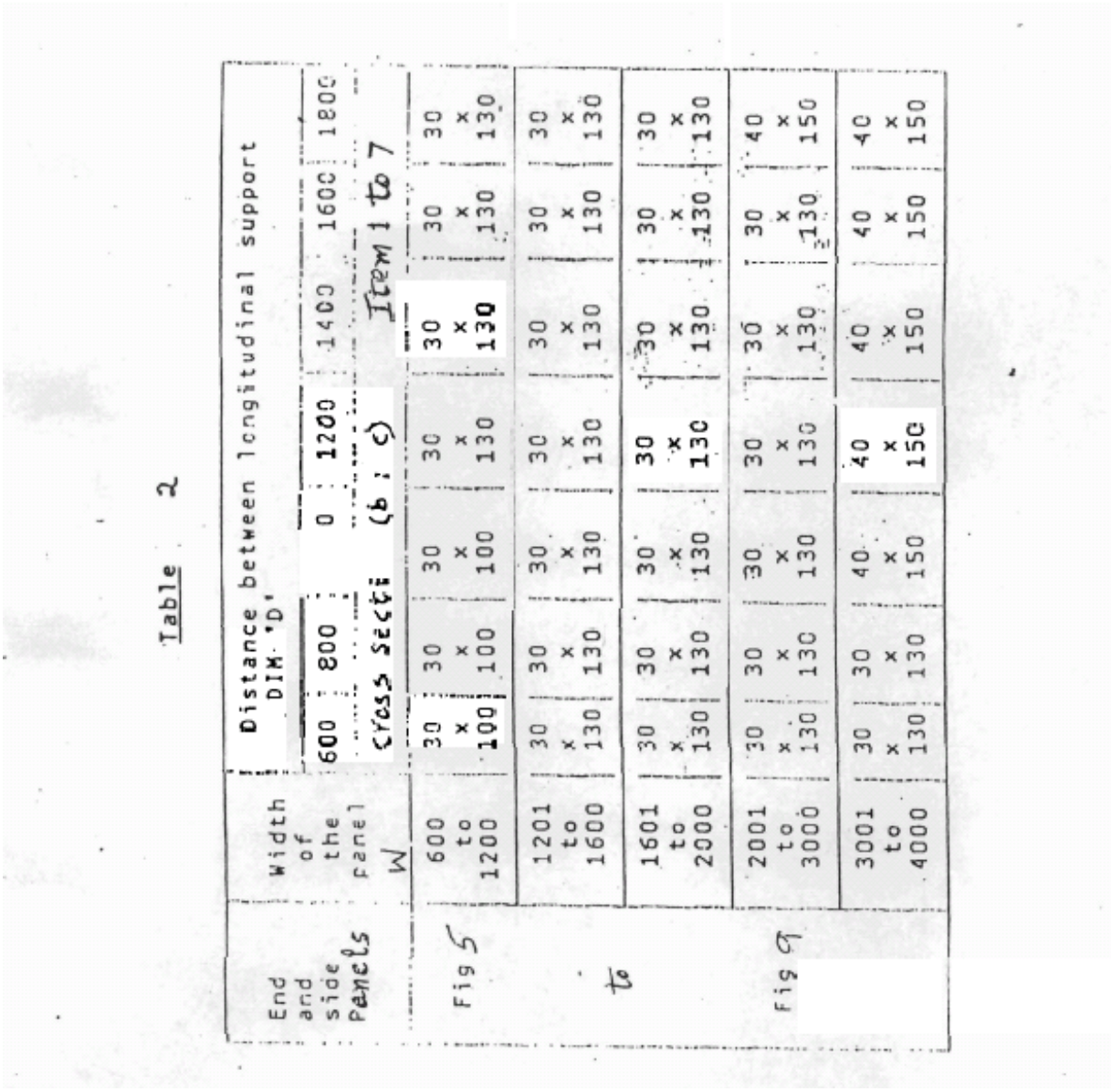


Table 2

End and side Panels	Width of the panel W	Distance between longitudinal support DIM 'D'											
		600 to 800			0 to 1200			1400 to 1600			1800		
Fig 5 to Fig 9		Cross section (b x c)						Item 1 to 7					
	600 to 1200	30 x 100	30 x 100	30 x 100	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		
	1601 to 2000	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			40 x 150		
	3001 to 4000	30 x 130	30 x 130	40 x 150	40 x 150			40 x 150			40 x 150		

