

A3

DRAWING No.

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-467-571-A901 REV 00

LINE SYMBOLS

SYMBOLS	NAME
	PIPE LINE
	CAPILLARY TUBING
	ELECTRIC SIGNAL
	SOFTWARE LINK
	PRESSURE LEAD
	DUCT

PIPING VALVE SYMBOLS

SYMBOLS	NAME
	GATE VALVE (NOR.CLOSED)
	GLOBE VALVE (NOR.CLOSED)
	BALL VALVE (NOR.CLOSED)
	BUTTERFLY VALVE (NOR.CLOSED)
	DIAPHRAGM VALVE (NOR.CLOSED)
	PINCH VALVE (NOR.CLOSED)
	NEEDLE VALVE (NOR.CLOSED)
	CHECK VALVE
	CHECK VALVE (WAFER)
	PRESSURE RELIEF VALVE
	KNIFE EDGE GATE VALVE

INSTRUMENT VALVE SYMBOLS

SYMBOLS	NAME
	ACTUATED BY AIR
	ACTUATED BY MOTOR
	AIR CONTROL VALVE
	SOLENOID ACTUATOR
	SELF REGULATING VALVE
	SELF REGULATING VALVE

TRENCH SYMBOLS

SYMBOLS	NAME
	TO ABSORBER AREA DRAIN SUMP
	TO GYPSUM AREA DRAIN SUMP
	TO LIMESTONE AREA DRAIN SUMP

SYMBOLS FOR PIPING PARTS & INSTRUMENT PARTS

SYMBOLS	NAME
	STEAM TRAP
	AIR TRAP
	Y-STRAINER
	T-STRAINER
	TEMPORARY STRAINER
	REDUCER
	EXPANSION JOINT
	DUCT EXPANSION JOINT
	FLEXIBLE HOSE
	SPOOL PIECE
	VENT
	HOSE CONNECTION
	BLIND FLANGE
	REDUCING FLANGE
	CAP (BW)
	CAP (SCR)
	TRENCH
	SIGHT GLASS
	SILENCER
	ORIFICE
	DIAPHRAGM
	MAGNETIC FLOW METER
	VORTEX FLOW METER
	PH METER
	FILTER
	MANHOLE
	PITOT TUBE
	SAMPLING POT
	SAMPLING NOZZLE
	ROTOMETER TYPE FLOW METER

SYMBOLS FOR VALVE OPERATION

SYMBOLS	NAME
	FAILURE OPEN (THE VALVE OPENS WHEN AIR OR ELECTRICITY FOR ACTUATOR FAILS.)
	FAILURE CLOSE (THE VALVE CLOSES WHEN AIR OR ELECTRICITY FOR ACTUATOR FAILS.)

INSULATION SYMBOLS

SYMBOLS	DESCRIPTION
H10	THERMAL INSULATION (100°C & LOWER)
H15	THERMAL INSULATION (101°C ~ 150°C)
H20	THERMAL INSULATION (151°C ~ 200°C)
H25	THERMAL INSULATION (201°C ~ 250°C)
H30	THERMAL INSULATION (251°C ~ 300°C)
H35	THERMAL INSULATION (301°C ~ 350°C)
HF	INSULATION FOR ANTI FREEZING
ET	ELECTRIC TRACE
ST	STEAM TRACE (LOW PRESSURE STEAM)
P10	PERSONAL PROTECTION (100°C & LOWER)
P15	PERSONAL PROTECTION (101°C ~ 150°C)
P20	PERSONAL PROTECTION (151°C ~ 200°C)
P25	PERSONAL PROTECTION (201°C ~ 250°C)
P30	PERSONAL PROTECTION (251°C ~ 300°C)
P35	PERSONAL PROTECTION (350°C ~ 400°C)

DELIVERY LIMITS

SYMBOLS	NAME
	BETWEEN NTPC AND CONTRACTOR
	BETWEEN SUB CONTRACTOR AND VENDOR

SYSTEM

NUMBER	NAME
1	FLUE GAS SYSTEM
2	SO ₂ ABSORPTION OXIDATION SYSTEM
3	REHEATING SYSTEM
4	GYPSUM DEWATERING HANDLING SYSTEM
5	LIMESTONE PREPARATION SYSTEM
6	BLANK
7	SUMP SYSTEM
8	UTILITY SYSTEM

FLUID NAME

FLUID SYMBOL	FLUID NAME	FLUID SYMBOL	FLUID NAME
AC	COMPRESSED AIR	WCS	COOLING WATER SUPPLY
AF	FLUIDIZER AIR	WCR	COOLING WATER RETURN
AI	INSTRUMENT AIR	WD	DRINKING WATER
AO	OXIDATION AIR	WP	PROCESS WATER
AS	SEAL AIR	WR	RAW WATER
DD	DUCT DRAIN	WC	Ca(OH) ₂ WATER
FS	FILTRATE SLURRY	WW	WASTE WATER
GS	GYPSUM SLURRY	VG	VACUUM PUMP VENT
LS	LIMESTONE SLURRY	VBG	BELT FILTER VENT GAS
		LD	LIME/LIMESTONE DEDUSTING
		LOL	LUBE OIL (LOW PRESSURE)
		LOH	LUBE OIL (HIGH PRESSURE)
		CW	CLARIFIED WATER

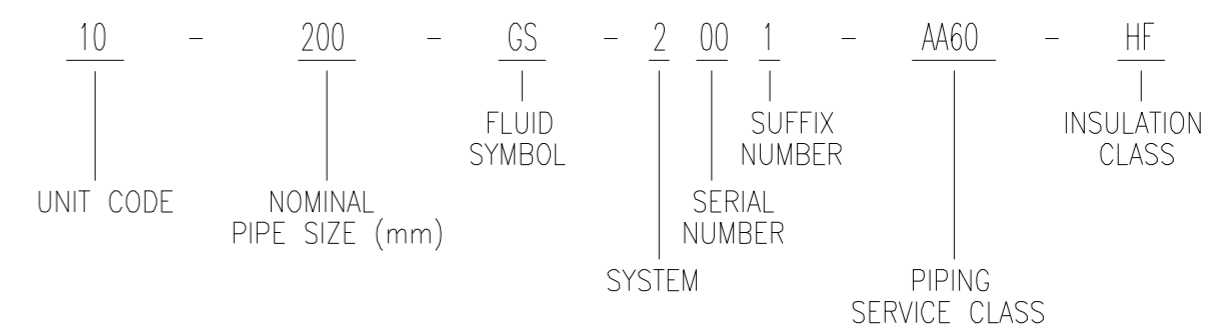
SERVICE CLASS

SERVICE CLASS	MATERIAL	FLUID SYMBOL
AA40	NATURAL RUBBER LINED PIPING	LS, WP, WC
AA60	NATURAL RUBBER LINED PIPING	GS,FS,WW,DD
BA01	Gr.304 STAINLESS STEEL PIPING / GI PIPING	AI, LOL
BA02	Gr.304 STAINLESS STEEL PIPING / GI PIPING	LOH
BA03	Gr.316L STAINLESS STEEL PIPING	WP, AO
CA01	CARBON STEEL GENERAL PIPING	AS,AO,AC,AF,LD
CC01	CARBON STEEL PRESSURE PIPING	WP,WR,WCS,WCR, VG, AA, CW
DA60	FRP PIPING (PIPE DIA UPTO 250 NB)	GS,FS,WW,DD
DA40	FRP PIPING (PIPE DIA UPTO 250 NB)	LS, WP, WC

UNIT CODE

SYMBOLS	UNIT IDENTIFICATION
00	COMMON
10	UNIT-1 FGD SYSTEM AND AUXILIARIES
20	UNIT-2 FGD SYSTEM AND AUXILIARIES

EXPRESSION OF PIPING LINE



CUSTOMER NOS:G509toG511&G208toG210

CUSTOMER: NTPC LIMITED.
PROJECT: RAMAGUNDAM STGI&II(3X500MW+3X200MW)
FGD SYSTEM PACKAGE

DEPT CODE	NAME (BHEL)	DATE
DRN	RAJU.P	25.04.20
CHD	P.NAVEEN	25.04.20
APPD	ACR/RSB	25.04.20

MITSUBISHI HITACHI POWER SYSTEMS, LTD.
AIR QUALITY CONTROL SYSTEMS TECHNOLOGY DIVISION

P & ID - LEGENDS AND NOTES

SCALE : NTS

TITLE:
NTPC DRG NO. SH 01 of 02

BHEL DRG NO	FILE NO	REV NO
	B240 - 00001	02

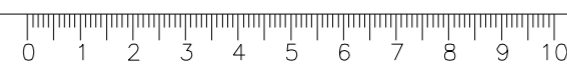
CONFIDENTIAL & PROPRIETARY INFORMATION

Rev 02 Rev 01

REV	DATE	ALT D	CHK	APPD	REV	DATE	ALT D	CHK	APPD
02	23.09.20	RAJU.P	NAVEEN	ACR	01	06.08.20	RAJU.P	NAVEEN	ACR

1.0 Included: Symbol for knife edge gate valve and change of material.
2.0 Revised the pipe material of BA01, BA02, BA03.
1.0 Included: FRP piping for pipe sizes less than 250 NB

CAUTION: THIS DRAWING IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LTD. AND IS NOT TO BE REPRODUCED OR USED TO FURNISH ANY INFORMATION FOR MAKING OF DRAWINGS OF APPARATUS EXCEPT WHERE PROVIDED FOR AGREEMENT WITH SAID COMPANY.



A3

DRAWING No.

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-467-571-A901 REV 00

THIRD ANGLE PROJECTION No. REQ'D

INSTRUMENT ABBREVIATION

	FIRST-LETTER		SUCCEEDING-LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER, COMBUSTION		BLANK	BLANK	BLANK
C	BLANK			CONTROL	
D	BLANK	DIFFERENTIAL			
E	VOLTAGE		SENSOR (PRIMARY ELEMENT)		
F	FLOW RATE	RATIO (FRACTION)			
G	BLANK		GLASS, VIEWING DEVICE		
H	HAND				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME, TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT		LOW
M	BLANK	MOMENTARY			MIDDLE, INTERMEDIATE
N	BLANK		BLANK	BLANK	BLANK
O	BLANK		ORIFICE, RESTRICTION		
P	PRESSURE, VACUUM		POINT(TE)ST CONNECTION		
Q	QUANTITY	INTEGRATE, TOTALIZE			
R	RADIATION		RECORD		
S	SPEED, FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION, MECHANICAL ANALYSIS			VALVE, DAMPER, LOUVER	
W	WEIGHT, FORCE		WELL		
X	UNCLASSIFIED	X AXIS	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT, STATE OR PRESENCE	Y AXIS		RELAY, COMPUTE, CONVERT	
Z	POSITION, DIMENSION	Z AXIS		DRIVER, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT	

INSTRUMENT SYMBOLS

SYMBOLS	NAME
	FIELD MOUNTED
	FOR CONTROL ROOM
	FOR LOCAL CONTROL PANEL
	FOR DCS
	INTERLOCK LOGIC

PNEUMATIC VALVE ACTUATOR

CODE NO.	ACTUATION
FLXXWA-D	DOUBLE SOLENOID NO LIMIT SWITCH
FLXXWA-DL	DOUBLE SOLENOID WITH LIMIT SWITCH
FLXXWA-S	SINGLE SOLENOID NO LIMIT SWITH
FLXXWA-SL	SINGLE SOLENOID WITH LIMIT SWITCH

MACHINERY SYMBOLS

SYMBOLS	NAME
	PUMP
	FAN / BLOWER
	AGITATOR (FLAT BLADE)
	AGITATOR (PROPELLOR)
	ROTARY VALVE
	CRUSHER
	BELT FEEDER
	BELT FILTER
	BALL MILL
	CYCLONE
	MIST ELIMINATOR

EQUIPMENT SYMBOLS

SYMBOLS	NAME
	BAG FILTER
	SILLO
	SLIDE GATE
	TANDEM LOUVER DAMPER (MULTIVANE)
	SINGLE STAGE LOUVER DAMPER (MULTIVANE)
	LOUVER DAMPER (SINGLE VANE)
	DISTRIBUTION BOX (3WAY)
	DISTRIBUTION BOX (2WAY)
	SUMP
	HEAT EXCHANGER
	SHELL AND TUBE HEAT EXCHANGER
	AIR DRYER
	FILTER
	SPRAY NOZZLE

DRIVER SYMBOLS

SYMBOLS	NAME
	AIR MOTOR
	ELECTRIC MOTOR

OTHER SYMBOLS

SYMBOLS	NAME
	INSERT PIPE / LANCE
	CHUTE
	TRUCK
	CHANGE OF MATERIAL

CONFIDENTIAL & PROPRIETARY INFORMATION

CUSTOMER NOS:G509toG511&G208toG210

CUSTOMER: NTPC LIMITED.			
PROJECT: RAMAGUNDAM STGI&II(3X500MW+3X200MW)			
FGD SYSTEM PACKAGE			
DEPT CODE	NAME (BHEL)	DATE	
DRN	RAJU.P	25.04.20	
M	P.NAVEEN	25.04.20	
APPD	ACR/RSB	25.04.20	

MITSUBISHI HITACHI POWER SYSTEMS, LTD.
AIR QUALITY CONTROL SYSTEMS TECHNOLOGY DIVISION

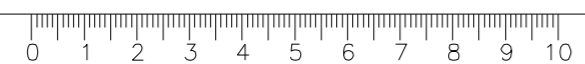
P & ID - LEGENDS AND NOTES

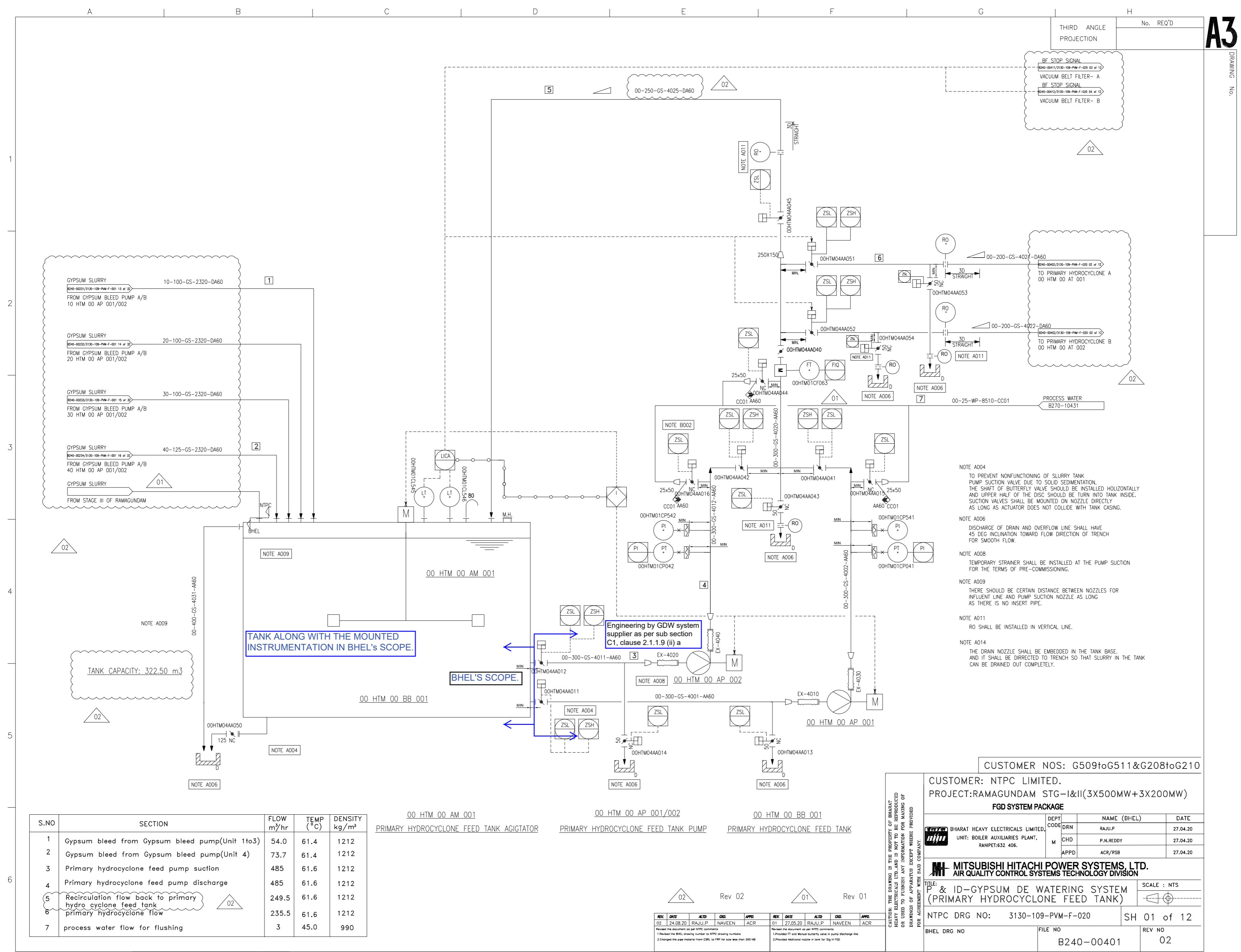
TITLE: NTPC DRG NO. SH 02 of 02

BHEL DRG NO. FILE NO. REV NO. B240 - 00002 02

REV	DATE	ALT	CHK	APP	REV	DATE	ALT	CHK	APP
02	23.09.20	RAJU.P	NAVEEN	ACR	01	06.08.20	RAJU.P	NAVEEN	ACR

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THIRD ANGLE PROJECTION
No. REQ'D

A3

DRAWING No.

- 1 GYPSUM SLURRY 10-100-GS-2320-DA60 FROM GYPSUM BLEED PUMP A/B 10 HTM 00 AP 001/002
- 2 GYPSUM SLURRY 20-100-GS-2320-DA60 FROM GYPSUM BLEED PUMP A/B 20 HTM 00 AP 001/002
- 3 GYPSUM SLURRY 30-100-GS-2320-DA60 FROM GYPSUM BLEED PUMP A/B 30 HTM 00 AP 001/002
- 4 GYPSUM SLURRY 40-125-GS-2320-DA60 FROM GYPSUM BLEED PUMP A/B 40 HTM 00 AP 001/002
- 5 GYPSUM SLURRY FROM STAGE III OF RAMAGUNDAM

TANK CAPACITY: 322.50 m³

TANK ALONG WITH THE MOUNTED INSTRUMENTATION IN BHEL'S SCOPE.

BHEL'S SCOPE.

Engineering by GDW system supplier as per sub section C.1, clause 2.1.1.9 (ii) a

- NOTE A004 TO PREVENT NONFUNCTIONING OF SLURRY TANK PUMP SUCTION VALVE DUE TO SOLID SEDIMENTATION, THE SHAFT OF BUTTERFLY VALVE SHOULD BE INSTALLED HORIZONTALLY AND UPPER HALF OF THE DISC SHOULD BE TURN INTO TANK INSIDE. SUCTION VALVES SHALL BE MOUNTED ON NOZZLE DIRECTLY AS LONG AS ACTUATOR DOES NOT COLLIDE WITH TANK CASING.
- NOTE A006 DISCHARGE OF DRAIN AND OVERFLOW LINE SHALL HAVE 45 DEG INCLINATION TOWARD FLOW DIRECTION OF TRENCH FOR SMOOTH FLOW.
- NOTE A008 TEMPORARY STRAINER SHALL BE INSTALLED AT THE PUMP SUCTION FOR THE TERMS OF PRE-COMMISSIONING.
- NOTE A009 THERE SHOULD BE CERTAIN DISTANCE BETWEEN NOZZLES FOR INFLUENT LINE AND PUMP SUCTION NOZZLE AS LONG AS THERE IS NO INSERT PIPE.
- NOTE A011 RO SHALL BE INSTALLED IN VERTICAL LINE.
- NOTE A014 THE DRAIN NOZZLE SHALL BE EMBEDDED IN THE TANK BASE. AND IT SHALL BE DIRECTED TO TRENCH SO THAT SLURRY IN THE TANK CAN BE DRAINED OUT COMPLETELY.

S.NO	SECTION	FLOW m ³ /hr	TEMP (°C)	DENSITY kg/m ³
1	Gypsum bleed from Gypsum bleed pump(Unit 1to3)	54.0	61.4	1212
2	Gypsum bleed from Gypsum bleed pump(Unit 4)	73.7	61.4	1212
3	Primary hydrocyclone feed pump suction	485	61.6	1212
4	Primary hydrocyclone feed pump discharge	485	61.6	1212
5	Recirculation flow back to primary hydro cyclone feed tank	249.5	61.6	1212
6	primary hydrocyclone flow	235.5	61.6	1212
7	process water flow for flushing	3	45.0	990

00 HTM 00 AM 001 PRIMARY HYDROCYCLONE FEED TANK AGITATOR
 00 HTM 00 AP 001/002 PRIMARY HYDROCYCLONE FEED TANK PUMP
 00 HTM 00 BB 001 PRIMARY HYDROCYCLONE FEED TANK

Rev 02 Rev 01

REV	DATE	BY	CHKD	APPD	REV	DATE	BY	CHKD	APPD
02	24.08.20	RAJULP	NAVEEN	ACR	01	27.05.20	RAJULP	NAVEEN	ACR

CUSTOMER NOS: G509toG511&G208toG210

CUSTOMER: NTPC LIMITED.
 PROJECT:RAMAGUNDAM STG-I&II(3X500MW+3X200MW)
FGD SYSTEM PACKAGE

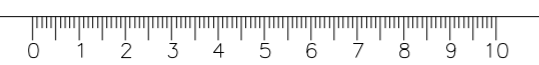
DEPT CODE	NAME (BHEL)	DATE
DRN	RAJULP	27.04.20
CHD	P.N.REDDY	27.04.20
APPD	ACR/RSB	27.04.20

MITSUBISHI HITACHI POWER SYSTEMS, LTD.
 AIR QUALITY CONTROL SYSTEMS TECHNOLOGY DIVISION

TITLE: P & ID-GYPSUM DE WATERING SYSTEM (PRIMARY HYDROCYCLONE FEED TANK) SCALE: NTS

NTPC DRG NO: 3130-109-PVM-F-020 SH 01 of 12

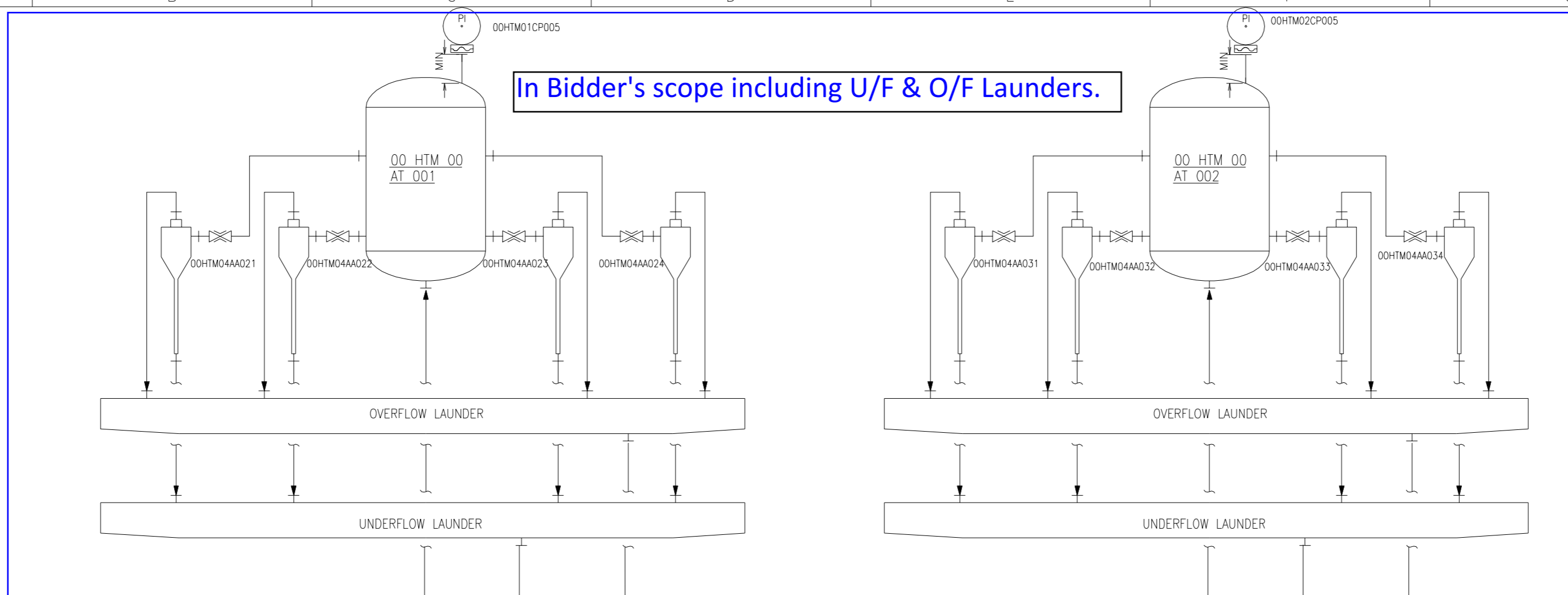
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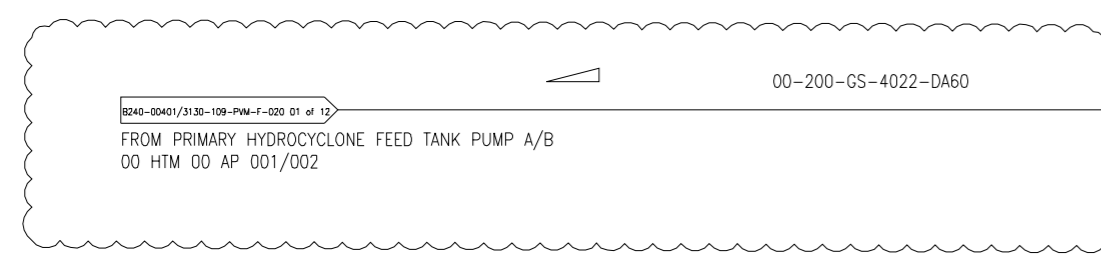
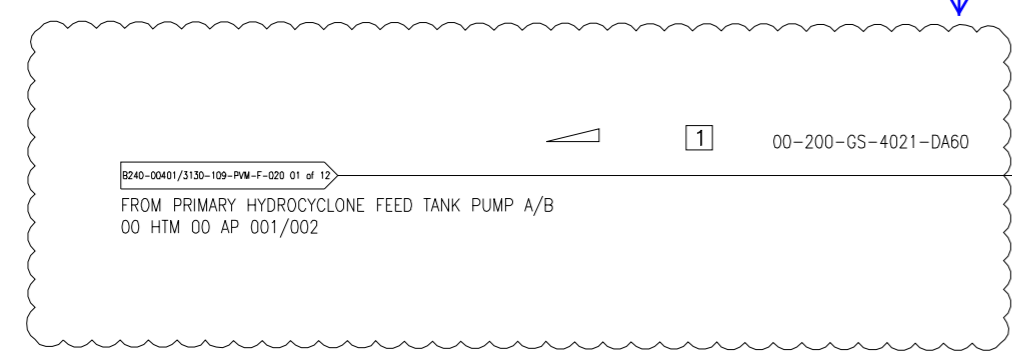
THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-467-571-A901 REV 00

THIRD ANGLE PROJECTION No. REQ'D **A3**

DRAWING No.



NOTE: NUMBER OF VALVES & HYDROCYCLONES SHALL BE FINALIZED AFTER VENDOR'S INFORMATION



Engineering & Supply by Bidder

Engineering by Bidder as per sub section C1, clause 2.1.1.9 (ii) a.

Engineering & Supply by Bidder

Engineering by Bidder as per sub section C1, clause 2.1.1.9 (ii) b.

Engineering & Supply by Bidder

Engineering by Bidder as per sub section C1, clause 2.1.1.9 (ii) a.

Engineering & Supply by Bidder

Engineering by Bidder as per sub section C1, clause 2.1.1.9 (ii) b.

Engineering & supply by Bidder as per sub section C1, clause 2.1.1.9 (i) a

Engineering & supply by Bidder as per sub section C1, clause 2.1.1.9 (i) a

00 HTM 00 AT 001/002
PRIMARY HYDROCYCLONE A/B - Capacity : 259.0 m³/hr

S NO	SECTION	FLOW m ³ /hr	TEMP (°C)	DENSITY kg/m ³
1	Primary hydrocyclone feed flow	234.5	61.4	1212
2	Primary hydrocyclone underflow	99.5	61.4	1358
3	Primary hydrocyclone overflow	136.0	61.4	1108

CUSTOMER NOS: G509toG511&G209toG210

CUSTOMER: NTPC LIMITED.
PROJECT:RAMAGUNDAM STG-I&II(3X500MW+3X200MW)
FGD SYSTEM PACKAGE

DEPT CODE	NAME (BHEL)	DATE
DRN	RAJU.P	27.04.20
M	P.N.REDDY	27.04.20
APPD	ACR/RSB	27.04.20

MITSUBISHI HITACHI POWER SYSTEMS, LTD.
AIR QUALITY CONTROL SYSTEMS TECHNOLOGY DIVISION

TITLE: P & ID-GYPSUM DE WATERING SYSTEM (PRIMARY HYDROCYCLONE)
SCALE : NTS

NTPC DRG NO: 3130-109-PVM-F-020 SH 02 of 12

BHEL DRG NO FILE NO REV NO
B240-00402 02

REV	DATE	AL/D	CHK	APPR	REV	DATE	AL/D	CHK	APPR
02	25.08.20	RAJU.P	NAVEEN	ACR	01	27.05.20	RAJU.P	NAVEEN	ACR

1.Revised the document as per NTPC comments
2.Changed the pipe material from CS to PPR for size less than 300 NB

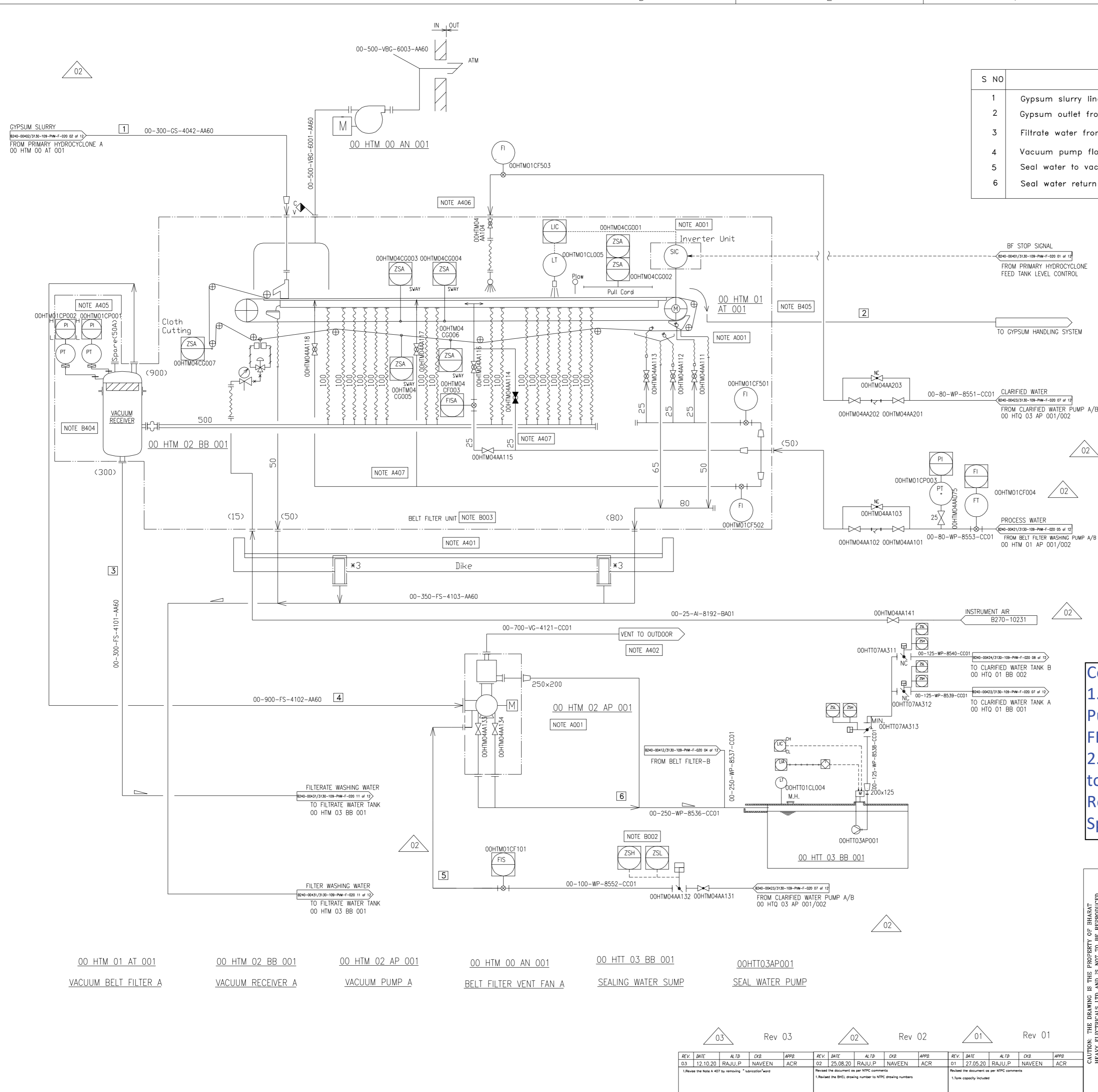
1.Include Note
2.Hydrocyclone capacity included

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THIRD ANGLE	No. REQ'D
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S NO	SECTION	FLOW m3/hr	TEMP(°C)	DENSITY kg/m3
1	Gypsum slurry line to belt filter	99.5	61.4	1357
2	Gypsum outlet from belt filter to gypsum handling system	67.1 TPH	58	900
3	Filtrate water from vacuum receiver to filtrate water tank	92.0	61.4	1006
4	Vacuum pump flow	LATER	LATER	LATER
5	Seal water to vacuum pump	48.9	45.0	990
6	Seal water return	48.9	45.0	990

- NOTE A001: MOTOR PID ARE NOT SHOWN.
- NOTE B002: OPEN AND CLOSE CONTACT SWITCHES ARE FOR REFERENCE ONLY. IN CASE THAT THERE IS CUSTOMER'S SPECIFICATION, THEY SHOULD BE DECIDED BASED ON IT.
- NOTE B003: SYSTEM COMPONENTS WRITTEN IN THE DRAWING ARE JUST DEFAULT. TYPE WILL BE SUBJECT TO CHANGE DUE TO VENDOR SELECTION.
- NOTE B005: PIPE SIZE WRITTEN IN THE DRAWING IS TYPICAL. IT SHOULD BE REVIEWED.
- NOTE A401: SURFACE OF CONCRETE FOUNDATION SHALL BE LINED WITH ANTI CORROSION MATERIAL.
- NOTE A402: BIRD SCREEN SHALL BE INSTALLED.
- NOTE A405: NOZZLE OF PRESSURE INDICATOR SHALL NOT HAVE A POCKET. IT MAY CAUSE REMAIN OF DRAIN.
- NOTE A406: CAKE WASH PIPING SHALL BE MOVABLE SO THAT ITS POSITION CAN BE ADJUSTED WELL DURING COMMISSIONING.
- NOTE A407: (WASH, AND SEAL WATER PIPING SHALL) BE DESIGNED TO DISTRIBUTE WATER EQUALLY (EX. TO CONNECT SUPPLY LINE TO MIDDLE OF HEADER).
- NOTE B403: STRAINER CAN BE OMITTED IF ANOTHER ONE IS APPLIED UPSTREAM.
- NOTE B404: TWO VACUUM RECEIVERS MAY BE REQUIRED DEPENDING ON THE CAPACITY OR PROCESS REQUIREMENT.
- NOTE B405: GYPSUM CHUTE SHALL BE DESIGNED VERTICALLY, NOT OBLIQUELY.

Complete System in Bidder scope EXCEPT:

1. Piping with accessories from Filtrate Extraction Pump to Filtrate Water Tank. Refer Scheme No. PE-FEP-00.
2. Associated drain of vacuum belt filters (drip tray) to filtrate tanks. Refer sub section C1, clause 2.1.1.9 (ii) f of the Specification.

CUSTOMER NOS: G509toG511&G208toG210

CUSTOMER: NTPC LIMITED.
 PROJECT:RAMAGUNDAM STG-I&II(3X500MW+3X200MW)
 FGD SYSTEM PACKAGE

DEPT	NAME (BHEL)	DATE
CODE DRN	RAJULP	27.04.20
M CHD	P.N.REDDY	27.04.20
APPD	ACR/RSB	27.04.20

MITSUBISHI HITACHI POWER SYSTEMS, LTD.
 AIR QUALITY CONTROL SYSTEMS TECHNOLOGY DIVISION

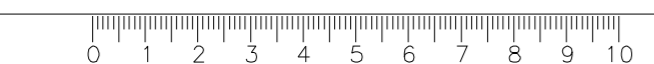
TITLE: P & ID-GYPSUM DE WATERING SYSTEM (GYPSUM BELT FILTER A)
 SCALE: NTS

NTPC DRG NO: 3130-109-PVM-F-020 SH 03 of 12

BHEL DRG NO FILE NO REV NO
 B240-00411 03

REV	DATE	AL	DR	APPD	REV	DATE	AL	DR	APPD	REV	DATE	AL	DR	APPD
03	12.10.20	RAJULP	NAVEEN	ACR	02	25.08.20	RAJULP	NAVEEN	ACR	01	27.05.20	RAJULP	NAVEEN	ACR

1. Revised the Note A 407 by removing "Substation" word
 1. Revised the BHEL drawing number to NTPC drawing numbers
 1. Type copy only included



THIRD ANGLE	No. REQ'D
	A3

DRAWING No.

Same scope as that of Belt filter -A.

S NO	SECTION	FLOW m ³ /hr	TEMP(°C)	DENSITY kg/m ³
1	Gypsum slurry line to belt filter	99.5	61.4	1357
2	Gypsum outlet from belt filter to gypsum handling system	67.1 TPH	55.8	900
3	Filtrate water from vacuum receiver to filtrate water tank	92.0	61.4	1006
4	Vacuum pump flow	LATER	LATER	LATER
5	Seal water to vacuum pump	48.9	45.0	990
6	Seal water return	48.9	45.0	990

- NOTE A001 MOTOR PID ARE NOT SHOWN.
- NOTE B002 OPEN AND CLOSE CONTACT SWITCHES ARE FOR REFERENCE ONLY. IN CASE THERE IS CUSTOMER'S SPECIFICATION, THEY SHOULD BE DECIDED BASED ON IT.
- NOTE B003 SYSTEM COMPONENTS WRITTEN IN THE DRAWING ARE JUST DEFAULT. TYPE WILL BE SUBJECT TO CHANGE DUE TO VENDOR SELECTION.
- NOTE B005 PIPE SIZE WRITTEN IN THE DRAWING IS TYPICAL. IT SHOULD BE REVIEWED.
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- NOTE A402 BIRD SCREEN SHALL BE INSTALLED.
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- NOTE A406 CAKE WASH PIPING SHALL BE MOVABLE SO THAT ITS POSITION CAN BE ADJUSTED WELL DURING COMMISSIONING.
- NOTE A407 WASH AND SEAL WATER PIPING SHALL BE DESIGNED TO DISTRIBUTE WATER EQUALLY (EX. TO CONNECT SUPPLY LINE TO MIDDLE OF HEADER).
- NOTE B403 STRAINER CAN BE OMITTED IF ANOTHER ONE IS APPLIED UPSTREAM.
- NOTE B404 TWO VACUUM RECEIVERS MAY BE REQUIRED DEPENDING ON THE CAPACITY OR PROCESS REQUIREMENT.
- NOTE B405 GYPSUM CHUTE SHALL BE DESIGNED VERTICALLY, NOT OBLIQUELY.

Complete System in Bidder scope EXCEPT:

1. Piping with accessories from Filtrate Extraction Pump to Filtrate Water Tank. Refer Scheme No. PE-FEP-00.
2. Associated drain of vacuum belt filters (drip tray) to filtrate tanks.

Refer sub section C1, clause 2.1.1.9 (ii) f of the Specification.

CUSTOMER NOS: G509toG511&G208toG210

CUSTOMER: NTPC LIMITED.
PROJECT:RAMAGUNDAM STG-I&II(3X500MW+3X200MW)
FGD SYSTEM PACKAGE

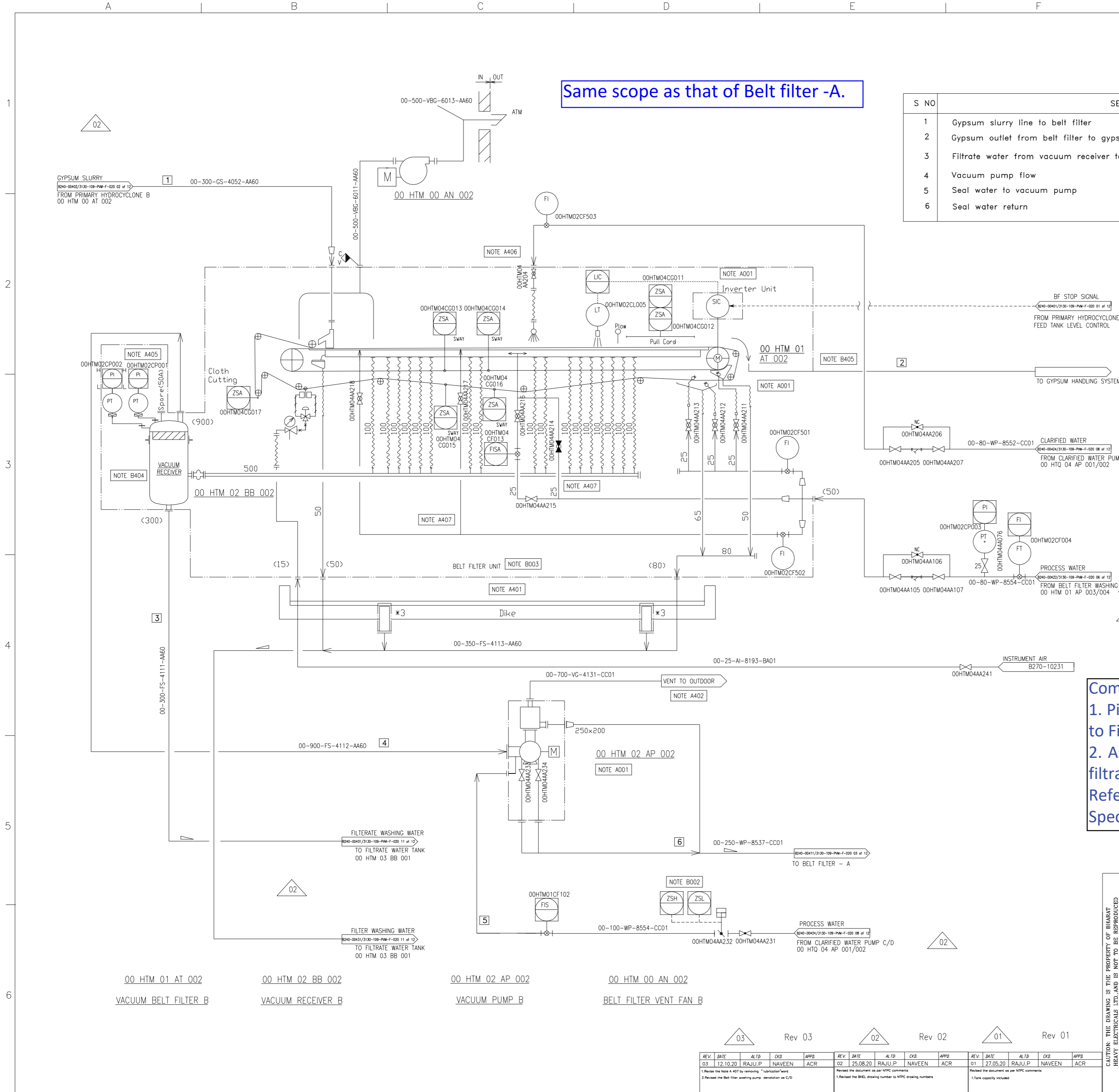
DEPT CODE	NAME (BHEL)	DATE
DRN	RAJULP	27.04.20
CHD	P.N.REDDY	27.04.20
APPD	ACR/RSB	27.04.20

MITSUBISHI HITACHI POWER SYSTEMS, LTD.
AIR QUALITY CONTROL SYSTEMS TECHNOLOGY DIVISION

TITLE: **P & ID-GYPSUM DE WATERING SYSTEM (GYPSUM BELT FILTER B)** SCALE : NTS

NTPC DRG NO: 3130-109-PVM-F-020 SH 04 of 12

BHEL DRG NO FILE NO REV NO
B240-00412 03

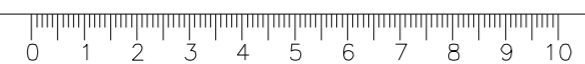


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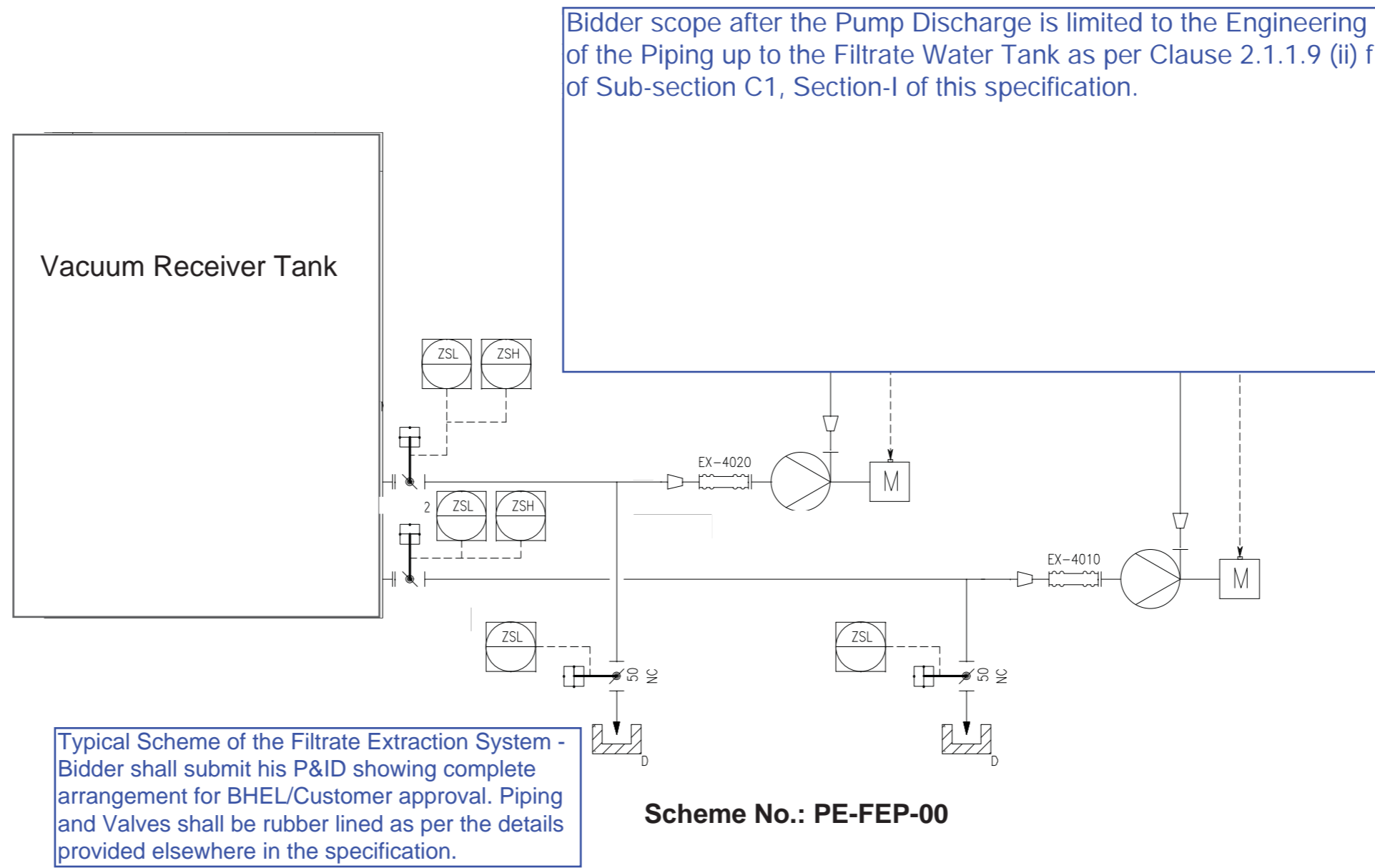
00 HTM 01 AT 002 VACUUM BELT FILTER B
00 HTM 02 BB 002 VACUUM RECEIVER B
00 HTM 02 AP 002 VACUUM PUMP B
00 HTM 00 AN 002 BELT FILTER VENT FAN B

Rev 03
Rev 02
Rev 01

REV	DATE	ALTD	CHK	APPD	REV	DATE	ALTD	CHK	APPD	REV	DATE	ALTD	CHK	APPD
03	12.10.20	RAJULP	NAVEEN	ACR	02	25.08.20	RAJULP	NAVEEN	ACR	01	27.05.20	RAJULP	NAVEEN	ACR



THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-467-571-A901 REV 00



Typical Scheme of the Filtrate Extraction System - Bidder shall submit his P&ID showing complete arrangement for BHEL/Customer approval. Piping and Valves shall be rubber lined as per the details provided elsewhere in the specification.