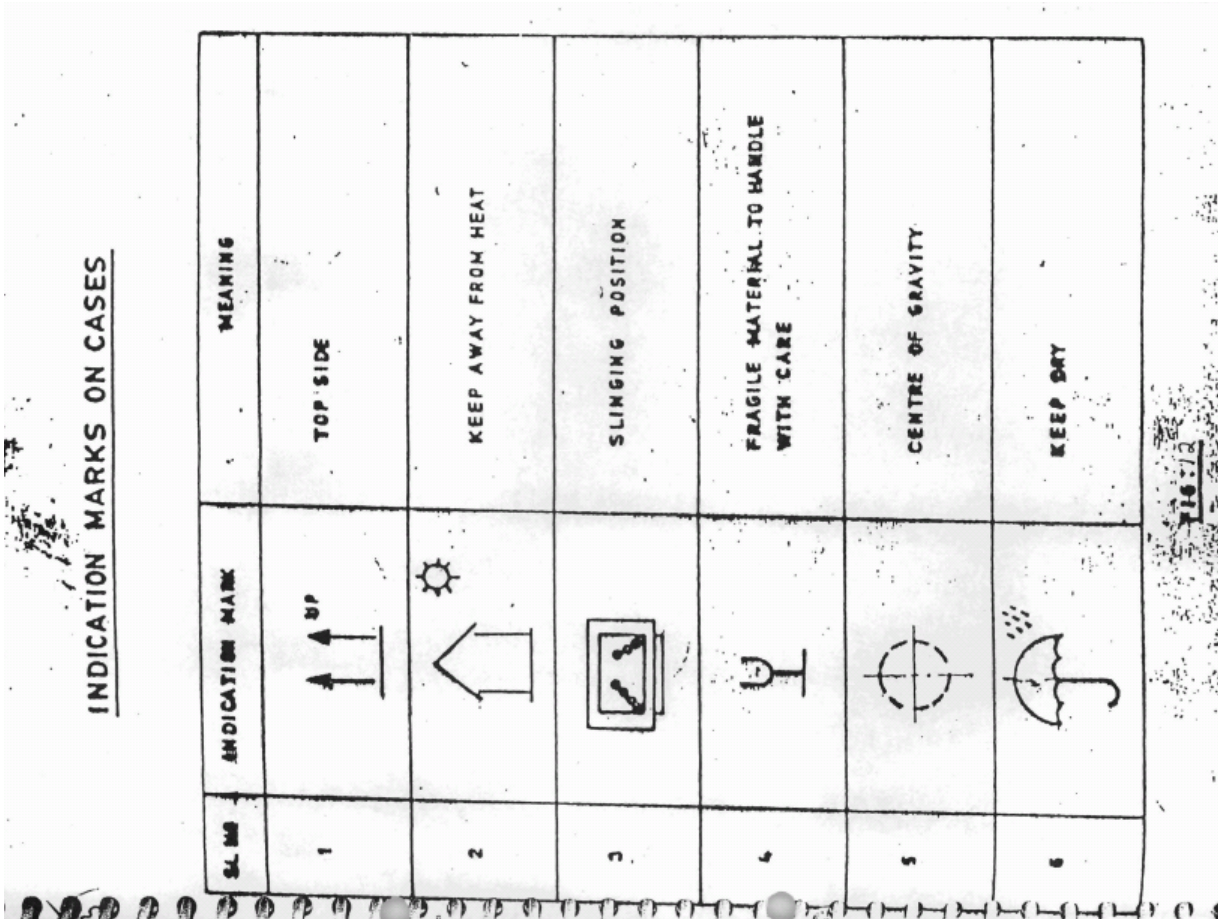

INDICATION MARKS ON CASES
SL NO
INDICATION MARK
MEANING
1
TOP SIDE
UP
2
KEEP AWAY FROM HEAT
3
SLINGING POSITION
4
FRAGILE MATERIAL TO HANDLE WITH CARE
5
CENTRE OF GRAVITY
6
KEEP DRY