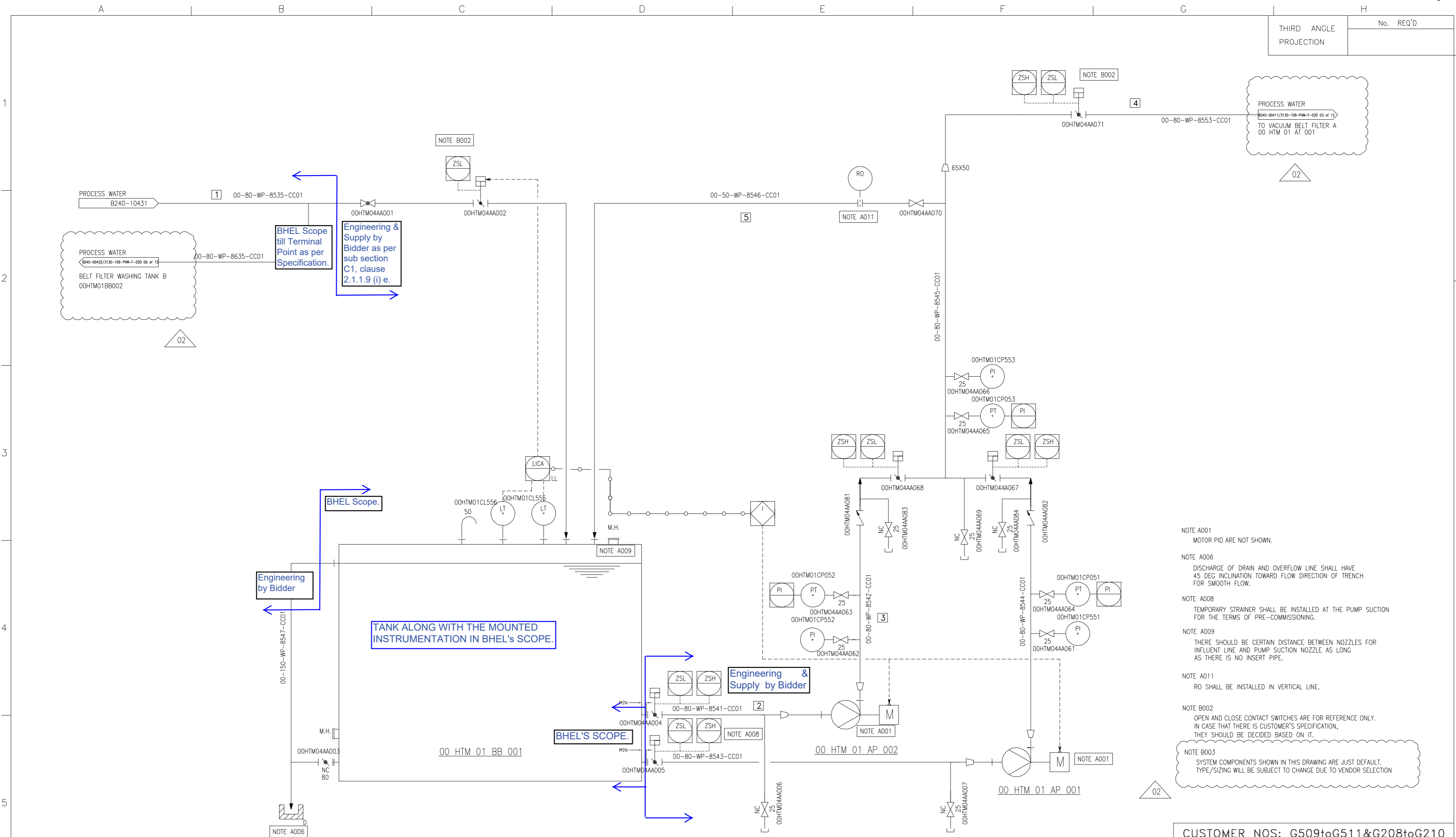
Scheme No.: PE-FEP-00

THIRD ANGLE PROJECTION

No. REQ'D

DRAWING No.

THIS IS PART OF TECHNICAL SPECIFICATION PE-IS-467-571-A901 REV 00



- NOTE A001
MOTOR PID ARE NOT SHOWN.
- NOTE A006
DISCHARGE OF DRAIN AND OVERFLOW LINE SHALL HAVE 45 DEG INCLINATION TOWARD FLOW DIRECTION OF TRENCH FOR SMOOTH FLOW.
- NOTE A008
TEMPORARY STRAINER SHALL BE INSTALLED AT THE PUMP SUCTION FOR THE TERMS OF PRE-COMMISSIONING.
- NOTE A009
THERE SHOULD BE CERTAIN DISTANCE BETWEEN NOZZLES FOR INFLUENT LINE AND PUMP SUCTION NOZZLE AS LONG AS THERE IS NO INSERT PIPE.
- NOTE A011
RO SHALL BE INSTALLED IN VERTICAL LINE.
- NOTE B002
OPEN AND CLOSE CONTACT SWITCHES ARE FOR REFERENCE ONLY. IN CASE THAT THERE IS CUSTOMER'S SPECIFICATION, THEY SHOULD BE DECIDED BASED ON IT.
- NOTE B003
SYSTEM COMPONENTS SHOWN IN THIS DRAWING ARE JUST DEFAULT. TYPE/SIZING WILL BE SUBJECT TO CHANGE DUE TO VENDOR SELECTION

00 HTM 01 BB 001
BELT FILTER WASHING TANK, Capacity : 43.9 m³

00 HTM 01 AP 001/002
BELT AND CLOTH WASHING TANK PUMP A/B

S NO	SECTION	FLOW m ³ /hr	TEMP(°C)	DENSITY kg/m ³
1	Process water to belt filter wash tank	24.8	45.0	990
2	At the suction of belt filter wash pump	31.0	45.0	990
3	At the discharge of belt filter wash pump	31.0	45.0	990
4	Wash water to belt filter	24.8	45.0	990
5	Recirculation flow to Belt filter wash tank	6.2	45.0	990

CUSTOMER NOS: G509toG511&G208toG210

CUSTOMER: NTPC LIMITED.
PROJECT:RAMAGUNDAM STG-I&II(3X500MW+3X200MW)
FGD SYSTEM PACKAGE

DEPT CODE	NAME (BHEL)	DATE
DRN	RAJU.P	27.04.20
M	P.N.REDDY	27.04.20
APPD	ACR/RSB	27.04.20

MITSUBISHI HITACHI POWER SYSTEMS, LTD.
AIR QUALITY CONTROL SYSTEMS TECHNOLOGY DIVISION

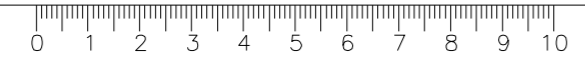
TITLE: P & ID-GYPSUM DE WATERING SYSTEM (BELT & CLOTH WASHING TANK A)
SCALE : NTS

NTPC DRG NO: 3130-109-PVM-F-020 SH 05 of 12

BHEL DRG NO: B240-00421 FILE NO: B240-00421 REV NO: 02

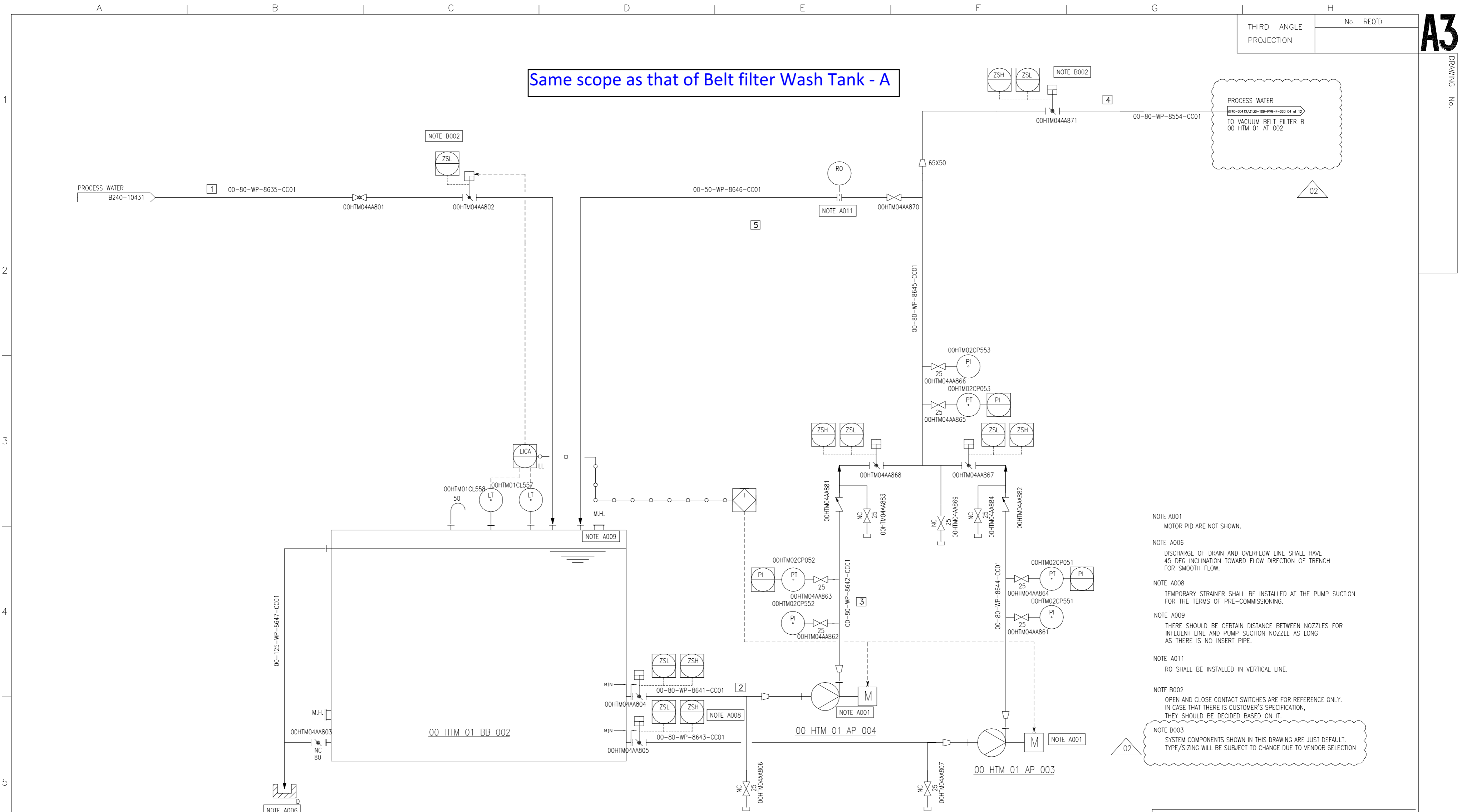
REV.	DATE	BY	CHK	APPD	REV.	DATE	BY	CHK	APPD
02	24.08.20	RAJU.P	NAVEEN	ACR	01	27.05.20	RAJU.P	NAVEEN	ACR

1. Revised the BHEL drawing number to NTPC drawing numbers.
2. Rev capacity intrested.



THIRD ANGLE PROJECTION No. REQ'D **A3**

Same scope as that of Belt filter Wash Tank - A



- NOTE A001
MOTOR PID ARE NOT SHOWN.
- NOTE A006
DISCHARGE OF DRAIN AND OVERFLOW LINE SHALL HAVE 45 DEG INCLINATION TOWARD FLOW DIRECTION OF TRENCH FOR SMOOTH FLOW.
- NOTE A008
TEMPORARY STRAINER SHALL BE INSTALLED AT THE PUMP SUCTION FOR THE TERMS OF PRE-COMMISSIONING.
- NOTE A009
THERE SHOULD BE CERTAIN DISTANCE BETWEEN NOZZLES FOR INFLUENT LINE AND PUMP SUCTION NOZZLE AS LONG AS THERE IS NO INSERT PIPE.
- NOTE A011
RO SHALL BE INSTALLED IN VERTICAL LINE.
- NOTE B002
OPEN AND CLOSE CONTACT SWITCHES ARE FOR REFERENCE ONLY. IN CASE THAT THERE IS CUSTOMER'S SPECIFICATION, THEY SHOULD BE DECIDED BASED ON IT.
- NOTE B003
SYSTEM COMPONENTS SHOWN IN THIS DRAWING ARE JUST DEFAULT. TYPE/SIZING WILL BE SUBJECT TO CHANGE DUE TO VENDOR SELECTION

00 HTM 01 BB 002
BELT FILTER WASHING TANK B_Capacity : 43.9 m3

00 HTM 01 AP 003/004
BELT & CLOTH WASHING TANK PUMP C/D

S NO	SECTION	FLOW m3/hr	TEMP(C)	DENSITY kg/m3
1	Process water to belt filter wash tank	24.8	45.0	990
2	At the suction of belt filter wash pump	31.0	45.0	990
3	At the discharge of belt filter wash pump	31.0	45.0	990
4	Wash water to belt filter	24.8	45.0	990
5	Recirculation flow to Belt filter wash tank	6.2	45.0	990

CUSTOMER NOS: G509toG511&G208toG210

CUSTOMER: NTPC LIMITED.
PROJECT:RAMAGUNDAM STG-I&II(3X500MW+3X200MW)
FGD SYSTEM PACKAGE

DEPT	NAME (BHEL)	DATE
DRN	RAJU.P	27.04.20
CHD	P.N.REDDY	27.04.20
APPD	ACR/RSB	27.04.20

MITSUBISHI HITACHI POWER SYSTEMS, LTD.
AIR QUALITY CONTROL SYSTEMS TECHNOLOGY DIVISION

SCALE : NTS
P & ID-GYPSUM DE WATERING SYSTEM (BELT & CLOTH WASHING TANK B)

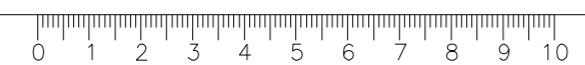
NTPC DRG NO: 3130-109-PVM-F-020 SH 06 of 12

BHEL DRG NO FILE NO REV NO
B240-00422 02

REV	DATE	ALTD	CHKD	APPD	REV	DATE	ALTD	CHKD	APPD
02	24.08.20	RAJU.P	NAVEEN	ACR	01	27.05.20	RAJU.P	NAVEEN	ACR

1. Revised the document as per NTPC comments
2. Revised the BHEL drawing number to NTPC drawing numbers
1. Revised the document as per NTPC comments
2. Revised the name of tank to Belt and cloth washing tank
2. Tank capacity included

CAUTION: THE DRAWING IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LTD. AND IS NOT TO BE REPRODUCED OR USED TO FURNISH ANY INFORMATION FOR MAKING OF DRAWINGS OF APPARATUS EXCEPT WHERE PROVIDED FOR AGREEMENT WITH SAID COMPANY.



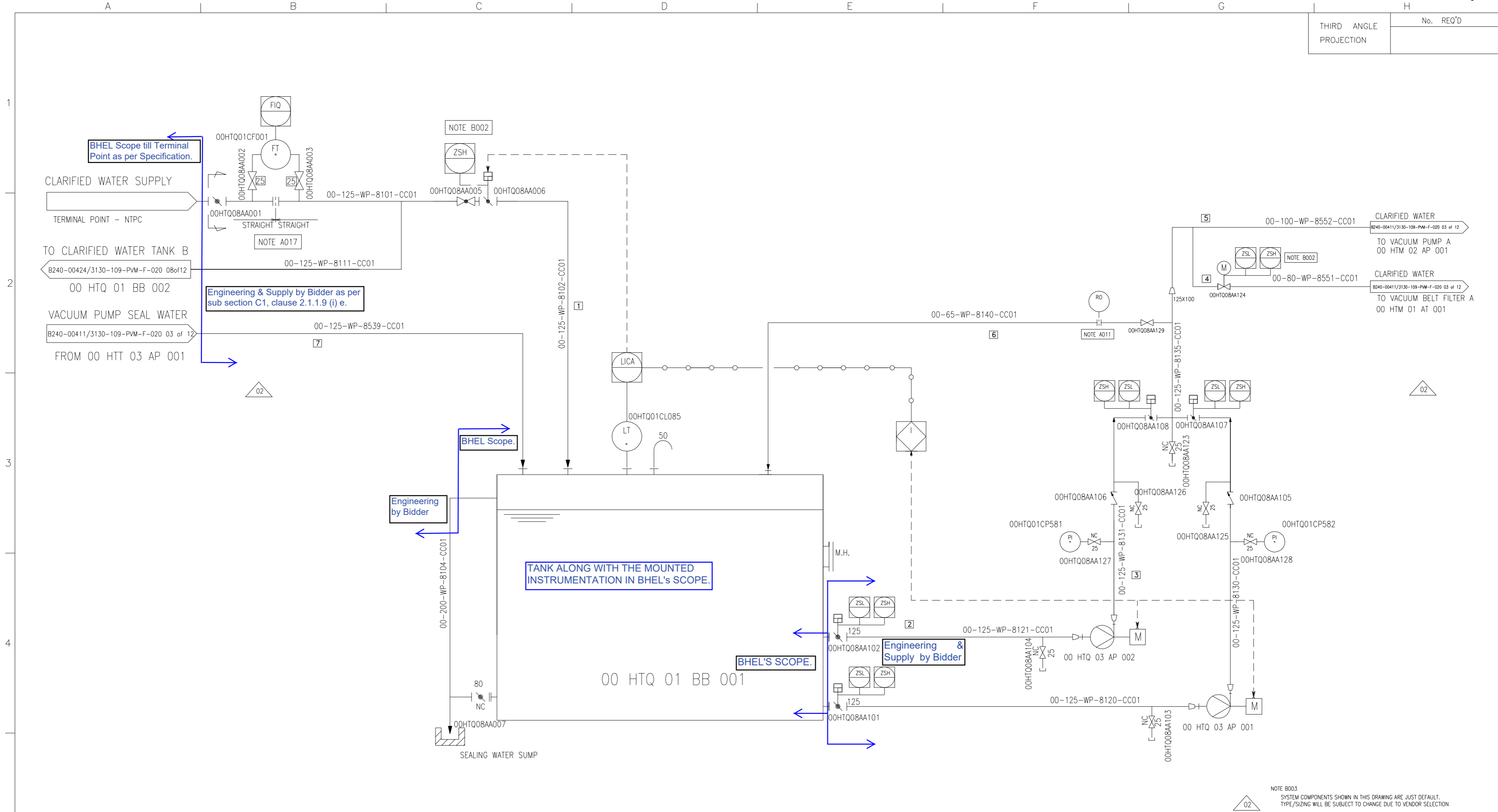
THIS IS PART OF TECHNICAL SPECIFICATION PE-IS-467-571-A901 REV 00

THIRD ANGLE PROJECTION

No.	REQ'D
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A3

DRAWING No.



CLARIFIED WATER TANK A, CAPACITY:43.9 m3/hr
00 HTQ 01 BB 001

CLARIFIED WATER PUMP A/B
00 HTQ 03 AP 001/002

NOTE B003
SYSTEM COMPONENTS SHOWN IN THIS DRAWING ARE JUST DEFAULT.
TYPE/SIZING WILL BE SUBJECT TO CHANGE DUE TO VENDOR SELECTION

S NO	SECTION	FLOW m3/hr	TEMP(C)	DENSITY kg/m3
1	Clarified water to clarified wash tank	24.8	45.0	990
2	At the suction of clarified wash pump	95.0	45.0	990
3	At the discharge of clarified wash pump	95.0	45.0	990
4	Clarified Wash water to belt filter	24.8	45.0	990
5	Vacuum pump seal water	49.6	45.0	990
6	Recirculation flow Back to clarified water tank	19.0	45.0	990
7	Clarified water from seal water pump to clarified water tank	49.6	45.0	990

CUSTOMER NOS:G509toG511&G208toG210

CUSTOMER: NTPC LIMITED.
PROJECT: RAMAGUNDAM STGI&II(3X500MW+3X200MW)
FGD SYSTEM PACKAGE

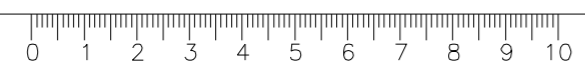
DEPT	NAME (BHEL)	DATE
DRN	RAJU.P	27.04.20
CHD	P.N.REDDY	27.04.20
APPD	ACR/RSB	27.04.20

MITSUBISHI HITACHI POWER SYSTEMS, LTD.
AIR QUALITY CONTROL SYSTEMS TECHNOLOGY DIVISION

P & ID-GYPSUM DE WATERING SYSTEM
TITLE: (CLARIFIED WATER TANK A)

NTPC DRG NO.	3130-109-PVM-F-020	SH 07 of 12
BHEL DRG NO	FILE NO	REV NO
	B240-00423	03

REV	DATE	ALD	APP	REV	DATE	ALD	APP	REV	DATE	ALD	APP
03	12.10.20	RAJU.P	NAVEEN	02	24.08.20	RAJU.P	NAVEEN	01	27.05.20	RAJU.P	NAVEEN



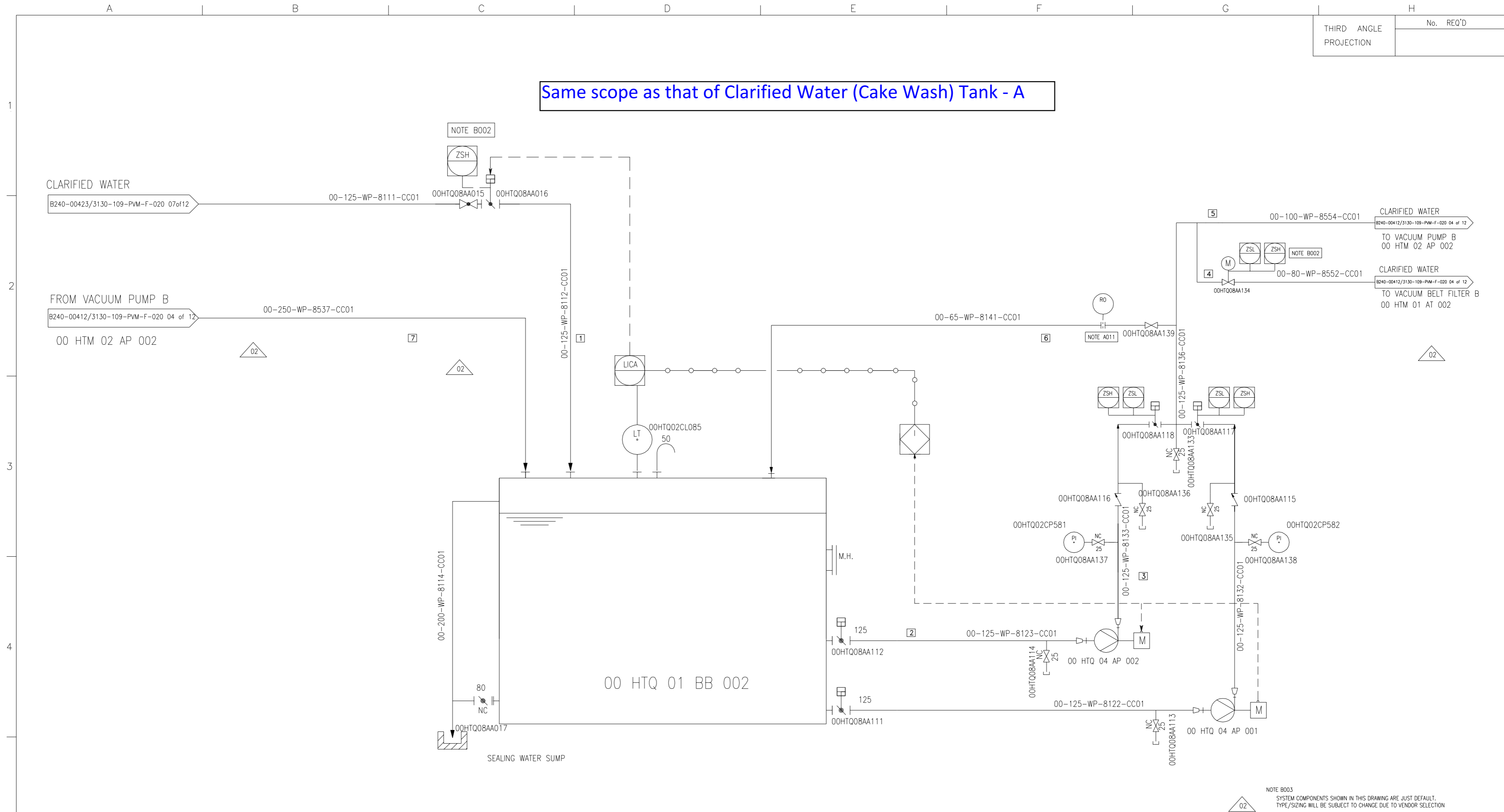
THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-467-571-A901 REV 00

THIRD ANGLE PROJECTION No. REQ'D

A3

DRAWING No.

Same scope as that of Clarified Water (Cake Wash) Tank - A



CLARIFIED WATER TANK B, Capacity: 43.9 m3/hr
00 HTQ 01 BB 002

CLARIFIED WATER PUMP C/D
00 HTQ 04 AP 001/002

NOTE B003
SYSTEM COMPONENTS SHOWN IN THIS DRAWING ARE JUST DEFAULT.
TYPE/SIZING WILL BE SUBJECT TO CHANGE DUE TO VENDOR SELECTION

S NO	SECTION	FLOW m ³ /hr	TEMP(°C)	DENSITY kg/m ³
1	Clarified water to clarified wash tank	24.8	45.0	990
2	At the suction of clarified wash pump	95.0	45.0	990
3	At the discharge of clarified wash pump	95.0	45.0	990
4	Clarified Wash water to belt filter	24.8	45.0	990
5	Vacuum pump seal water	49.6	45.0	990
6	Recirculation flow Back to clarified water tank	19.0	45.0	990
7	Clarified water from seal water pump to clarified water tank	49.6	45.0	990

CUSTOMER NOS:G509toG511&G208toG210

CUSTOMER: NTPC LIMITED.
PROJECT: RAMAGUNDAM STG1&II(3X500MW+3X200MW)
FGD SYSTEM PACKAGE

DEPT	NAME (BHEL)	DATE
DRN	RAJU.P	27.04.20
M	P.N.REDDY	27.04.20
APPD	ACR/RSB	27.04.20

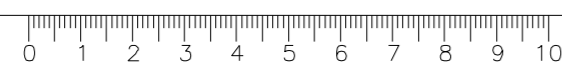
MITSUBISHI HITACHI POWER SYSTEMS, LTD.
AIR QUALITY CONTROL SYSTEMS TECHNOLOGY DIVISION

P & ID-GYPSUM DE WATERING SYSTEM
TITLE: (CLARIFIED WATER TANK B)
SCALE: NTS

NTPC DRG NO. 3130-109-PVM-F-020 SH 08 of 12

BHEL DRG NO. FILE NO. REV NO.
B240-00424 03

REV	DATE	ALTD	DES	APPD	REV	DATE	ALTD	DES	APPD	REV	DATE	ALTD	DES	APPD
03	12.10.20	RAJU.P	NAVEEN	ACR	02	24.08.20	RAJU.P	NAVEEN	ACR	01	27.05.20	RAJU.P	NAVEEN	ACR

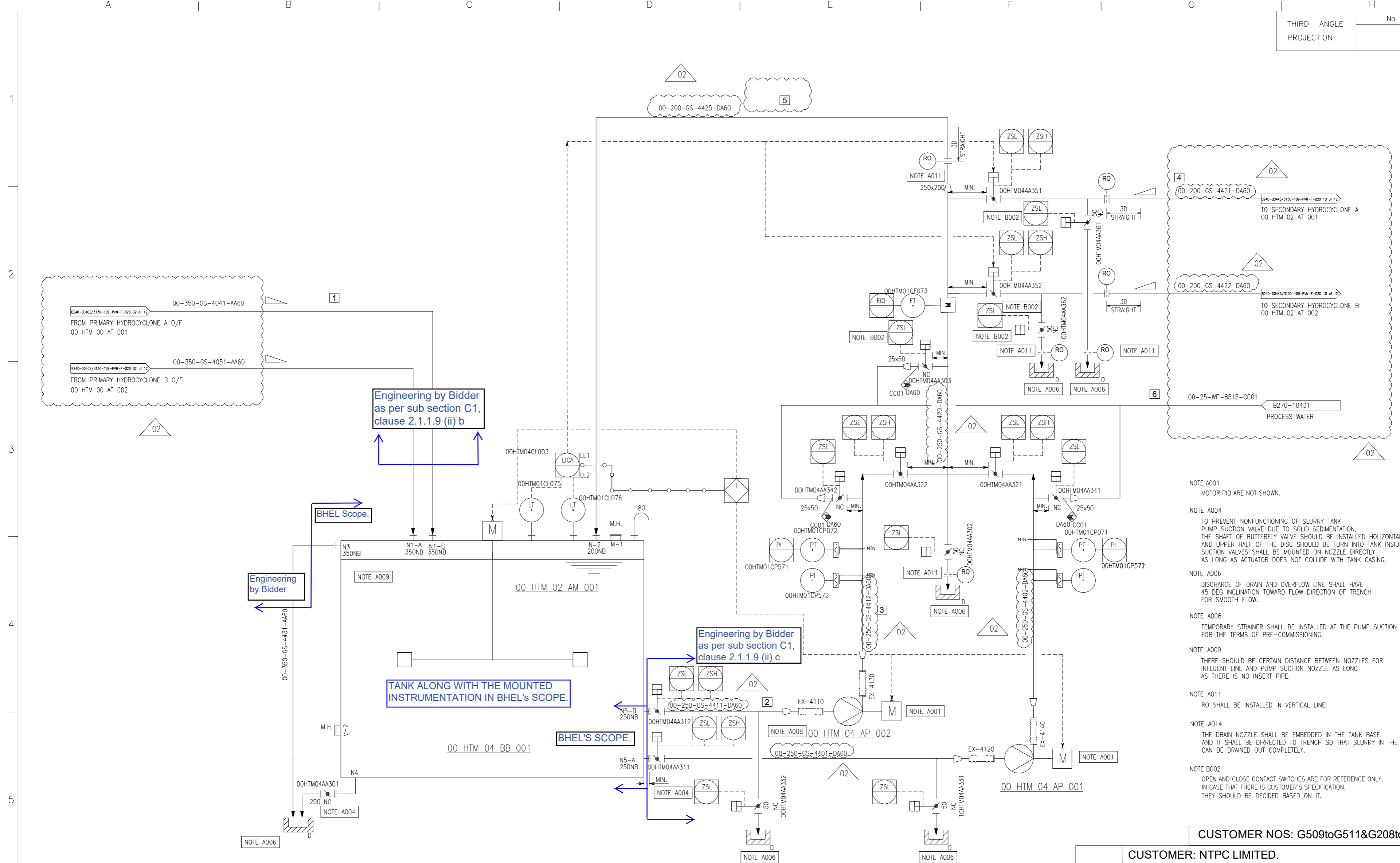


THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-467-571-A901 REV 00

THIRD ANGLE PROJECTION No. REQ'D

A3

DRAWING No.



- NOTE A001
MOTOR PID ARE NOT SHOWN.
- NOTE A004
TO PREVENT NONFUNCTIONING OF SLURRY TANK PUMP SUCTION VALVE DUE TO SOLID SEDIMENTATION, THE SHAFT OF BUTTERFLY VALVE SHOULD BE INSTALLED HORIZONTALLY AND UPPER HALF OF THE DISC SHOULD BE TURN INTO TANK INSIDE. SUCTION VALVES SHALL BE MOUNTED ON NOZZLE DIRECTLY AS LONG AS ACTUATOR DOES NOT COLLIDE WITH TANK CASING.
- NOTE A006
DISCHARGE OF DRAIN AND OVERFLOW LINE SHALL HAVE 45 DEG INCLINATION TOWARD FLOW DIRECTION OF TRENCH FOR SMOOTH FLOW.
- NOTE A008
TEMPORARY STRAINER SHALL BE INSTALLED AT THE PUMP SUCTION FOR THE TERMS OF PRE-COMMISSIONING.
- NOTE A009
THERE SHOULD BE CERTAIN DISTANCE BETWEEN NOZZLES FOR INFLUENT LINE AND PUMP SUCTION NOZZLE AS LONG AS THERE IS NO INSERT PIPE.
- NOTE A011
RO SHALL BE INSTALLED IN VERTICAL LINE.
- NOTE A014
THE DRAIN NOZZLE SHALL BE EMBEDDED IN THE TANK BASE AND IT SHALL BE DIRRECTED TO TRENCH SO THAT SLURRY IN THE TANK CAN BE DRAINED OUT COMPLETELY.
- NOTE B002
OPEN AND CLOSE CONTACT SWITCHES ARE FOR REFERENCE ONLY. IN CASE THAT THERE IS CUSTOMER'S SPECIFICATION, THEY SHOULD BE DECIDED BASED ON IT.

S NO	SECTION	FLOW m ³ /hr	TEMP (°C)	DENSITY kg/m ³
1	Primary hydrocyclone overflow	136.1	61.4	1112
2	Secondary hydrocyclone feed pump suction	280.0	61.4	1112
3	Secondary hydrocyclone feed pump discharge	280.0	61.4	1112
4	Secondary hydrocyclone flow	136.1	61.4	1112
5	Recirculation Flow to Secondary hydro cyclone feed tank	143.9	61.4	1112
6	process water flow for flushing	3	45.0	990

00 HTM 02 AM 001
SECONDARY HYDROCYCLONE FEED TANK AGITATOR

00 HTM 04 AP 001/002
SECONDARY HYDROCYCLONE FEED TANK PUMP

00 HTM 04 BB 001
SECONDARY HYDROCYCLONE FEED TANK Capacity :189.4 m³

CUSTOMER NOS: G509toG511&G208toG210

CUSTOMER: NTPC LIMITED.
PROJECT:RAMAGUNDAM STG-I&II(3X500MW+3X200MW)
FGD SYSTEM PACKAGE

BHARAT HEAVY ELECTRICALS LIMITED, UNIT: BOILER AUXILIARIES PLANT, RANIPET-832 408.	DEPT	NAME (BHEL)	DATE
	DRN	RAJUP	27.04.20
	M	P.NAREDDY	27.04.20
	APPD	ACR/RSB	27.04.20

MITSUBISHI HITACHI POWER SYSTEMS, LTD.
AIR QUALITY CONTROL SYSTEMS TECHNOLOGY DIVISION

TITLE: P & ID-GYPSUM DE WATERING SYSTEM (SECONDARY HYDROCLONE FEED TANK)
SCALE: NTS

NTPC DRG NO: 3130-109-PVM-F-020 SH 09 of 12

BHEL DRG NO: B240-00441 FILE NO: REV NO: 02

REV	DATE	BY	CHK	APPD	REV	DATE	BY	CHK	APPD
02	25.08.20	RAJUP	NAVEEN	ACR	01	27.05.20	RAJUP	NAVEEN	ACR

1. Revised the document as per NTPC comments
2. Changed the pipe material from CSRL to FRP for size less than 300 NB

CAUTION: THIS DRAWING IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT IS TO BE USED FOR THE PROJECT AND NOT TO BE REPRODUCED OR USED FOR ANY OTHER PROJECT WITHOUT THE WRITTEN PERMISSION OF BHARAT HEAVY ELECTRICALS LIMITED. DRAWINGS OF APPARATUS EXCEPT WHERE PROVIDED FOR AGREEMENT WITH SAID COMPANY.

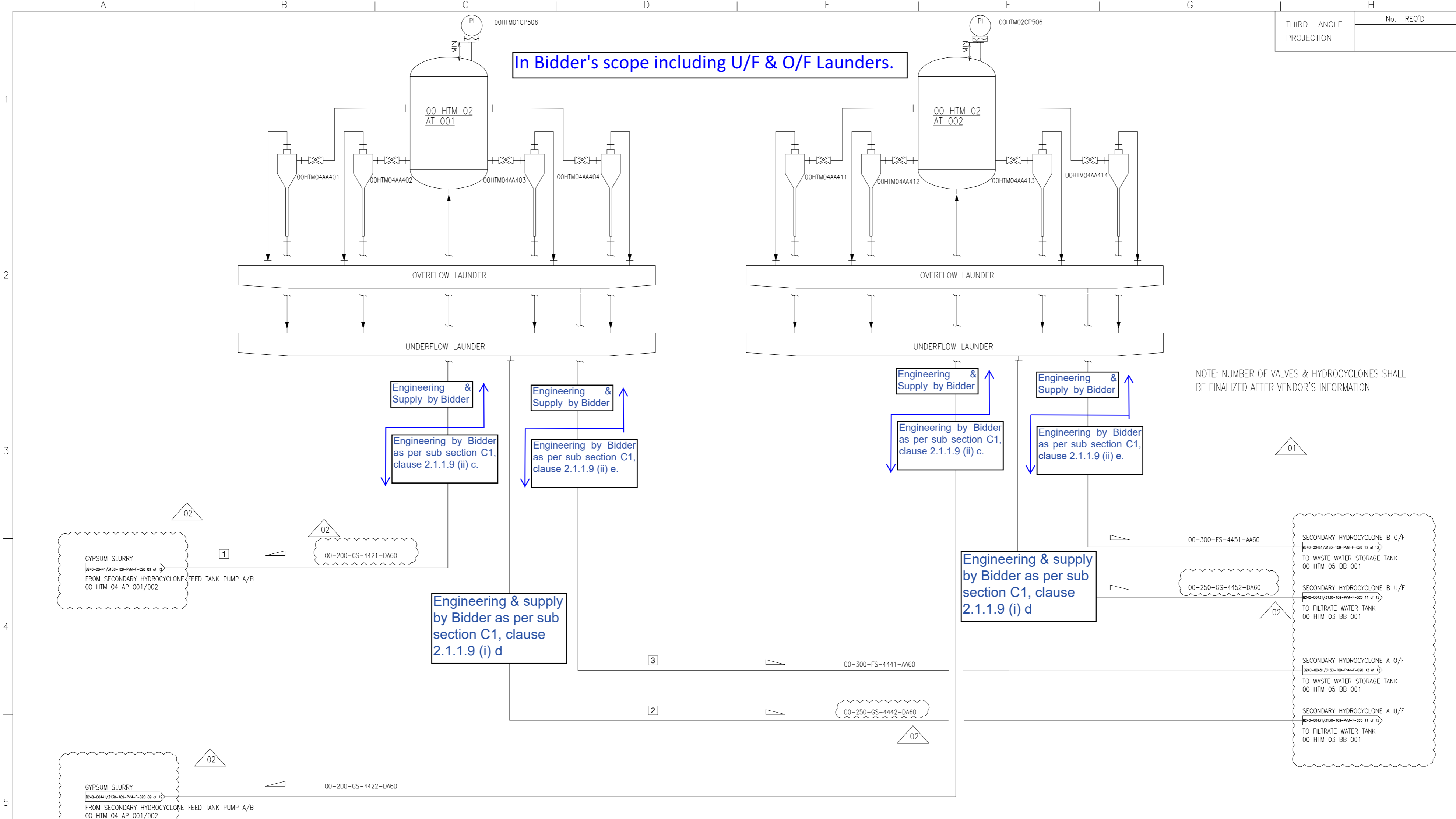
THIS IS PART OF TECHNICAL SPECIFICATION PE-IS-467-571-A901 REV 00



THIRD ANGLE PROJECTION No. REQ'D **A3**

DRAWING No.

In Bidder's scope including U/F & O/F Launder.



NOTE: NUMBER OF VALVES & HYDROCYCLONES SHALL BE FINALIZED AFTER VENDOR'S INFORMATION

GYPSUM SLURRY
FROM SECONDARY HYDROCYCLONE FEED TANK PUMP A/B
00 HTM 04 AP 001/002

GYPSUM SLURRY
FROM SECONDARY HYDROCYCLONE FEED TANK PUMP A/B
00 HTM 04 AP 001/002

Engineering & supply by Bidder as per sub section C1, clause 2.1.1.9 (i) d

Engineering & supply by Bidder as per sub section C1, clause 2.1.1.9 (i) d

00 HTM 02 AT 001/002
SECONDARY HYDROCYCLONE A/B, Capacity: 137 m3/hr

SECONDARY HYDROCYCLONE B O/F
TO WASTE WATER STORAGE TANK
00 HTM 05 BB 001

SECONDARY HYDROCYCLONE B U/F
TO FILTRATE WATER TANK
00 HTM 03 BB 001

SECONDARY HYDROCYCLONE A O/F
TO WASTE WATER STORAGE TANK
00 HTM 05 BB 001

SECONDARY HYDROCYCLONE A U/F
TO FILTRATE WATER TANK
00 HTM 03 BB 001

S NO	SECTION	FLOW m/hr	TEMP (°C)	DENSITY kg/m ³
1	Secondary hydrocyclone feed flow	136.1	61.4	1112
2	Secondary hydrocyclone underflow	51.1	61.4	1259
3	Secondary hydrocyclone overflow	85.0	61.4	1023

CUSTOMER NOS: G509toG511 & G208toG210

CUSTOMER: NTPC LIMITED.
PROJECT: RAMAGUNDAM STG-I&II(3X500MW+3X200MW)
FGD SYSTEM PACKAGE

DEPT CODE	NAME (BHEL)	DATE
DRN	RAJULP	27.04.20
M CHD	P.N.REDDY	27.04.20
APPD	ACR/R/SB	27.04.20

MITSUBISHI HITACHI POWER SYSTEMS, LTD.
AIR QUALITY CONTROL SYSTEMS TECHNOLOGY DIVISION

TITLE: P & ID-GYPSUM DE WATERING SYSTEM (SECONDARY HYDRO CLONE)
SCALE: NTS

NTPC DRG NO: 3130-109-PVM-F-020 SH 10 of 12

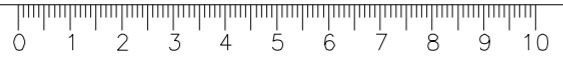
BHEL DRG NO: FILE NO: B240-00445 REV NO: 02

REV.	DATE	ALTD.	CHK.	APPR.	REV.	DATE	ALTD.	CHK.	APPR.
02	25.08.20	RAJU.P	NAVEEN	ACR	01	27.05.20	RAJU.P	NAVEEN	ACR

1. Revised the document as per NTPC comments
2. Changed the pipe material from CSRL to FRP for size less than 300 NB

1. Include Note
2. Hydrocyclone capacity included

CAUTION: THE DRAWING IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LTD. AND IS NOT TO BE REPRODUCED OR USED TO FURNISH ANY INFORMATION FOR MAKING OF DRAWINGS OF APPARATUS EXCEPT WHERE PROVIDED FOR AGREEMENT WITH SAID COMPANY.

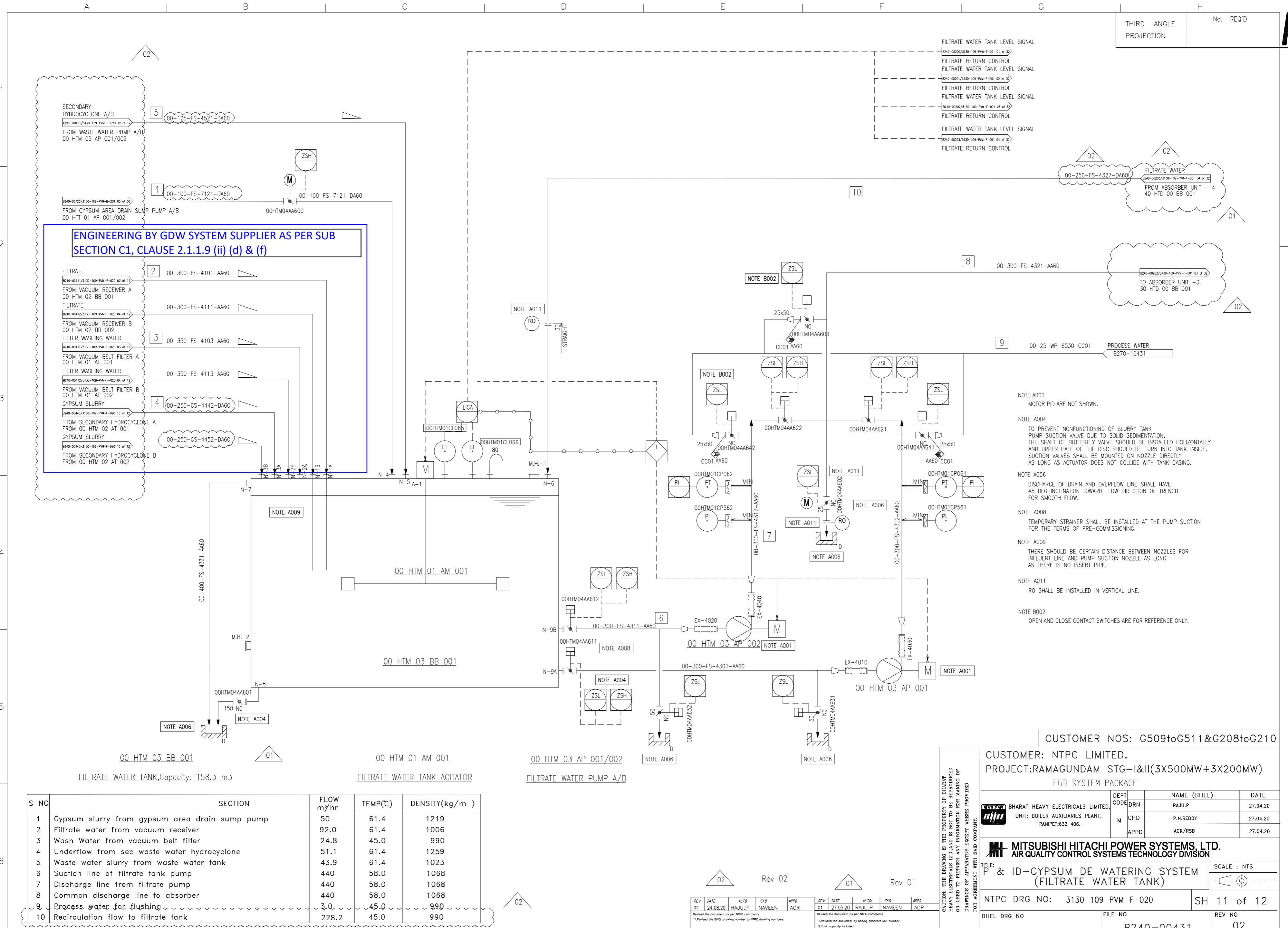


THIS IS PART OF TECHNICAL SPECIFICATION PE-IS-467-571-A901 REV 00

A3

DRAWING No.

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-467-571-A901 REV 00



THIRD ANGLE PROJECTION	No. REQ'D
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ENGINEERING BY GDW SYSTEM SUPPLIER AS PER SUB SECTION C1, CLAUSE 2.1.1.9 (ii) (d) & (f)

- 1. 00-100-FS-7121-DA60
- 2. 00-300-FS-4101-AA60
- 3. 00-350-FS-4103-AA60
- 4. 00-250-GS-4442-DA60
- 5. 00-125-FS-4521-DA60

- NOTE A001: MOTOR PID ARE NOT SHOWN.
- NOTE A004: TO PREVENT NONFUNCTIONING OF SLURRY TANK PUMP SUCTION VALVE DUE TO SOLID SEDIMENTATION, THE SHAFT OF BUTTERFLY VALVE SHOULD BE INSTALLED HORIZONTALLY AND UPPER HALF OF THE DISC SHOULD BE TURN INTO TANK INSIDE. SUCTION VALVES SHALL BE MOUNTED ON NOZZLE DIRECTLY AS LONG AS ACTUATOR DOES NOT COLLIDE WITH TANK CASING.
- NOTE A006: DISCHARGE OF DRAIN AND OVERFLOW LINE SHALL HAVE 45 DEG INCLINATION TOWARD FLOW DIRECTION OF TRENCH FOR SMOOTH FLOW.
- NOTE A008: TEMPORARY STRAINER SHALL BE INSTALLED AT THE PUMP SUCTION FOR THE TERMS OF PRE-COMMISSIONING.
- NOTE A009: THERE SHOULD BE CERTAIN DISTANCE BETWEEN NOZZLES FOR INFLUENT LINE AND PUMP SUCTION NOZZLE AS LONG AS THERE IS NO INSERT PIPE.
- NOTE A011: RO SHALL BE INSTALLED IN VERTICAL LINE.
- NOTE B002: OPEN AND CLOSE CONTACT SWITCHES ARE FOR REFERENCE ONLY.