FIG-13: MARKING PLATE

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

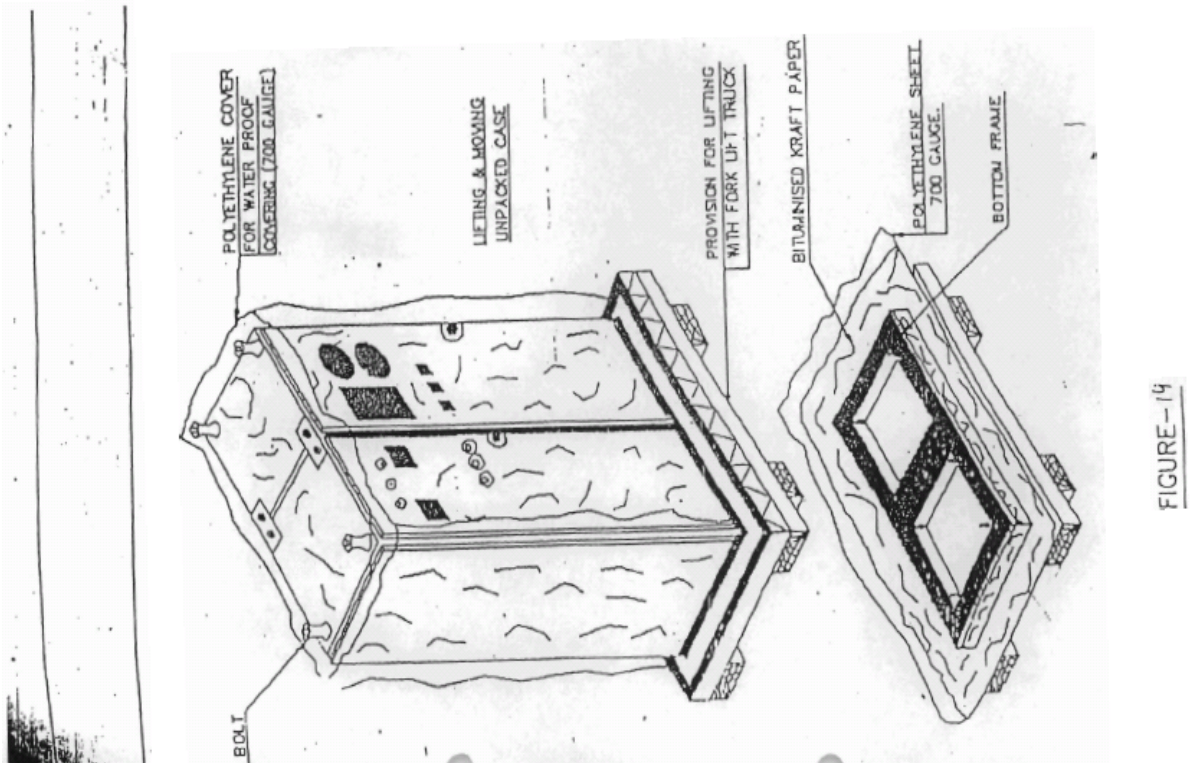


FIGURE-14