S NO	SECTION	FLOW m ³ /hr	TEMP(°C)	DENSITY(kg/m ³)
1	Gypsum slurry from gypsum area drain sump pump	50	61.4	1219
2	Filtrate water from vacuum receiver	92.0	61.4	1006
3	Wash Water from vacuum belt filter	24.8	45.0	990
4	Underflow from sec waste water hydrocyclone	51.1	61.4	1259
5	Waste water slurry from waste water tank	43.9	61.4	1023
6	Suction line of filtrate tank pump	440	58.0	1068
7	Discharge line from filtrate pump	440	58.0	1068
8	Common discharge line to absorber	440	58.0	1068
9	Process water for flushing	3.0	45.0	990
10	Recirculation flow to filtrate tank	228.2	45.0	990

CUSTOMER NOS: G509toG511&G208toG210

CUSTOMER: NTPC LIMITED.
PROJECT:RAMAGUNDAM STG-I&II(3X500MW+3X200MW)
FGD SYSTEM PACKAGE

DEPT CODE	NAME (BHEL)	DATE
DRN	RAJU.P	27.04.20
CHD	P.N.REDDY	27.04.20
APPD	ACR/RSB	27.04.20

MITSUBISHI HITACHI POWER SYSTEMS, LTD.
AIR QUALITY CONTROL SYSTEMS TECHNOLOGY DIVISION

TITLE: P & ID-GYPSUM DE WATERING SYSTEM (FILTRATE WATER TANK) SCALE: NTS

NTPC DRG NO: 3130-109-PVM-F-020 SH 11 of 12

BHEL DRG NO: FILE NO: B240-00431 REV NO: 02

REV.	DATE	ALTD.	CHKD.	APPD.	REV.	DATE	ALTD.	CHKD.	APPD.
02	24.08.20	RAJU.P	NAVEEN	ACR	01	27.05.20	RAJU.P	NAVEEN	ACR

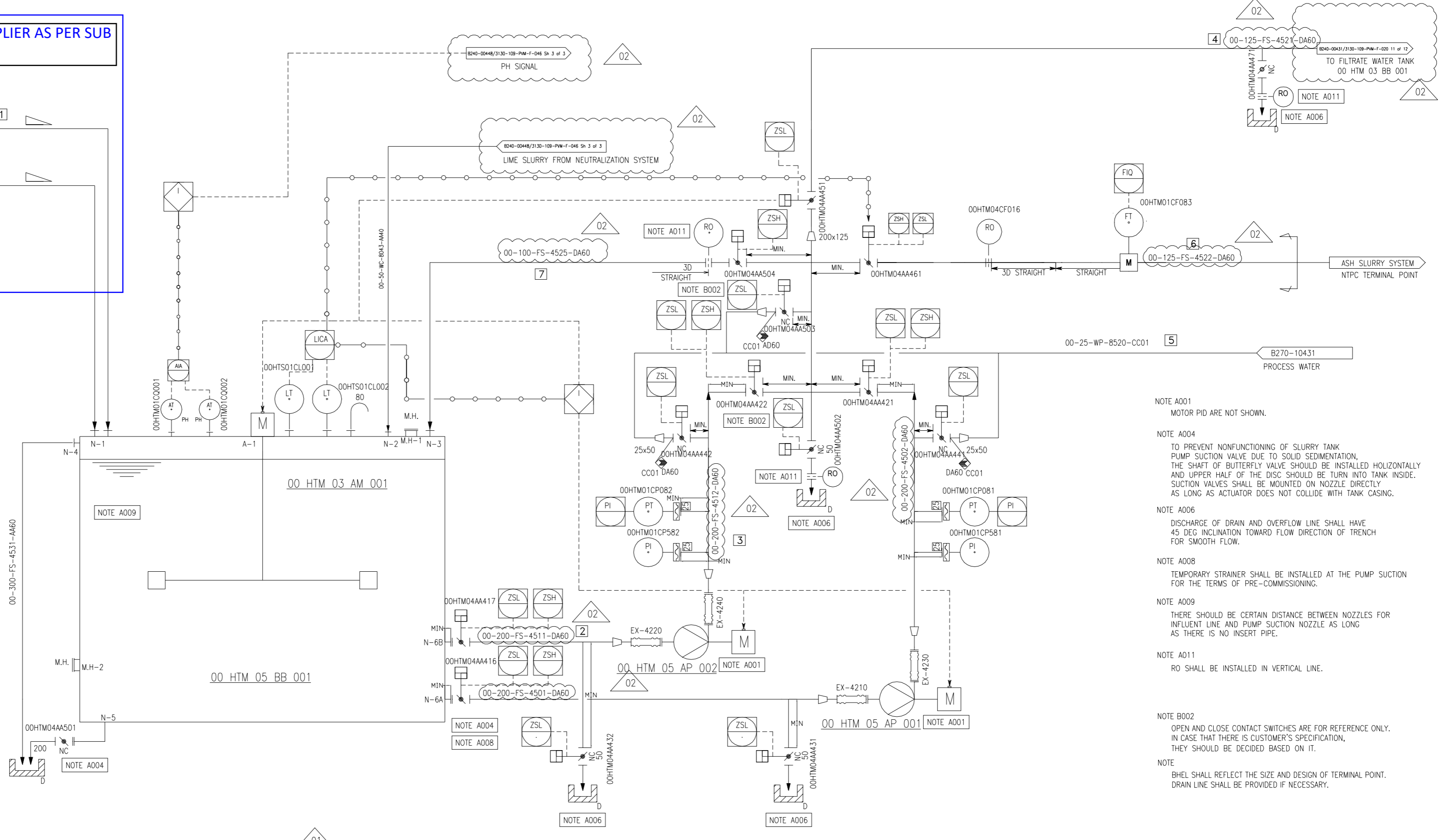
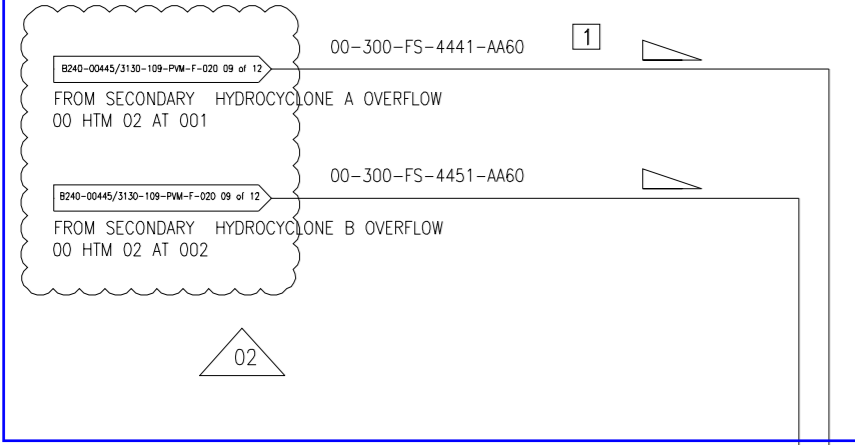
1.Revised the document as per NTPC comments
2.Tank capacity included.



THIRD ANGLE PROJECTION No. REQ'D **A3**

DRAWING No.

ENGINEERING BY GDW SYSTEM SUPPLIER AS PER SUB SECTION C1, CLAUSE 2.1.1.9 (ii) (e)



- NOTE A001
MOTOR PID ARE NOT SHOWN.
- NOTE A004
TO PREVENT NONFUNCTIONING OF SLURRY TANK PUMP SUCTION VALVE DUE TO SOLID SEDIMENTATION, THE SHAFT OF BUTTERFLY VALVE SHOULD BE INSTALLED HORIZONTALLY AND UPPER HALF OF THE DISC SHOULD BE TURN INTO TANK INSIDE. SUCTION VALVES SHALL BE MOUNTED ON NOZZLE DIRECTLY AS LONG AS ACTUATOR DOES NOT COLLIDE WITH TANK CASING.
- NOTE A006
DISCHARGE OF DRAIN AND OVERFLOW LINE SHALL HAVE 45 DEG INCLINATION TOWARD FLOW DIRECTION OF TRENCH FOR SMOOTH FLOW.
- NOTE A008
TEMPORARY STRAINER SHALL BE INSTALLED AT THE PUMP SUCTION FOR THE TERMS OF PRE-COMMISSIONING.
- NOTE A009
THERE SHOULD BE CERTAIN DISTANCE BETWEEN NOZZLES FOR INFLUENT LINE AND PUMP SUCTION NOZZLE AS LONG AS THERE IS NO INSERT PIPE.
- NOTE A011
RO SHALL BE INSTALLED IN VERTICAL LINE.
- NOTE B002
OPEN AND CLOSE CONTACT SWITCHES ARE FOR REFERENCE ONLY. IN CASE THAT THERE IS CUSTOMER'S SPECIFICATION, THEY SHOULD BE DECIDED BASED ON IT.
- NOTE
BHEL SHALL REFLECT THE SIZE AND DESIGN OF TERMINAL POINT. DRAIN LINE SHALL BE PROVIDED IF NECESSARY.

00 HTM 05 BB 001
WASTE WATER STORAGE TANK. Capacity: 427.2 m³

00 HTM 03 AM 001
WASTE WATER STORAGE TANK AGITATOR

00 HTM 05 AP 001/002
WASTE WATER PUMP A/B

CUSTOMER NOS: G509toG511&G208toG210

S NO	SECTION	FLOW m ³ /hr	TEMP (°C)	DENSITY kg/m ³
1	Gyp slurry from sec hydro cyclone over flow	85.0	61.4	1023
2	Gyp slurry to WW pump Suction	126	61.4	1023
3	Gyp slurry from WW pump discharge	126	61.4	1023
4	Gyp slurry to filtrate water tank	43.90	61.4	1023
5	Process water line for flushing	3	45	990
6	Gyp slurry to NTPC terminal point	41.20	61.4	1023
7	Recirculation flow back to waste water tank	40.90	61.4	1023

CUSTOMER: NTPC LIMITED.
PROJECT:RAMAGUNDAM STG-I&II(3X500MW+3X200MW)
FGD SYSTEM PACKAGE

DEPT	DRN	NAME (BHEL)	DATE
CODE	M	RAJU.P	27.04.20
	APPD	P.N.REDDY	27.04.20
		ACR/RSB	27.04.20

MITSUBISHI HITACHI POWER SYSTEMS, LTD.
AIR QUALITY CONTROL SYSTEMS TECHNOLOGY DIVISION

TITLE: **P & ID-GYPSUM DEWATERING SYSTEM (WASTE WATER TANK)**

SCALE : NTS

NTPC DRG NO: 3130-109-PVM-F-020 SH 12 of 12

BHEL DRG NO: B240-00451 REV NO: 02

REV	DATE	ALTB	CHKD	APPR	REV	DATE	ALTB	CHKD	APPR
02	25.08.20	RAJU.P	NAVEEN	ACR	01	27.05.20	RAJU.P	NAVEEN	ACR

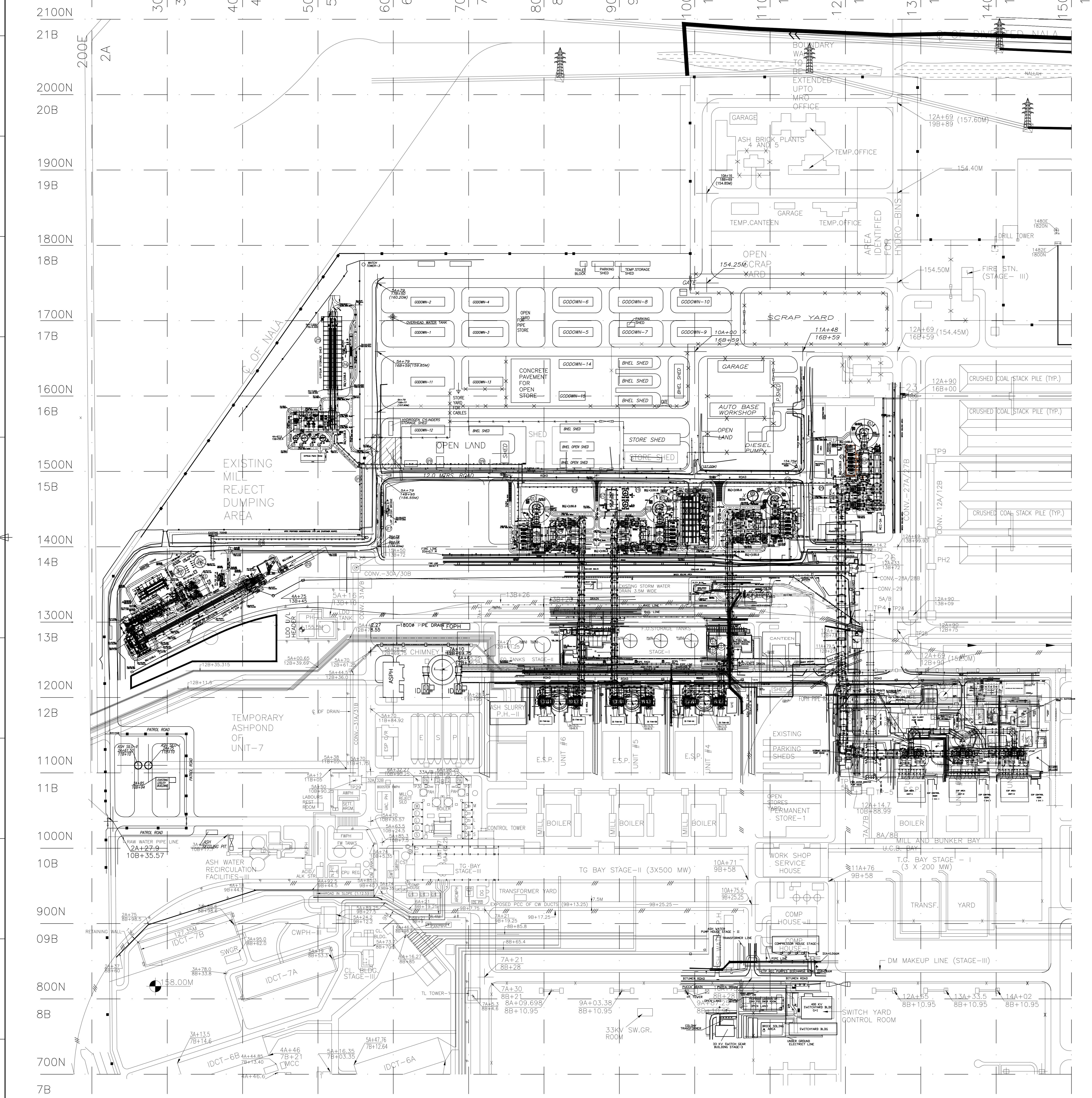
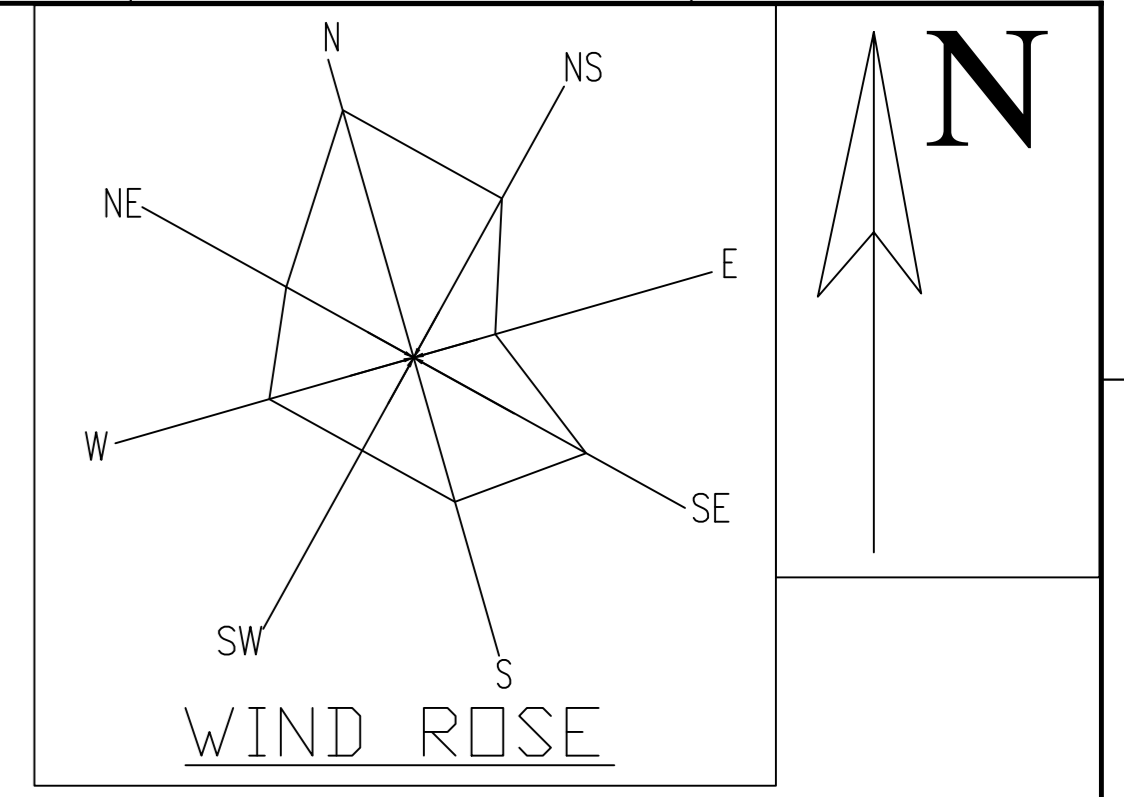
1. Revised the BHEL drawing number to NTPC drawing numbers
2. Changed the pipe material from CSRL to FRP for size less than 300 mm

1. Revised the document by removing the neutralization system and updated the same in other MLD.
2. Flow capacity included.



THIS IS PART OF TECHNICAL SPECIFICATION PE-IS-467-571-A901 REV 00

DRAWING NO. 0-FW-000-01375



EQUIPMENT/STRUCTURE NO	DESCRIPTION
01	NEW WET STACK
02	WET LIMESTONE BASED ABSORBER
03	RC PUMPS AND OXIDATION BLOWER HOUSE
04	BOOST UP FANS
05	AUXILIARY ABSORBENT TANK
06	LHP MCC ROOM STAGE-I & II
07	ACW PUMP HOUSE
08	FGD CONTROL ROOM
09	PIPE AND CABLE RACK
10	LIMESTONE STORAGE SILOS
11	BALL MILL BUILDING
12	WET LIMESTONE BALL MILL
13	LIMESTONE SLURRY STORAGE TANKS
14	GYPNUM DEWATERING BUILDING CUM COMPRESSOR HOUSE
15	SECONDARY HYDRO CYCLONE FEED TANK
16	PRIMARY HYDRO CYCLONE FEED TANK
17	WASTE WATER TANK
18	FILTRATE WATER TANKS
19	PROCESS WATER TANKS
20	TRUCK UNLOADER RAMP
21	TRUCK UNLOADER
22	LIMESTONE BELT CONVEYER
23	LIMESTONE STORAGE DAY SILOS
24	LIMESTONE CRUSHER HOUSE
25	GYPNUM STORAGE SHED
26	GYPNUM WEIGH BRIDGE
27	LIMESTONE WEIGH BRIDGE

- NOTES:**
1. ALL DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS IN METRES
 2. EL(±)0.000 OF MAIN PLANT AREA CORRESPONDS TO RL(+152.00).
 3. LOCATION/SIZES OF VARIOUS FACILITIES/BUILDINGS ARE TENTATIVE ONLY, SHALL BE FINALISED DURING DETAIL ENGINEERING.
 4. FGL OF FGD FACILITIES SHALL BE AS PER LEVEL MARKED IN RESPECTIVE AREA.

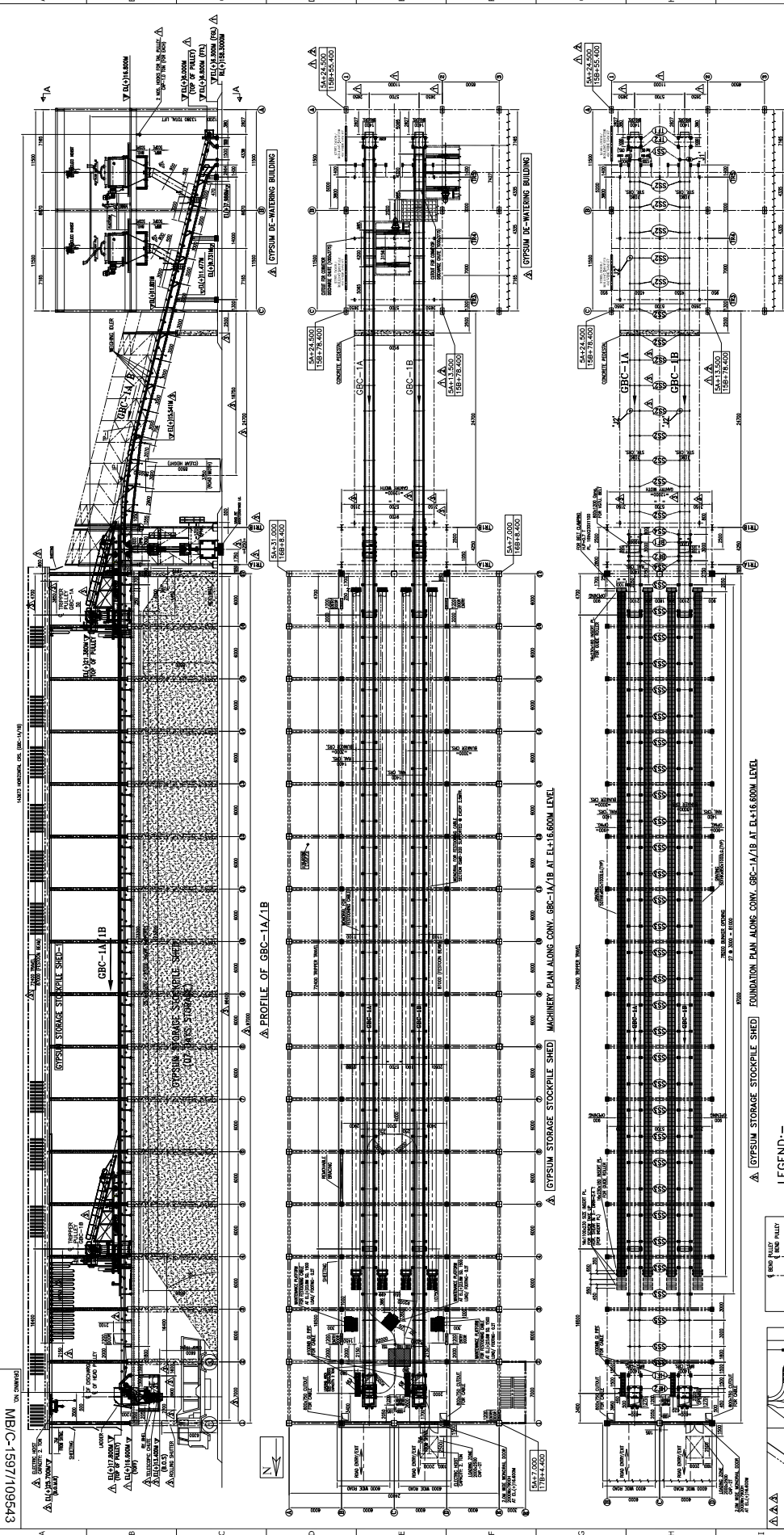
- REFER DRG NOS:**
1. 3130-109-PVM-B-037
 2. 3130-109-PVM-B-049
 3. 3130-109-PVM-B-010
 4. 3130-109-PVM-B-047
 5. 3130-109-PVM-B-050
 6. 3130-109-PVE-B-030
- GENERAL ARRANGEMENT & DATA SHEET FOR BOOSTER FAN**
GENERAL LAYOUT OF FGD DUCTING
GENERAL ARRANGEMENT FOR ABSORBER.
GA OF BALL MILL BUILDING
GENERAL LAYOUT OF PIPE RACK/TRESTLE & CABLE WAYS
LAYOUT OF ELECTRICAL & CONTROL BUILDING

PROGRESSIVE COPY FOR R04 DATED 30.10.2021

REV	DATE	ALTD	CHKD	APPRD	REV	DATE	ALTD	CHKD	APPRD	REV	DATE	ALTD	CHKD	APPRD
01	08.09.2021	SKM	DEEPAK B	SANJAY KUMAR	02	11.09.2021	Srinivasulu	DEEPAK KUMAR/SANJAY	01	12.03.2020	Srinivasulu	DEEPAK KUMAR/SANJAY		
02					03				02					
03					04				03					
04					05				04					

NTPC DRAWING NO : 3130-109-PVM-F-044
 CUSTOMER: NTPC LIMITED.
 PROJECT: RAMAGUNDAM SUPER THERMAL POWER PLANT
 STAGE-I(3X200MW) & STAGE-II(3X500MW)
 TITLE: PLANT LAYOUT OF FGD SYSTEM
 DRAWING NO. 0-FW-000-01375 SH 01 OF 01 REV 03A
 SCALE: 1:1900

THIS IS PART OF TECHNICAL SPECIFICATION PELTS-467-571-A901 REV 00



NTPC Limited
 OWNER/CONSULTANT
 CORPORATION OF INDIA (GOVERNMENT OF INDIA)
 PUNJICENT
RAMAGUNDAM I & II (3X200MW+3X500MW) FGD - (LHP & GHP PACKAGE)
 MAIN CONTRACTOR: BHARAT HEAVY ELECTRICALS LTD., INDUSTRIAL SYSTEMS GROUP, BANGALORE
 SIB CONTRACTOR: MACALBER EECAT PRIVATE LIMITED (INDIA) PVT. LTD., INDIA (UP/401804)
 DRAWING NO: 3130-GS-PM-B-175
 SHEET NO: 11 OF 15
 DATE: 14/07/2020
 SCALE: 1:225
 PROJECT: SA OF CONVEYOR-GBC 1A/1B

EMPERIAL LOAD DATA PER DRAWING (TONNES)

DRAWING NO.	DECK	ROOF	WALL	CEILING	WIND	SEISMIC
3130-GS-PM-B-175	0.25	0.25	0.25	0.25	0.25	0.25

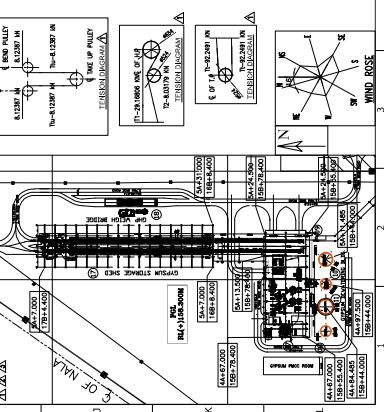
STATUS OF DRAWING

NO.	DATE	DESCRIPTION	BY	CHKD.	APPD.
1	14/07/2020	ISSUED FOR PERMIT			

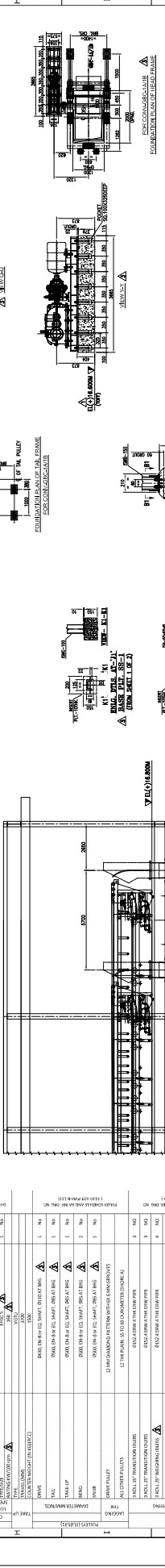
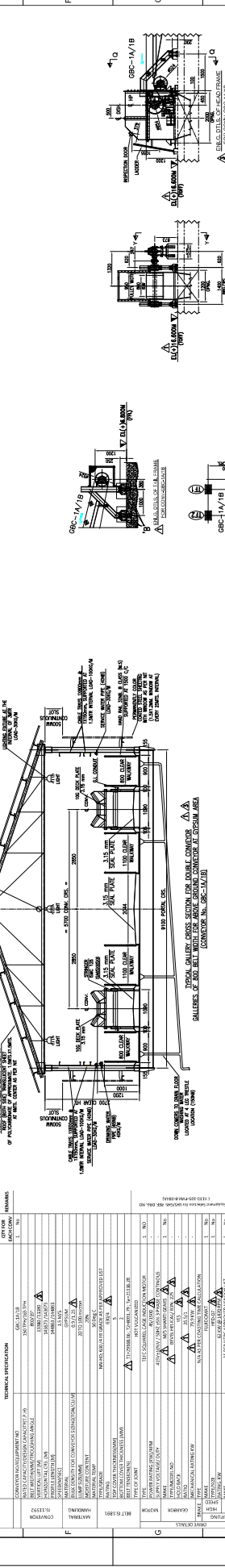
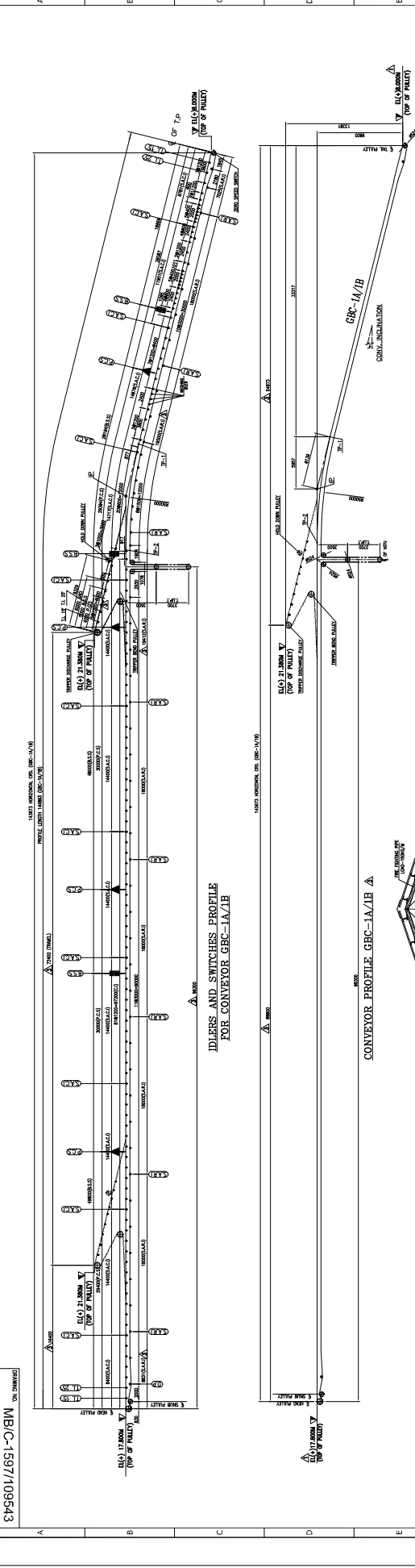
REFERENCE DRAWINGS/DOCUMENTS

REF. NO.	DESCRIPTION
3130-GS-PM-B-074	FLOOR DIAGRAM OF LIMESTONE AND GYPSUM HANDLING
3130-GS-PM-B-075	FOOT PLAN OF LIME STONE & GYPSUM HANDLING PLANT
3130-GS-PM-B-076	FOOT PLAN OF ROOF SYSTEM
3130-GS-PM-B-078	TOP CROSS SECTION OF CONVEYOR GALLERY
3130-GS-PM-B-080	PLAN OF GYPSUM STORAGE SHED
3130-GS-PM-B-081	SECTION THROUGH CONVEYOR INCLUDING POWER, INSULATION AND BELT TRACING

- LEGEND:-**
- SP - SHRE FLUET
 - CT - CORNER FLUET
 - RT - RETURN FLUET
 - DP - DUCTWORK FLUET
 - SACI - SELF SAVING
 - SOFTY - SOFTENING FLUET
 - RES - PULVERIZED FUEL
 - RES - BEST SMOKE SHEDS
 - TR - TRANSFER FLUET
 - TOP - TOP OF CONCRETE
 - TOP - TOP OF STEEL
 - TOP - TOP OF BRICK
 - TOP - TOP OF MASONRY
- NOTES:-**
- ALL DIMENSIONS ARE IN MM & LEVELS ARE IN METERS.
 - ELEVATION OF MAIN FLOOR AND CORRESPONDING TO RL (+10.00).
 - FEL (ELEVATION) CORRESPONDING TO RL (+10.00) IN OPEN AND COVER AREA.
 - SHOW AREAS WITH FINISH LEVEL. SOME AREAS MAY VARY LEVEL.
 - CONSTRUCTION DETAILS SHALL BE AS PER THE APPROVED CONSTRUCTION.
 - INSPECTION DOOR SHALL BE LEAK PROOF.
 - ROOF SHALL BE AS PER THE APPROVED STRUCTURAL DESIGN.
 - SHED ROOF SHALL BE PROVIDED.



THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-467-571-A901 REV 00



OWNER/CONSULTANT
NTPC Limited
 (A CORPORATION OF PUBLIC ENTERPRISES)

PROJECT: RAMAGUNDAM I & II (3X200MW+3X500MW) FGD - (LHP & GHP PACKAGE)

MIN CONTRACTOR: BHARAT HEAVY ELECTRICALS LTD. INDUSTRIAL SYSTEMS GROUP, BANGALORE

SUB CONTRACTOR: MACALBER DEEYAT PRIVATE LIMITED (A COMPANY OF PUBLIC ENTERPRISES) INDIA (UP/401804)

REVISIONS: 1:225

STATUS OF DRAWING: [] ISSUED FOR TENDER [] FOR QUOTE [] FOR CONTRACT [] FOR WORK [] FOR AS-BUILT

DATE: 14/02/2008

SCALE: 1:225

FILE NO.: SA OF CONVEYOR-GBC 1A/1B

DRW. NO.: MHC-1597/109543

DATE: 14/02/2008

REVISIONS:

NO.	DATE	DESCRIPTION
1	14/02/2008	ISSUED FOR TENDER
2	14/02/2008	FOR QUOTE
3	14/02/2008	FOR CONTRACT
4	14/02/2008	FOR WORK
5	14/02/2008	FOR AS-BUILT

VIEW - A-A
 (FROM SHEET L OF 2)

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-467-571-A901 REV 00



**NTPC RAMAGUNDAM - I & II
(3x200 MW + 3x500 MW)**

**GYPSUM DEWATERING EQUIPMENT
TECHNICAL SPECIFICATION**

**MASTER DRAWING LIST WITH SCHEDULE OF
SUBMISSION**

SPECIFICATION No: PE-TS-467-571-A901

SECTION : I

SUB-SECTION : D


REV. 00

SHEET 1 OF 6

**SECTION-I
SUB-SECTION-D**

ANNEXURE-V


**MASTER DRAWING LIST WITH SCHEDULE OF
SUBMISSION**

	NTPC RAMAGUNDAM - I & II (3x200 MW + 3x500 MW)	SPECIFICATION No: PE-TS-467-571-A901	
		SECTION : I	
	GYPHUM DEWATERING EQUIPMENT TECHNICAL SPECIFICATION	SUB-SECTION : D	
		REV. 00	
	MASTER DRAWING LIST WITH SCHEDULE OF SUBMISSION	SHEET 2 OF 6	


Drawings/Drawings to be submitted by the bidder

SN	Doc / Drawing No.	Drawing Title	Remarks		No. of weeks from LOI	
			Type*			
1	PE-V0-467-571-A901	Sub-Vendor List of Components for GDE.	Primary		4	
2	PE-V0-467-571-A902	Manufacturing Quality plan of GDE	Primary		4	
3	PE-V0-467-571-A903	P & I Diagram with Bill of quantity (BOQ) of GDE.	Primary		3	
4	PE-V0-467-571-A904	Control Philosophy of GDE.	Primary		6	
5	PE-V0-467-571-A905	Design Philosophy of complete GDE.	Primary		3	
6	PE-V0-467-571-A906	General Arrangement Drawing of Gypsum Dewatering Equipment (Showing layout of all the equipments of GDE in the building)	Primary	Basic Engineering drawings/ Documents (Primary drawings/ documents)	6	
7	PE-V0-467-571-A907	Sizing calculations of (a) VBF, (b) Vacuum Receiver, (c) Vacuum Pump, (d) Belt Wash Pump, (e) Cake wash Pumps, (f) Drives and (g) other Accessories for GDE.	Primary		3	
8	PE-V0-467-571-A908	General Arrangement Drawings of VBF including cross-sectional details, foundation plan and load details.	Primary		6	
9	PE-V0-467-571-A909	Datasheet of Vacuum Belt Filter & all accessories of GDE.	Primary		8	
10	PE-V0-467-571-A910	Piping Layout (Integral-Vendor Scope) with supports & fixing arrangement with BOQ for GDE.	Primary		10	
11	PE-V0-467-571-A911	Piping Layout (Non Integral - BHEL Scope) with supports & fixing arrangement with BOQ for GDE.	Primary		10	
12	PE-V0-467-571-A912	Instrument schedule along with GA & Data sheet for GDE.	Secondary			
13	PE-V0-467-571-A913	Data Sheet of Instruments of GDE	Secondary			
14	PE-V0-467-571-A914	Valve schedule for GDE.	Secondary			
15	PE-V0-467-571-A915	GA & Data sheet of Valves for GDE.	Secondary			

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-467-571-A901 REV.00

	NTPC RAMAGUNDAM - I & II (3x200 MW + 3x500 MW)		SPECIFICATION No: PE-TS-467-571-A901		
			SECTION : I		
	GYPHUM DEWATERING EQUIPMENT TECHNICAL SPECIFICATION		SUB-SECTION : D		
			REV. 00		
	MASTER DRAWING LIST WITH SCHEDULE OF SUBMISSION		SHEET 3 OF 6		
16	PE-V0-467-571-A916	Piping Isometric (Integral-Vendor Scope) with supports & fixing arrangement with BOQ for GDE.	Secondary		
17	PE-V0-467-571-A917	Piping Isometric (Non Integral - BHEL Scope) with supports & fixing arrangement with BOQ for GDE.	Secondary		
18	PE-V0-467-571-A918	Block logic diagram & Inter-Connection drawing of GDE.	Secondary		
19	PE-V0-467-571-A919	General Arrangement Drawings of (a) Vacuum Pump, (b) Vacuum Receiver, (c) Hydrocyclones (Primary & Secondary), (d) Belt Wash Pump, (e) Cake Wash Pump & (f) Vent Fan, along with cross sectional details, foundation plan and loading details.	Secondary		
20	PE-V0-467-571-A920	Cable Schedule of GDE.	Secondary		
21	PE-V0-467-571-A921	Electrical load List for GDE.	Secondary		
22	PE-V0-467-571-A922	Local Panel Control Circuit Diagram of GDE.	Secondary		
23	PE-V0-467-571-A923	General Arrangement Drawing & Data sheet of Motors for GDE.	Secondary		
24	PE-V0-467-571-A924	T-S & Performance curves of Vacuum Pump for GDE.	Secondary		
25	PE-V0-467-571-A925	I/O List (Drives & Instruments) of GDE.	Secondary		
26	PE-V0-467-571-A926	Utility Consumption of GDE.	Secondary		
27	PE-V0-467-571-A927	Schedule for Lubrication and other Consumables.	Secondary		
28	PE-V0-467-571-A928	Painting Schedule of GDE	Secondary		
29	PE-V0-467-571-A929	Bill of Material (BOM) of complete GDE for Main Supply	Secondary		
30	PE-V0-467-571-A930	Mandatory Spare List & BBU of GDE	Secondary		
31	PE-V0-467-571-A931	Platform Drawing of GDE with detailed BOQ	Secondary		
32	PE-V0-467-571-A932	Overall space and headroom requirement with details of handling during Erection, operation & maintenance of the equipments of GDE	Secondary		

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-467-571-A901 REV 00

	NTPC RAMAGUNDAM - I & II (3x200 MW + 3x500 MW)	SPECIFICATION No: PE-TS-467-571-A901	
		SECTION : I	
	GYPSUM DEWATERING EQUIPMENT TECHNICAL SPECIFICATION	SUB-SECTION : D	
		REV. 00	
	MASTER DRAWING LIST WITH SCHEDULE OF SUBMISSION	SHEET 4 OF 6	


33	PE-V0-467-571-A933	Erection & Commissioning Manual of GDE including- i. Installation and assembly procedure of complete GDE ii. Pre-Commissioning Check List of GDE	Secondary		
34	PE-V0-467-571-A934	Operation & Maintenance (O&M) Manual of GDE including Transportation and Storage Specification for GDE Components	Secondary		
35	PE-V0-467-571-A935	Schedule of Start-up & Commissioning Spares for GDE	Secondary		
36	PE-V0-467-571-A936	List of Special tools & Tackles for GDE	Secondary		
37	PE-V0-467-571-A937	Monthly Progress Report for GDE	Secondary		
38	PE-V0-467-571-A938	Packing List for complete GDE	Secondary		
39	PE-V0-467-571-A939	Performance Test Procedure of GDE	Secondary		


*Manufacturing Clearance to be given to the Vendor based on approval of 'Primary' Drawings.

*Secondary drawings are to be submitted within 2-3 weeks after approval of relevant primary drawings.

Notes:

1. The above drawing list is tentative and shall be finalized with the successful bidder after placement of order. While some of the drawings indicated above may not be applicable, some additional drawings may also be required based on scope of work.
2. Drawings shall be prepared in Auto-Cad/3D Modelling software latest edition, as applicable. Required no. of hard and soft copies (editable) of the drawings shall be furnished as per requirement specified elsewhere in the specification.
3. Only manual calculation with authentic supporting literature (e.g. extracts of hand Book/ standard/codes) shall be acceptable. All design calculations and drawings shall be in SI system only.
4. All the drawings and documents including general arrangement drawing, data sheet, calculation etc. to be furnished to the customer during detailed engineering stage shall include / indicate the following details for clarity w.r.t. Inspection, construction, erection and maintenance etc.:

	NTPC RAMAGUNDAM - I & II (3x200 MW + 3x500 MW)	SPECIFICATION No: PE-TS-467-571-A901	
	GYPSUM DEWATERING EQUIPMENT TECHNICAL SPECIFICATION	SECTION : I	
		SUB-SECTION : D	
		REV. 00	
MASTER DRAWING LIST WITH SCHEDULE OF SUBMISSION	SHEET 5 OF 6		
<p>a) All drawings and documents shall indicate the list of all reference drawings including General Arrangement.</p> <p>b) All drawings shall include / show plan, elevation, side view, cross-section, skin section, blow-up view; all major self-manufactured and bought out items shall be labeled and included in BOQ / BOM in tabular form.</p> <p>c) Painting schedule shall also be made as a part of general arrangement drawing of each equipment / items indicating at least 3 trade names.</p> <p>d) All the drawings required to be furnished to customer during detailed engineering stage shall include technical parameters, details of paints and lubrication, hardness and BOQ / BOM in tabular form indicating all major components including bought out items and their quantity, material of construction indicating its applicable code / standard, weight, make etc.</p> <p>e) Drawings/ documents to be submitted for purchaser's review/ approval shall be under Revision A, B, C... etc. while drawings /documents to be submitted thereafter for customer's approval after purchaser's approval shall be under R-0, 1, 2, 3 etc.</p> <p>f) Drawings and documents not covered above but required to check safety of machines/ equipment/ system, shall be submitted during detailed engineering stage without any commercial implication.</p> <p>g) All drawings shall include "B.O.M" and indicate quantity, material of construction, make along with IS/BS No., Technical parameters, dimensions, hardness, machining symbol and tolerance, requirement of radiography and hydraulic tests, painting details, elevation, side view, plan, skin section and blow-up view for clarity.</p> <p>h) All drawings shall be prepared as per BHEL's title block and shall bear BHEL's drawing No. Documents marked for submission to BHEL's Customer shall also bear BHEL's Customer's drawing No.</p> <p>i) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's/ Customer's/ Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.</p>			

	NTPC RAMAGUNDAM - I & II (3x200 MW + 3x500 MW)	SPECIFICATION No: PE-TS-467-571-A901	
	GYPSUM DEWATERING EQUIPMENT TECHNICAL SPECIFICATION	SECTION : I	
		SUB-SECTION : D	
		REV. 00	
MASTER DRAWING LIST WITH SCHEDULE OF SUBMISSION	SHEET 6 OF 6		

- j) Bidder to follow the following the drawing submission schedule:
- k) 1st submission of drawings from date of LOI as per the submission schedule.
- l) Every revised submission incorporating comments – within 7 days.
- m) Bidder to submit revised drawings complete in all respects incorporating all comments. Any incomplete drawing submitted shall be treated as non-submission with delays attributable to bidder's account. For any clarification/ discussion required to complete the drawings, the bidder shall depute his personal to BHEL for across the table discussions/ finalizations/ submissions of drawings.



**NTPC RAMAGUNDAM - I & II
(3x200 MW + 3x500 MW)**

**GYPSUM DEWATERING EQUIPMENT
TECHNICAL SPECIFICATION**

PACKING PROCEDURE

SPECIFICATION No: PE-TS-467-571-A901

SECTION : I

SUB-SECTION : D

REV. 00


SHEET 1 OF 4

SECTION-I


SUB-SECTION-D

ANNEXURE-VI


PACKING PROCEDURE

	NTPC RAMAGUNDAM - I & II (3x200 MW + 3x500 MW)	SPECIFICATION No: PE-TS-467-571-A901	
	GYPSUM DEWATERING EQUIPMENT TECHNICAL SPECIFICATION	SECTION : I	
		SUB-SECTION : D	
		REV. 00	
		SHEET 2 OF 4	
PACKING PROCEDURE			

1.0	PACKING AND FORWARDING
1.	<p>Proper packing to be ensured for the Gypsum Dewatering Equipment & its components.</p> <p>Indigenous Supply: Shall be wrapped in polythene bags & packed in a strong rigid wooden crate. Rain water should not enter into the pump internals during storage in the outer yard of power plant.</p> <p>Imported Supply: All imported supply should be packed as per Sea worthy packing standards Annexure-VII of this sub-section. All imported items should have Sea worthy packing. Liberal packing materials and struts shall be provided to arrest rolling and to protect from transit damages.</p>
2.	Equipment and process materials shall be packed and semi-knocked down, to the extent possible, to facilitate handling and storage and to protect bearings and other machine surfaces from oxidation. Each container, box, crate or bundle shall be reinforced with steel strapping in such a manner that breaking of one strap will not cause complete failure of packaging. The packing shall be of best standard to withstand rough handling and to provide suitable protection from tropical weather while in transit and while awaiting erection at the site.
3.	Equipment and materials in wooden cases or crates shall be properly cushioned to withstand the abuse of handling, transportation and storage. Packing shall include preservatives suitable to tropical conditions. All machine surfaces and bearings shall be coated with oxidation preventive compounds. All parts subject to damage when in contact with water shall be coated with suitable grease and wrapped in heavy asphalt or tar impregnated paper.
4.	The entire equipment/ system has to be supplied in containers and it should be suitable for storing in the outer yard of the plant for a minimum period of 12 months. Crates and packing material used for shipping will become the property of owner.
5.	Packaging or shipping units shall be designed within the limitations of the unloading facilities of the receiving ports and the ship will be used. It shall be the bidder's responsibility to investigate these limitations and to provide suitable packaging and shipping to permit transportation to site.
6.	Packing (tare) shall be part of the equipment cost and shall not be subject to return. The packing should ensure integrity and cohesiveness of each delivery batch of equipment during transportation. In case of equipment assemblies and unit's delivery in the packing of glass, plastics or paper the specification of packing with the material and weight characteristics are to be indicated.
7.	<p>Each package should have the following inscriptions and signs stenciled with an indelible ink legibly and clearly:</p> <ol style="list-style-type: none"> a. Destination b. Package Number c. Gross and Net Weight d. Dimensions e. Lifting places f. Handling marks and the following delivery marking

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8.	Each package or shipping units shall be clearly marked or stenciled on at least two sides with the DETAILED SHIPPING ADDRESS –TO BE PROVIDED LATER. In addition, each package or shipping unit shall have the symbol painted in red on at least two sides of the package, covering one fourth of the area of the side.			
9.	Each part of the equipment which is to be shipped as a separate piece or smaller parts packed within the same case shall be legibly marked to show the unit of which it is part, and match marked to show its relative position in the unit, to facilitate assembly in the field. Unit marks and match marks shall be made with steel stamps and with paint.			
10.	Each case shall contain a packing list showing the detailed contents of the package. When any technical documents are supplied together with the shipment of materials no single package shall contain more than one set of such documents. Shipping papers shall clearly indicate in which packages the technical documents are contained.			
11.	The case number shall be written in the form of a fraction, the numerator of which is the serial number of the case and the denominator the total number of case in which a complete unit of equipment is packed.			
12.	Wherever necessary besides usual inscriptions the cases shall bear special indication such as “Top”, “Do not turn over”, “Care”, “Keep Dry” etc. as well as indication of the center of gravity (with red vertical lines) and places for attaching slings (with chain marks).			
13.	Marking for Safe handling: To ensure safe handling, packing case shall be marked to show the following: <ul style="list-style-type: none"> a. Upright position b. Sling position and center of Gravity position c. Storage category d. Fragile components (to be marked properly with a clear warning for safe handling) 			
14.	Each crate or package is to contain a packing list in a waterproof envelope. All items are to be clearly marked for easy identification against the packing List. All cases, packages etc. are to be clearly marked on the outside to indicate the total weight where the weight is bearing and the correct position of the slings are to bear an identification mark relating them to the appropriate shipping documents. All stencil marks on the outside of cases are either to be made in waterproof material or protected by shellac or varnish to prevent obliteration in transit.			
15.	The packing slip shall contain the following information: - Customer name, Name of the equipment, Purchase Order number with Date, Address of the delivery site, Name and Address of the Sender, Serial Number of pump & accessories, BHEL item Code, Gross Weight and Net weight of Supplied items.			
16.	Prior to transport from manufacturer’s work to destination, components of the unit shall be completely cleaned to remove any foreign particles. Flange faces and other machined surfaces shall be protected by an easily removable rust preventive coating followed by suitable wrapping.			
17.	All necessary painting, corrosion protection & preservation measures shall be taken as specified in painting schedule. Supplier shall consider the coastal environment zone which is defined as “very severe” during final finishing/shipping.			

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-467-571-A901 REV 00

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18.	<p>Successful bidder shall furnish the detail packing /shipment box details with information like packing box size, type of packing, weight of each consignment, sequence no. of dispatch, no. of consignment for each deliverable item against each billing break up units/ billable blocks. Without these details the BBU shall not be approved during detail engineering.</p> <p>Also, complete billing break-up with above mentioned details shall be submitted to Purchaser within 10 days of placement of the LOI.</p>
19.	<p>All items/equipment shall be dispatched in properly packed condition (i.e. no item shall be dispatched in loose condition such that it becomes difficult to store/identify its location at site at a later stage).</p>
20.	<p>Cases which cannot be marked as above shall have metal tags with the necessary markings on them. The metal tags shall be securely attached to the packages with strong steel binding wire. Each piece, Skid, Case or package shipped separately shall be labelled or tagged properly.</p>

BIDDER TO REFER SUB-SECTION C2-A FOR CUSTOMER SPECIFICATION IN THIS REGARD.

**NTPC RAMAGUNDAM - I & II
(3x200 MW + 3x500 MW)
GYPSUM DEWATERING EQUIPMENT**

SECTION : I

SUB-SECTION : D

REV. 00

Annexure VII - SEA-WORTHY PACKING PROCEDURE (53 Pages)


VOLUME IIB

**TECHNICAL SPECIFICATION
FOR
SEAWORTHY PACKING FOR EXPORT JOBS**

SPECIFICATION NO. PE-TS-888-100-A001



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI, INDIA**

	TITLE	SPECIFICATION NO. PE-TS-888-100-A001	
	TECHNICAL SPECIFICATION FOR SEAWORTHY PACKING FOR EXPORT JOBS	VOLUME II B	
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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

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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.

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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.