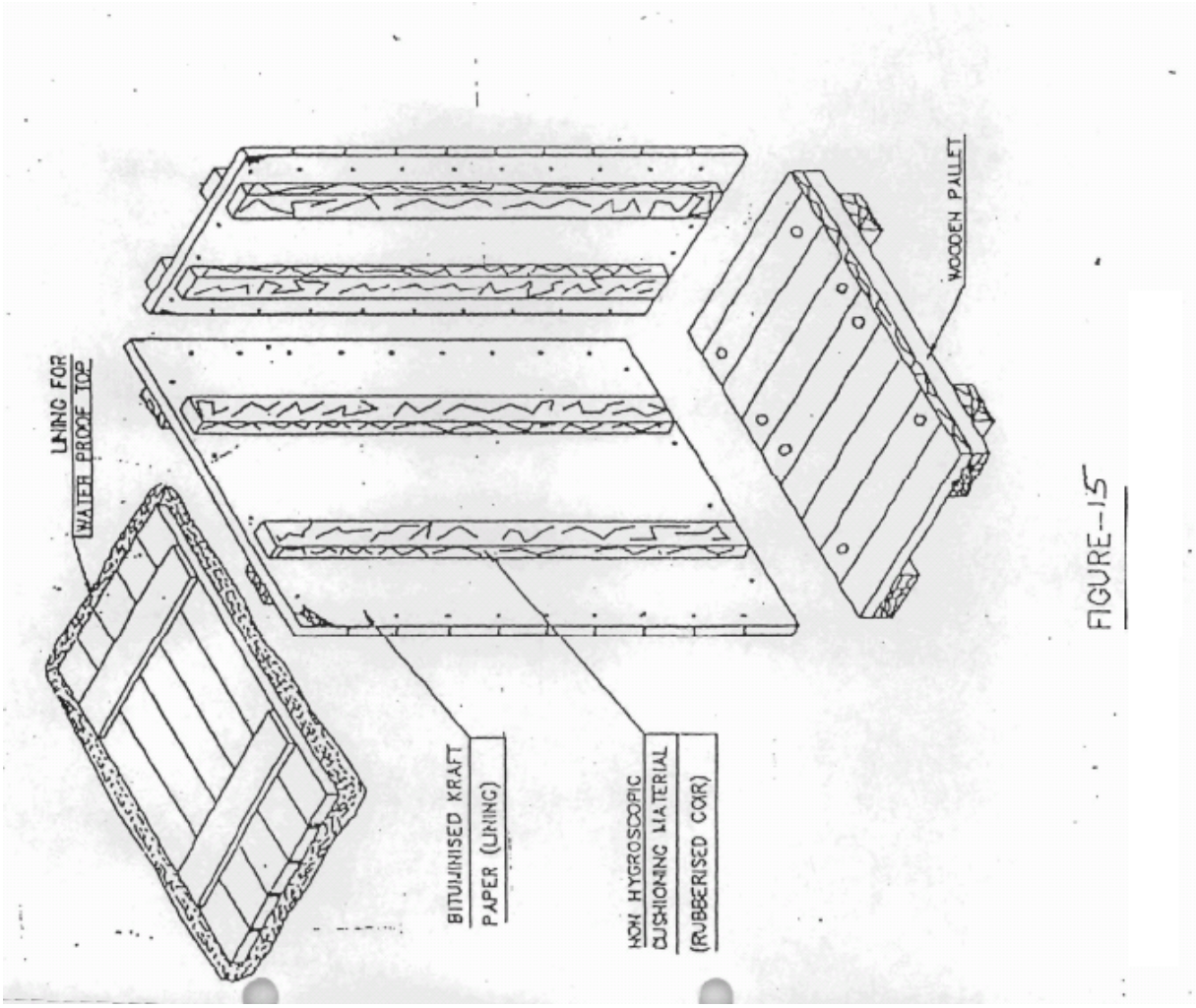

WOODEN PALLET
LINING FOR WATER PROOF TOP
BITUMINISED KRAFT PAPER (LINING)
NON HYGROSCOPIC CUSHIONING MATERIAL (RUBBERISED COIR)