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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

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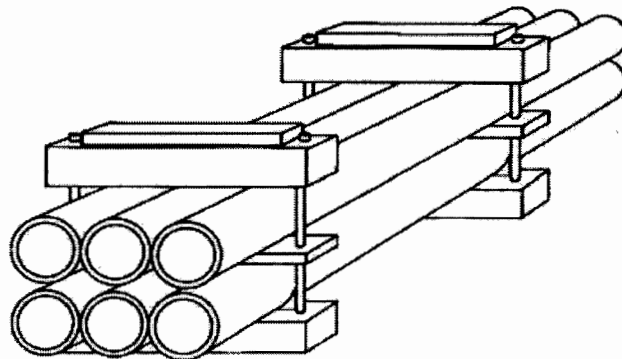
Structural Steel, reinforcing rods, bars, etc., should be packed in bundles of uniform length. Refer to articles 8.1.2, for strapping requirements. Bundle weight not normally to exceed 2,000 kg. Fabricated structures and structural steelwork, etc, should be bundled and packed using wooden beams and long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

8.2 Bundling – Packing Category I

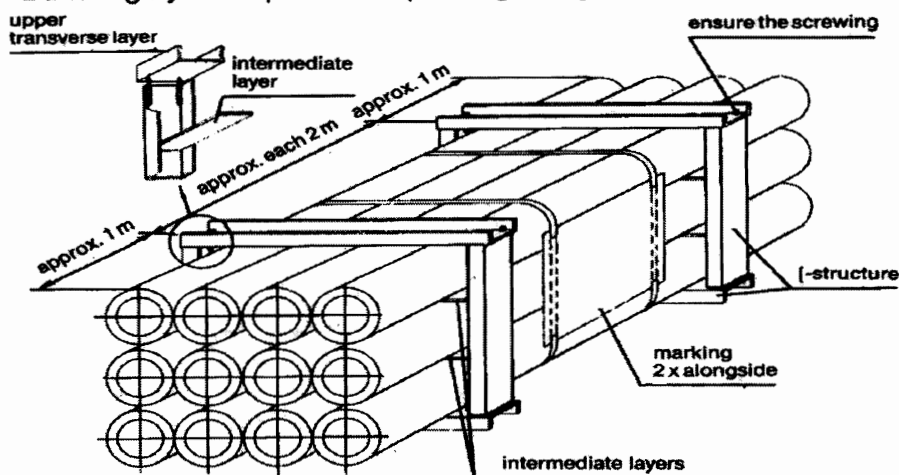
8.2.1 Type of Equipment

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

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- 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)

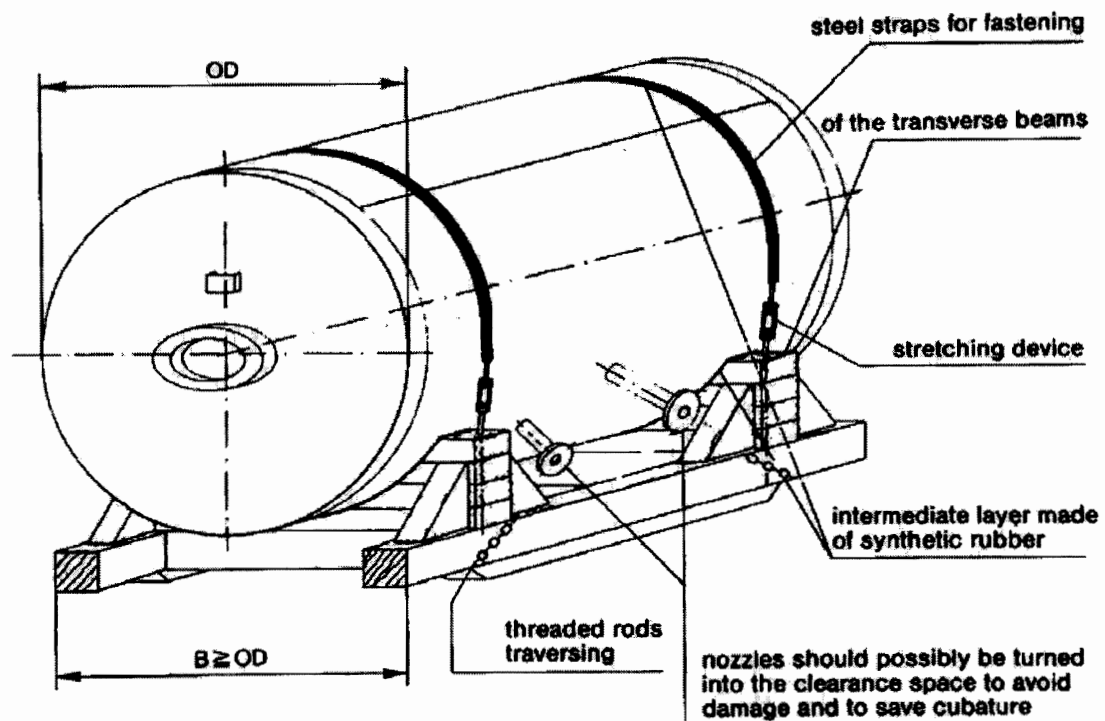
8.3.1 Type of Equipment


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



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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

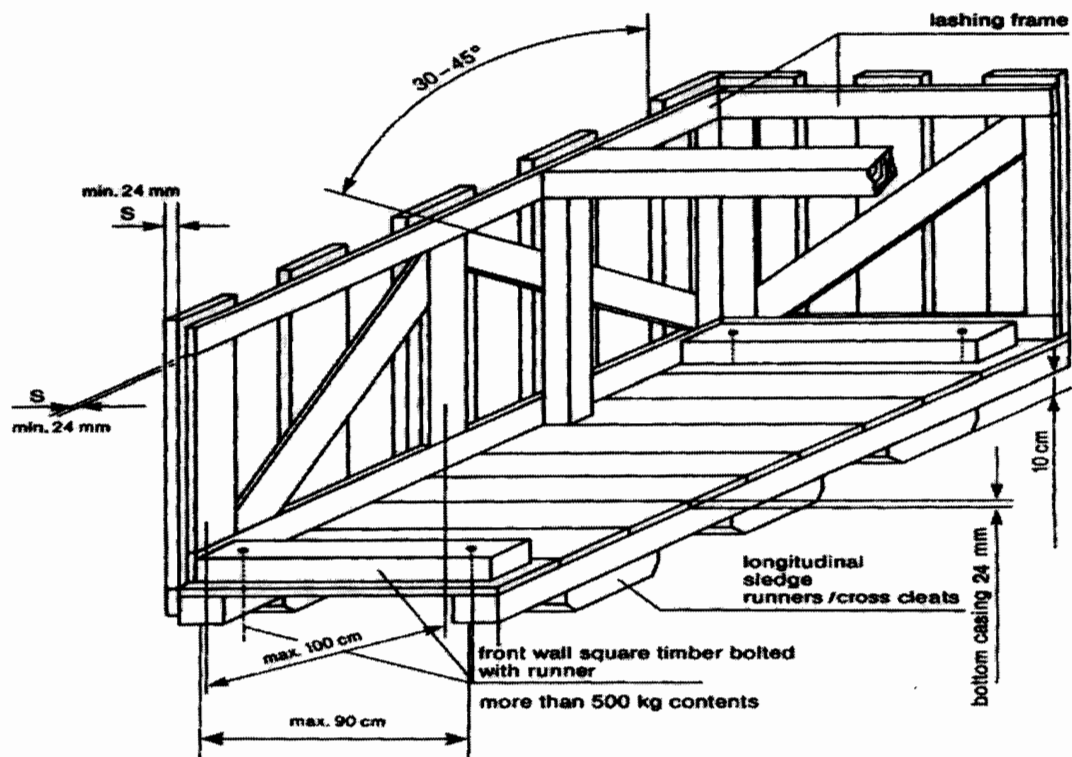
Fabricated equipment, which cannot be transported on cradles; frame-works, prefabricated piping and fittings, mechanical and electrical assemblies. *This type of packing is recommended where many parts of the equipment/component/assembly are not protruding out.*


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



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8.4.2 Cases with Lining – Packing Category IV

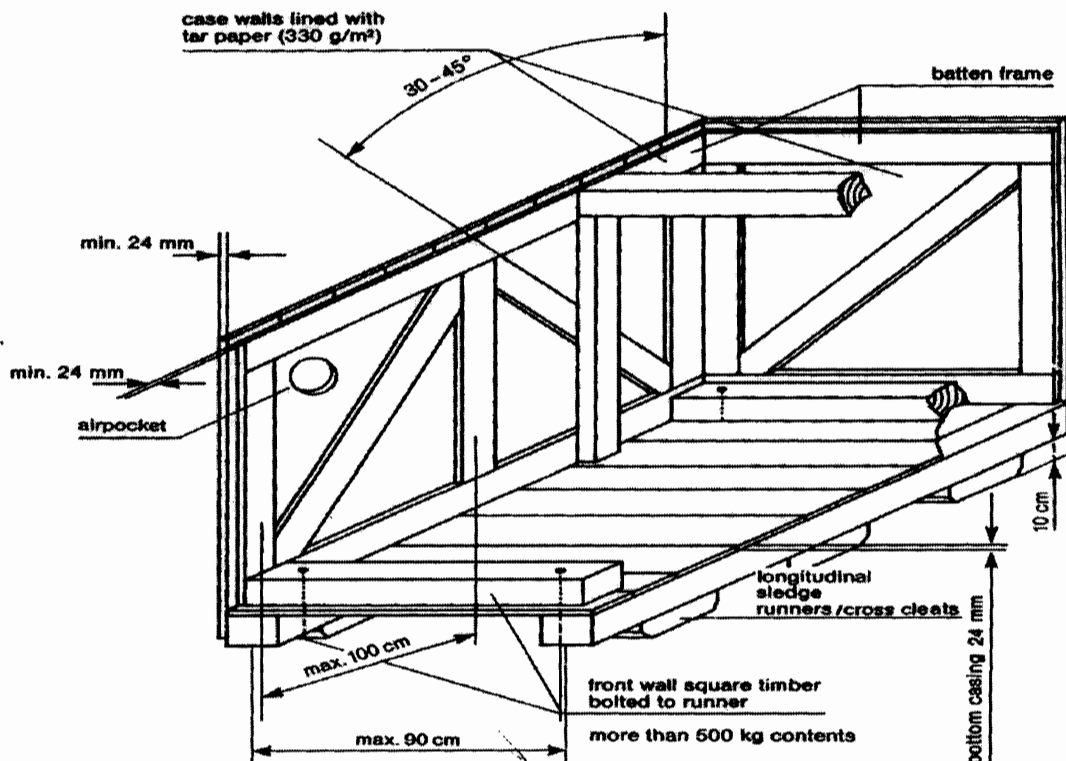
8.4.2.1 Type of Equipment

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.

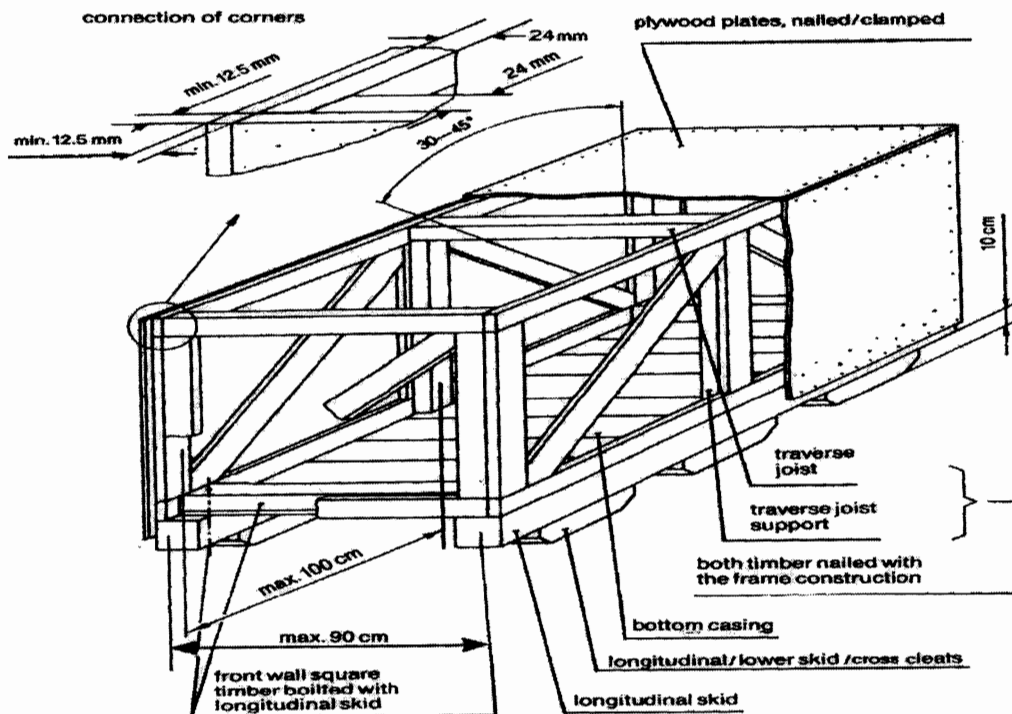
Packing Category IV



8.4.3 Cases with Alternative Surface Materials

8.4.3.1 Plywood Box – Packing Category IV A

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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

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

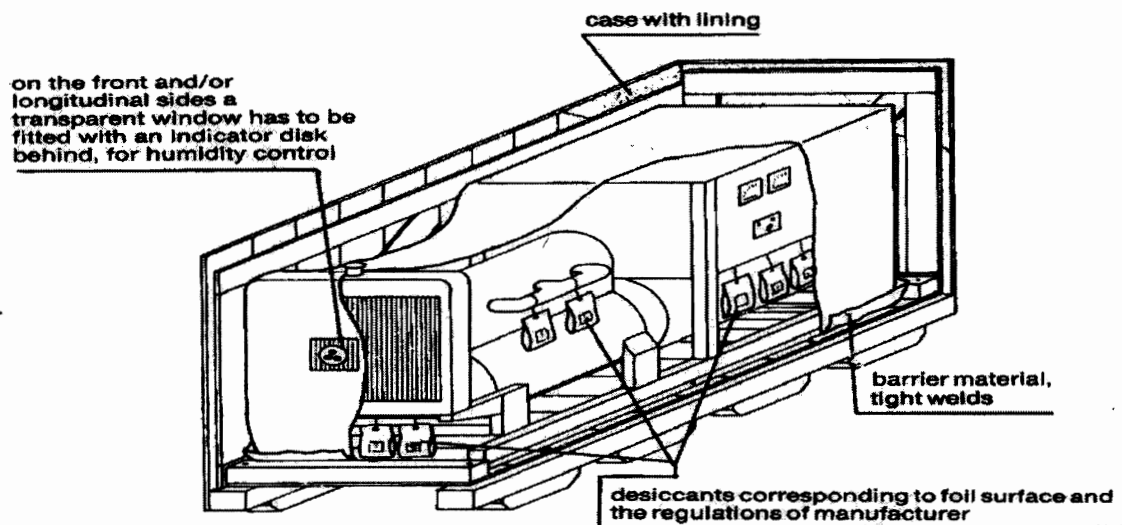
8.4.5.2 Type of Construction

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).

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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.

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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 Detailed specification for Wooden Crates/Boxes/Cases and other packing materials

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, cracks, 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

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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

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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.



TITLE

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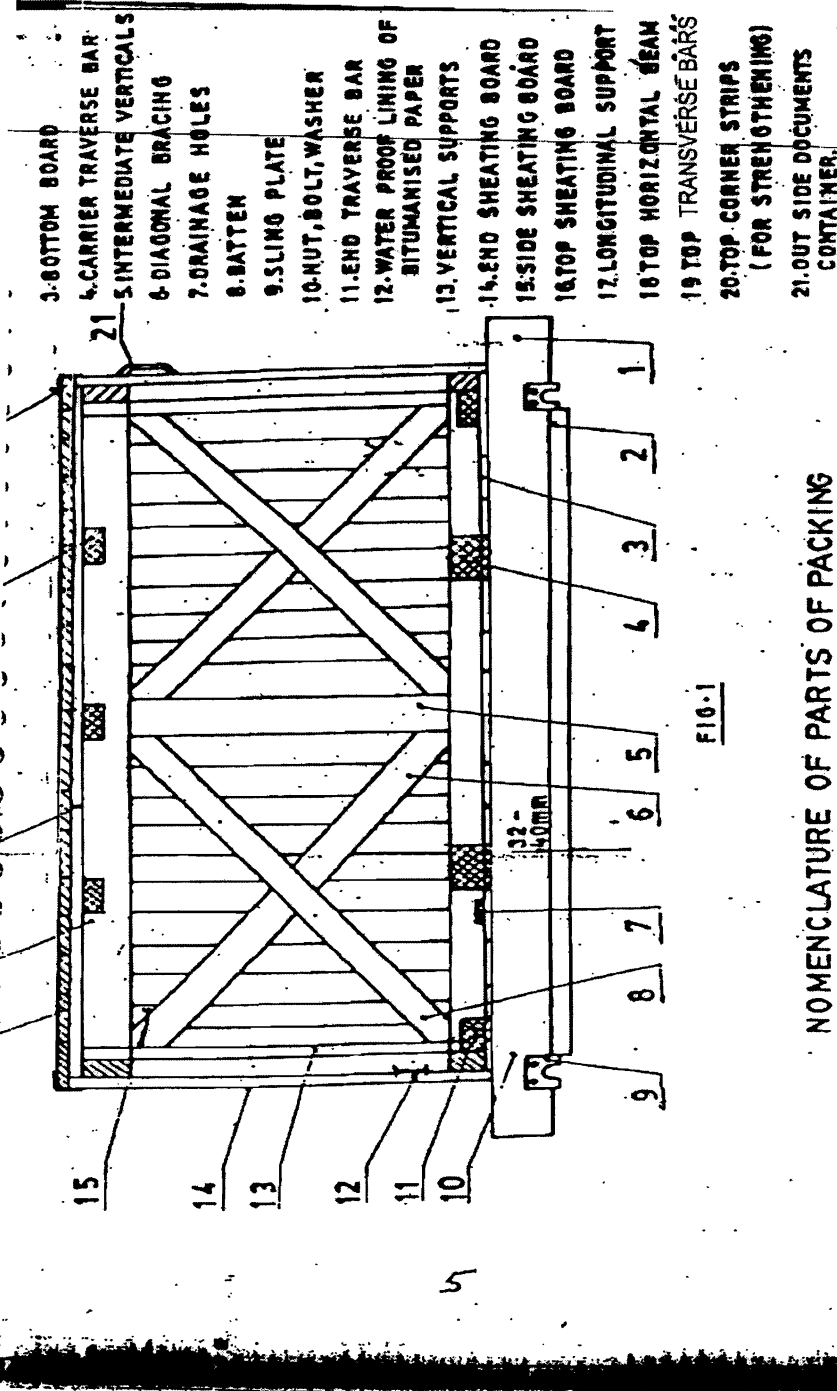
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BOTTOM FRAME ARRANGEMENTS

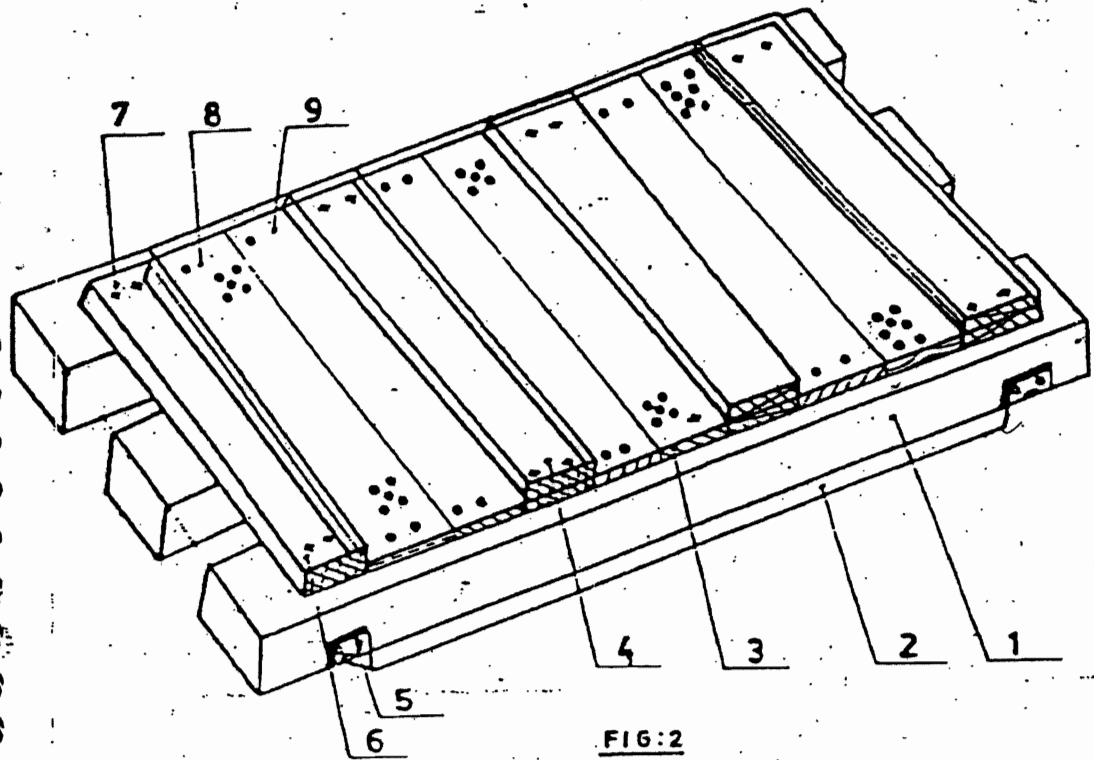



FIG:2

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 TRAVERSE BAR
5. SLING PLATE
6. TRAVERSE BAR
7. BOLT, NUT & WASHER
8. DRAINAGE HOLES
9. NAILS

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TOP FRAME ARRANGEMENT

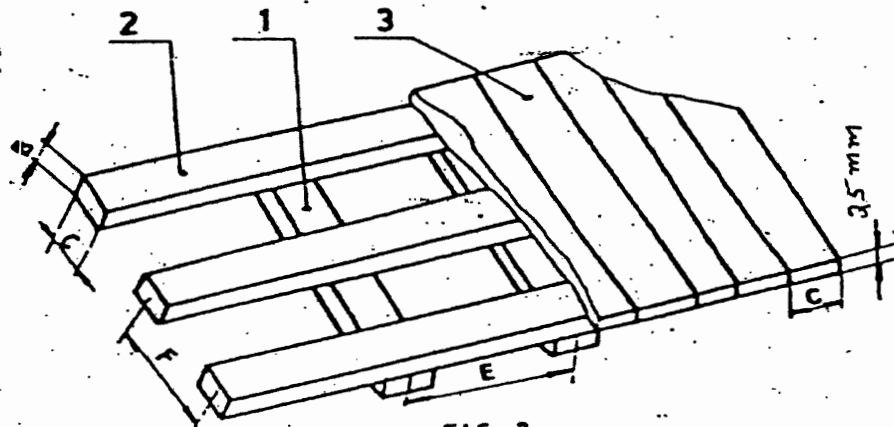
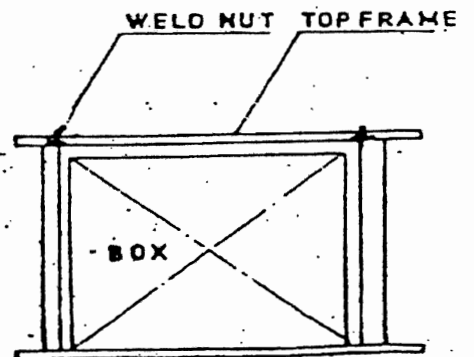
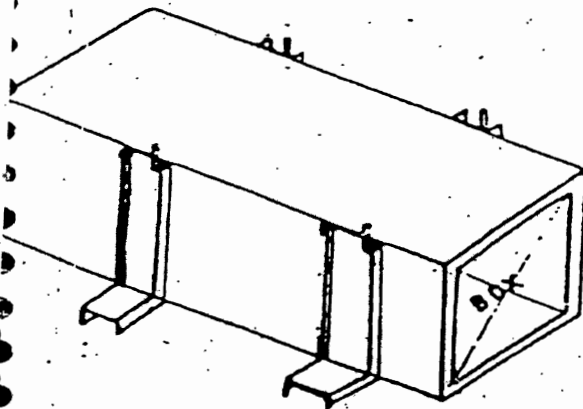