FIGURE-15

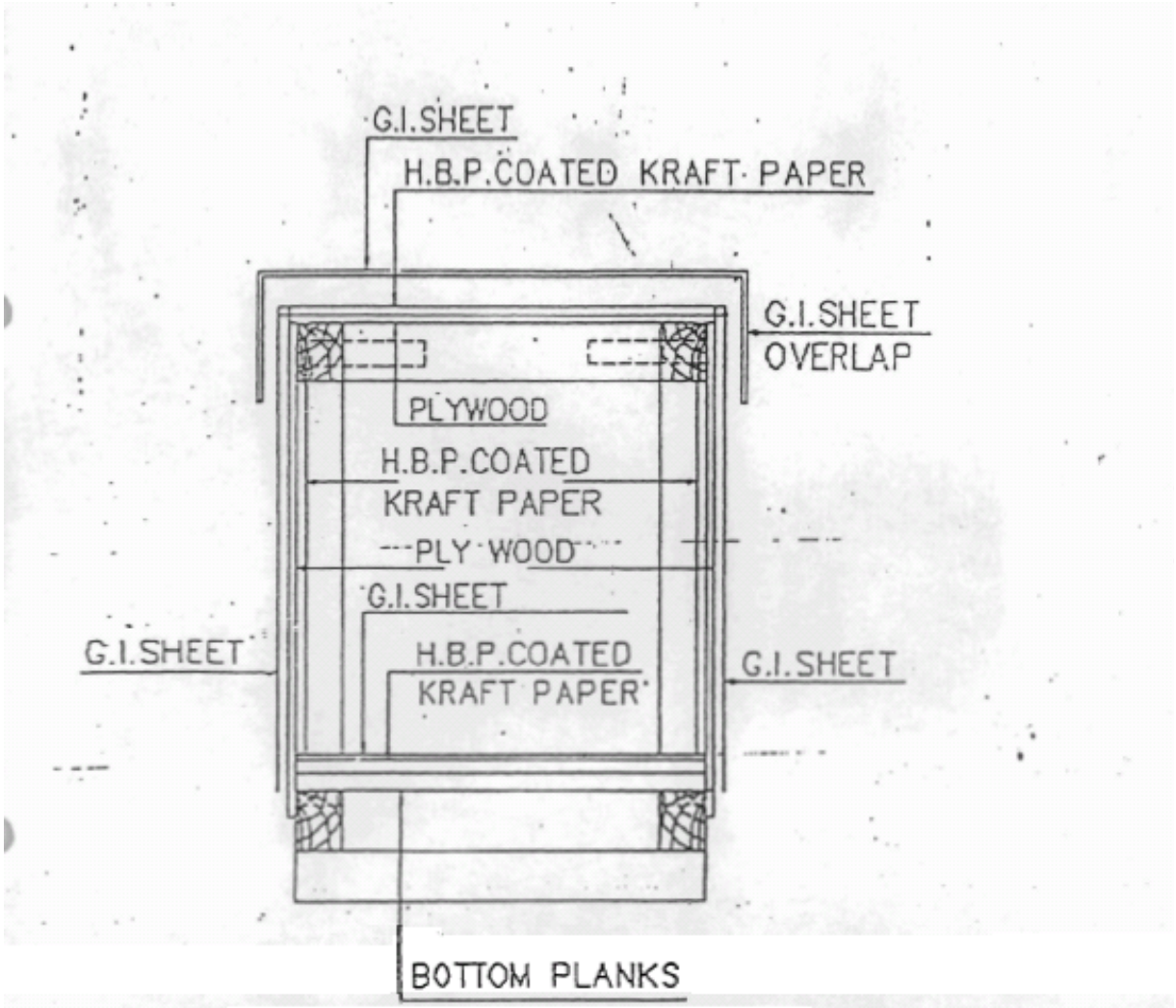


FIG-16 : CLOSED PACKING CASE WITH G.I.SHEET SHOWING LAYERS OF PACKING MATERIALS.