FIG-3


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

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

ARRANGEMENT OF C-CLAMPS AROUND CASES



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ARRANGEMENT OF DIAGONAL BRACING AND HORIZONTAL SUPPORT

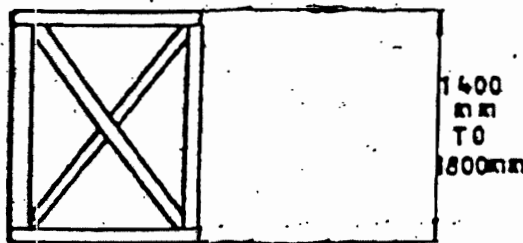


FIG: 6

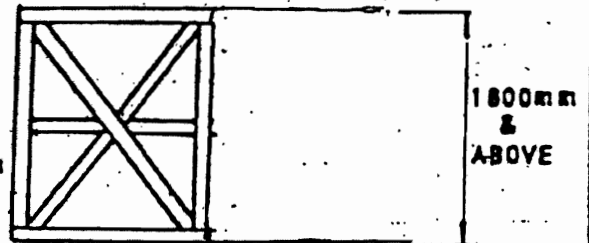


FIG: 8

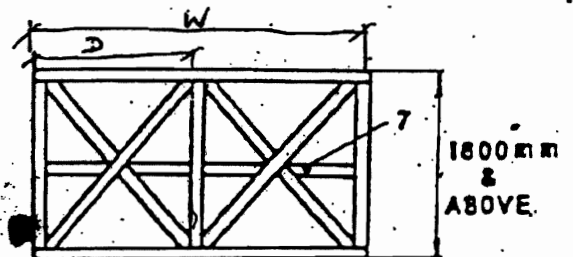


FIG: 7

7- Middle Horizontal Support

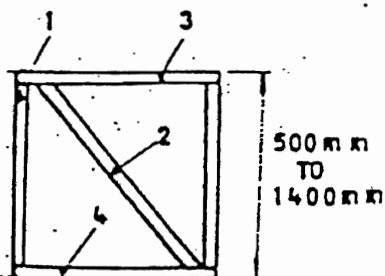


FIG: 5

1- Vertical Support

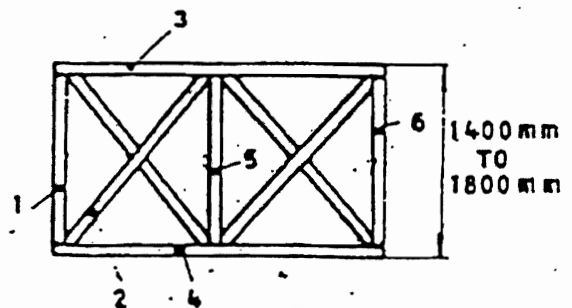



FIG: 7

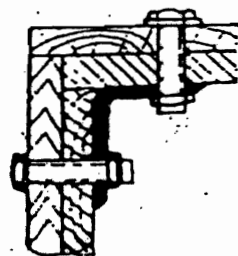
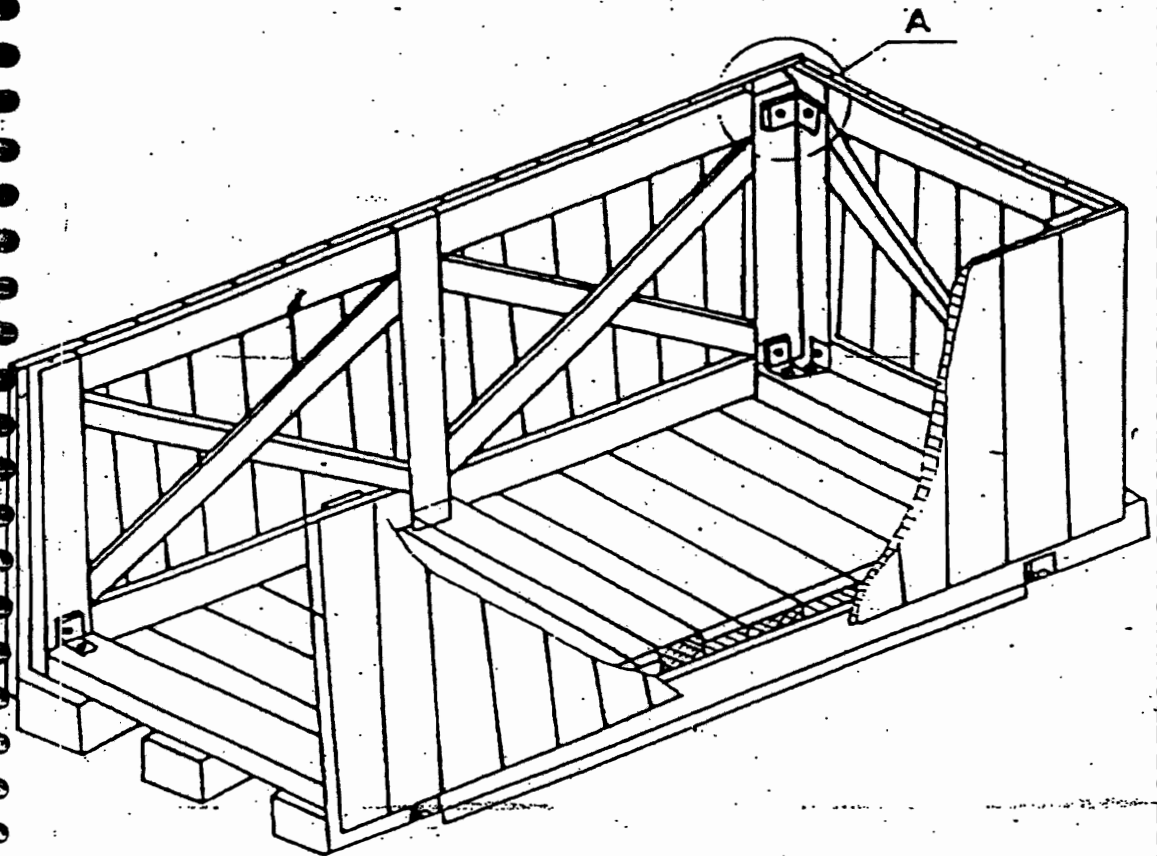
1, 5, 6 - Vertical Support

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ARRANGEMENT OF PACKING CASE



DETAIL-A

HOLE DIAMETER
MUST CONFORM
TO BOLT DIA

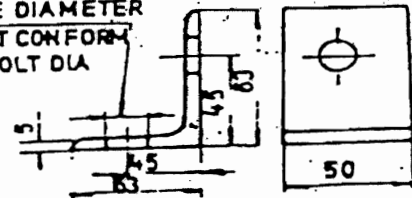



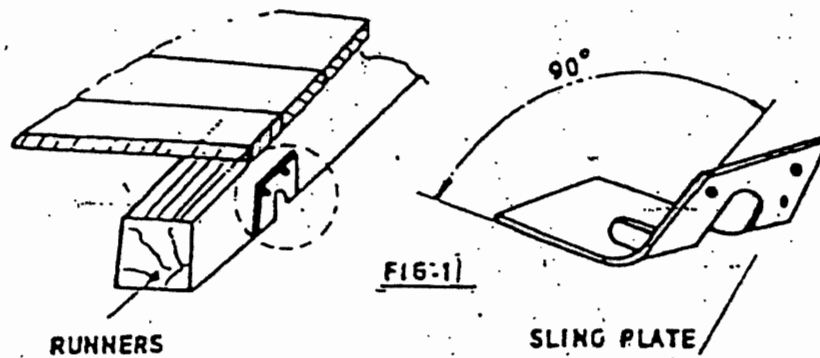
FIG:10

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ARRANGEMENT OF SLING & PLATE ON

CASES



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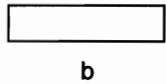
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TABLE-1

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





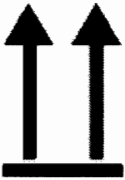




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Table-2

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	30	30	30	30	30	30
		X	X	X	X	X	X	X
		100	100	100	130	130	130	130
	1201 to 1600	30	30	30	30	30	30	30
		X	X	X	X	X	X	X
		130	130	130	130	130	130	130
	1601 to 2000	30	30	30	30	30	30	30
		X	X	X	X	X	X	X
		130	130	130	130	130	130	130
	2001 to 3000	30	30	30	30	30	30	40
		X	X	X	X	X	X	X
		130	130	130	130	130	130	150
	3001 to 4000	40	40	40	40	40	40	40
		X	X	X	X	X	X	X
		150	150	150	150	150	150	150

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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.


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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.

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Do not destroy barrier		<p>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".</p>
Tear off here		<p>This symbol is intended only for the receiver.</p>

FIG-12

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		BHEL-PEM-DELHI-INDIA			
CONSIGNEE					
MATERIAL					
CUSTOMER REF.			M.D. 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				

FIG-13: MARKING PLATE

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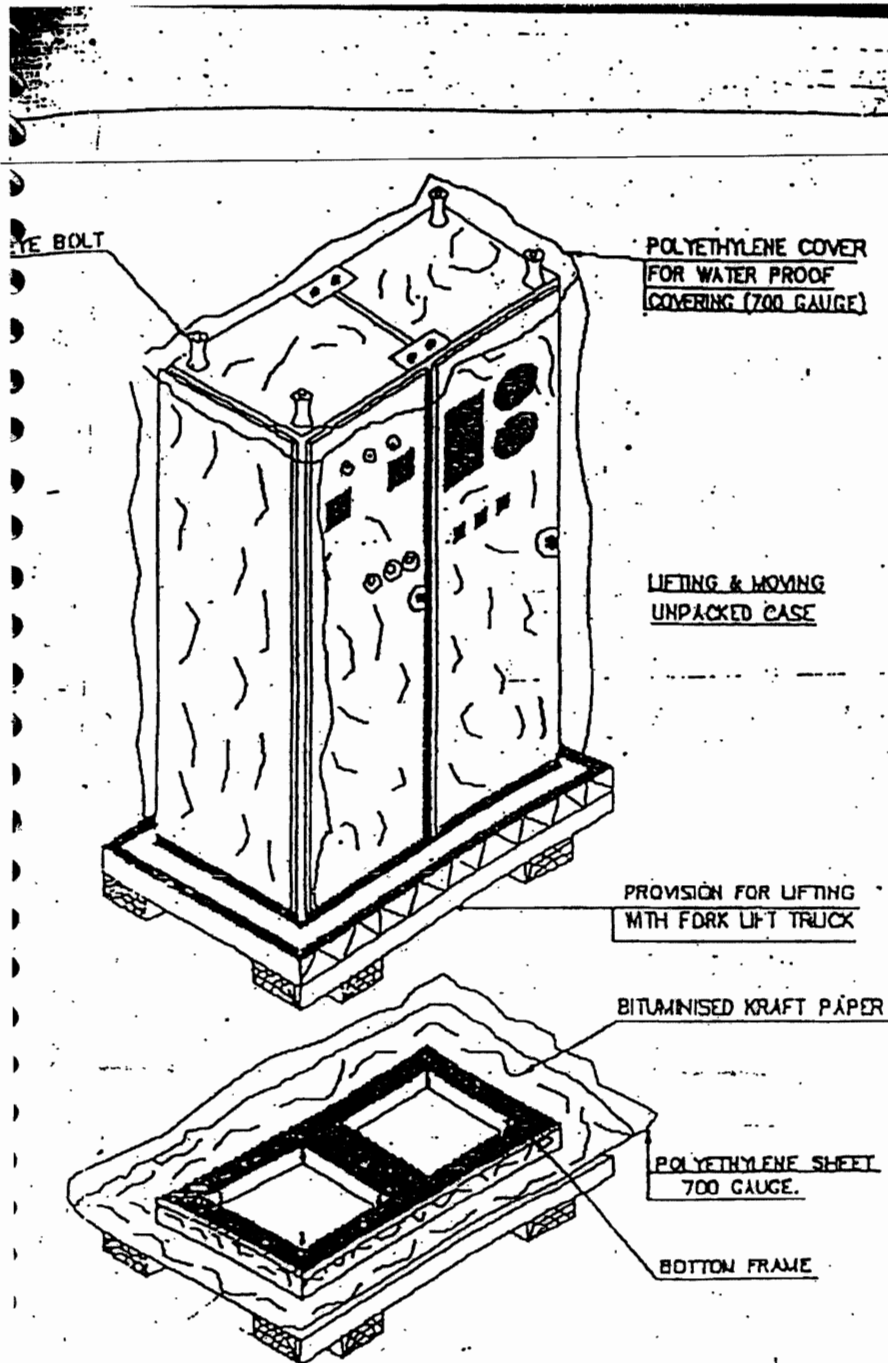

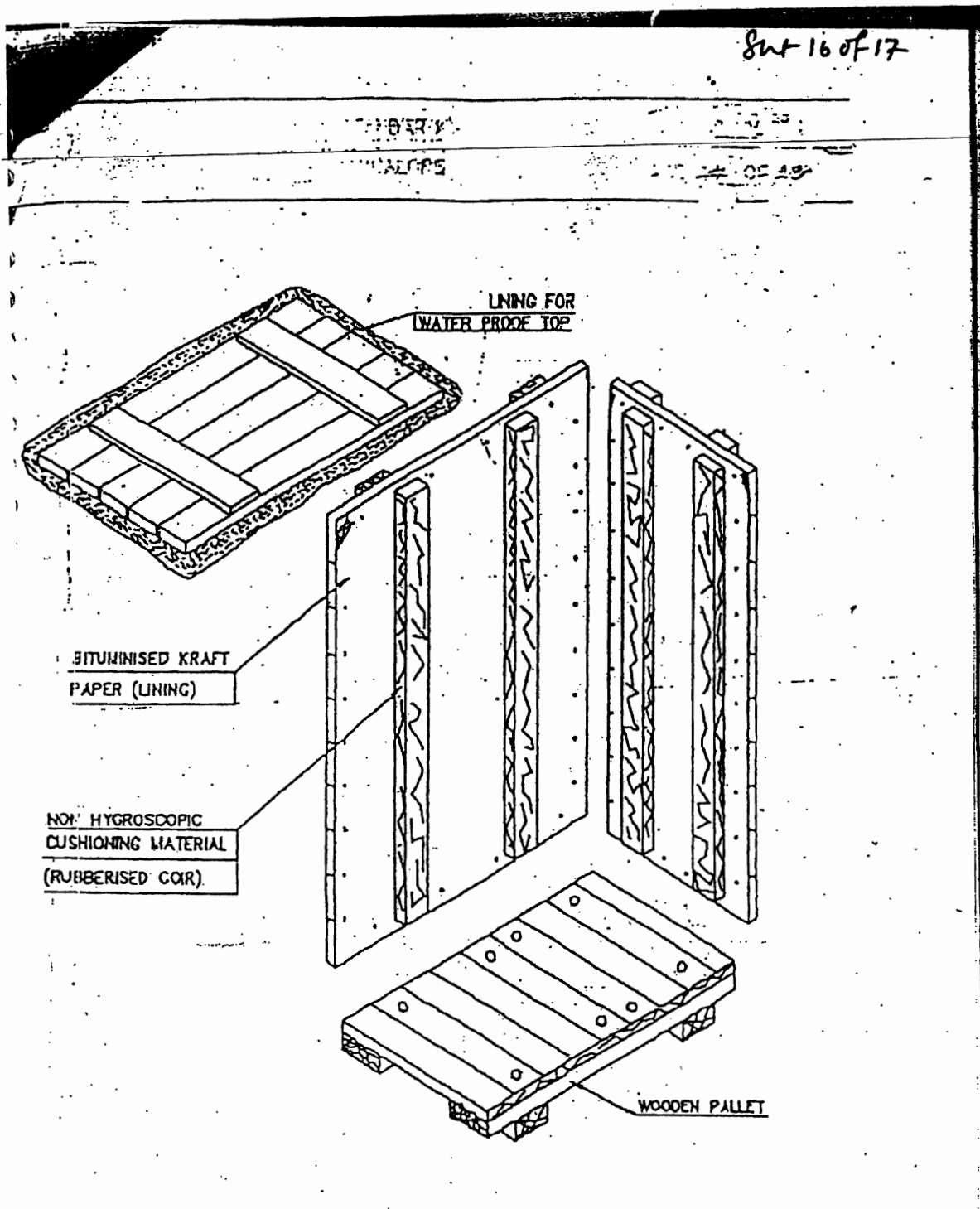



FIGURE-14

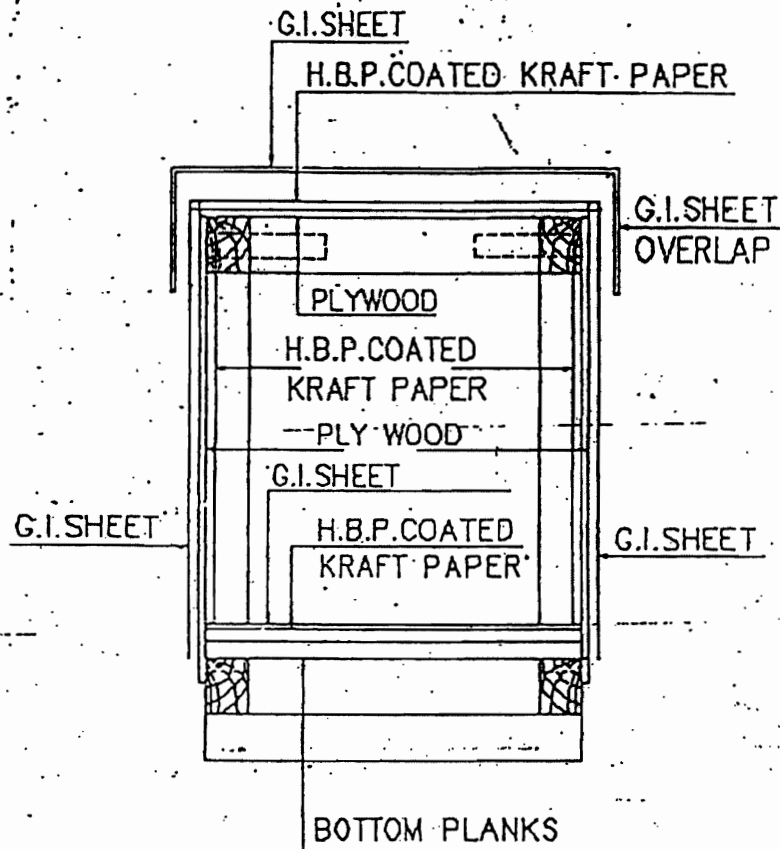
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**FIG-16 : CLOSED PACKING CASE WITH G.I.SHEET
SHOWING LAYERS OF PACKING MATERIALS.**

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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.

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- 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.

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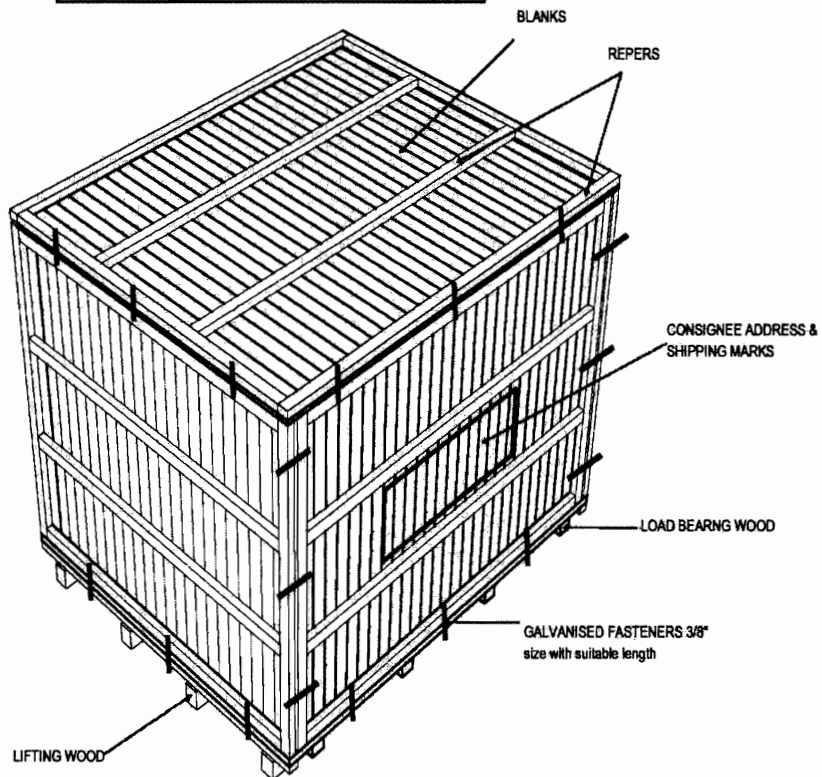
- Thermocol packing shall be made for glass items like Ball vessel sight glass, Vpiece sight glass & pressure gauge.
- Silica gel desiccants shall be kept inside of each case to absorb the moisture.
- A Packing list covered in a polythene envelope shall be fixed inside and outside of each packing case.
- 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.

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

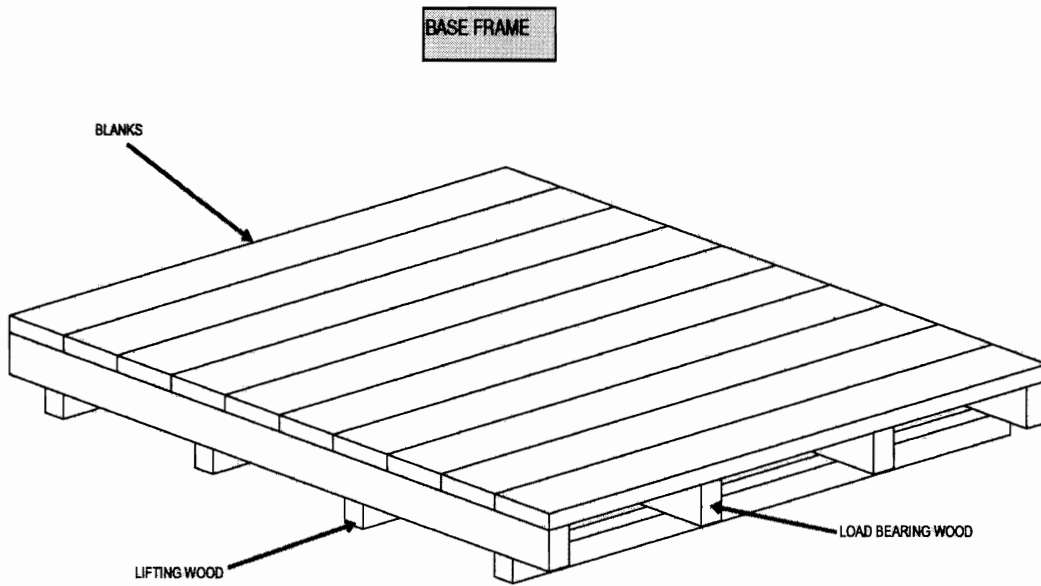
This Type of case to be used for following items:

1. BALL SEPERATOR
2. BALL COLECTOR SKID




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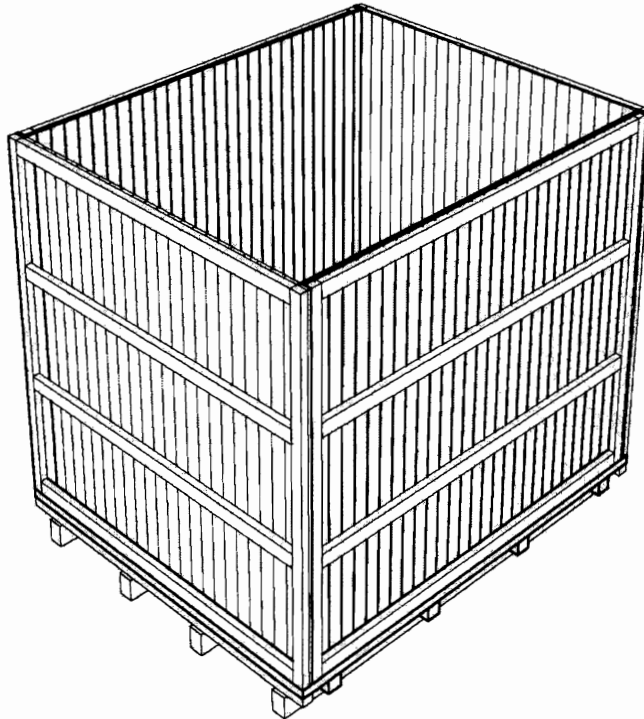


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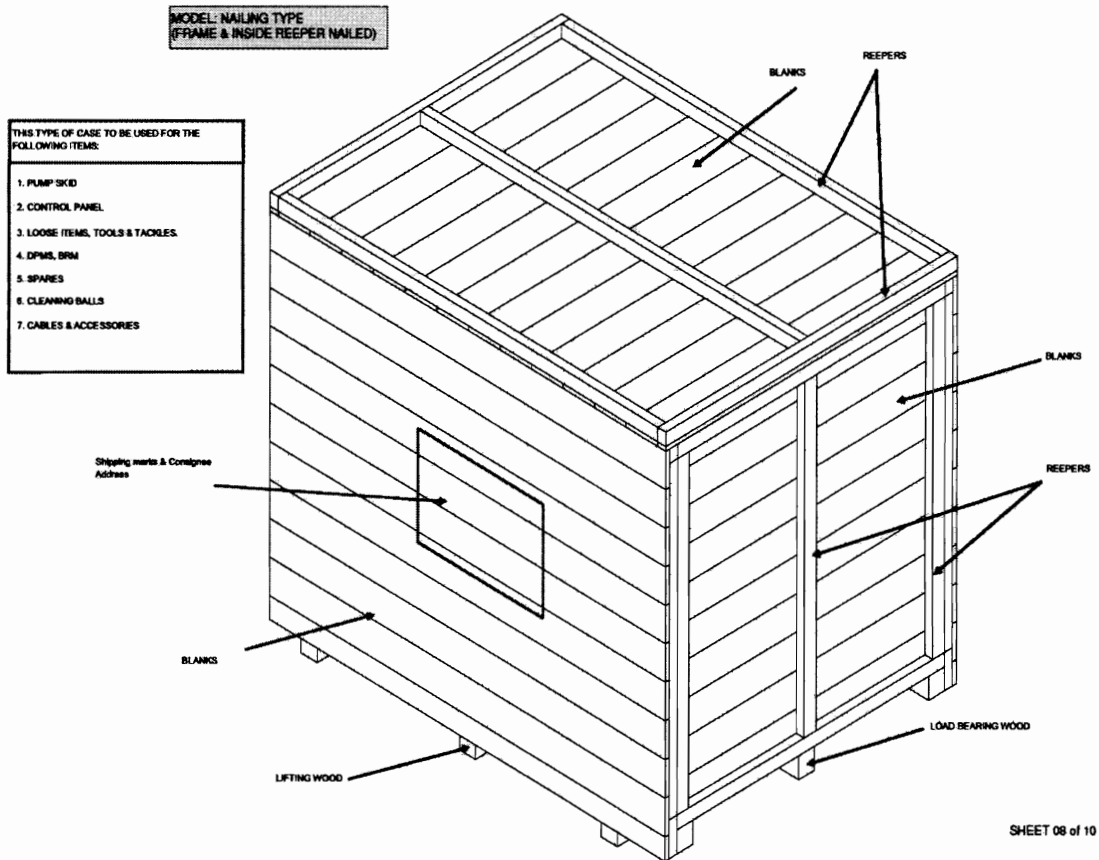
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MODEL: FASTNERS TYPE - WITHOUT TOP

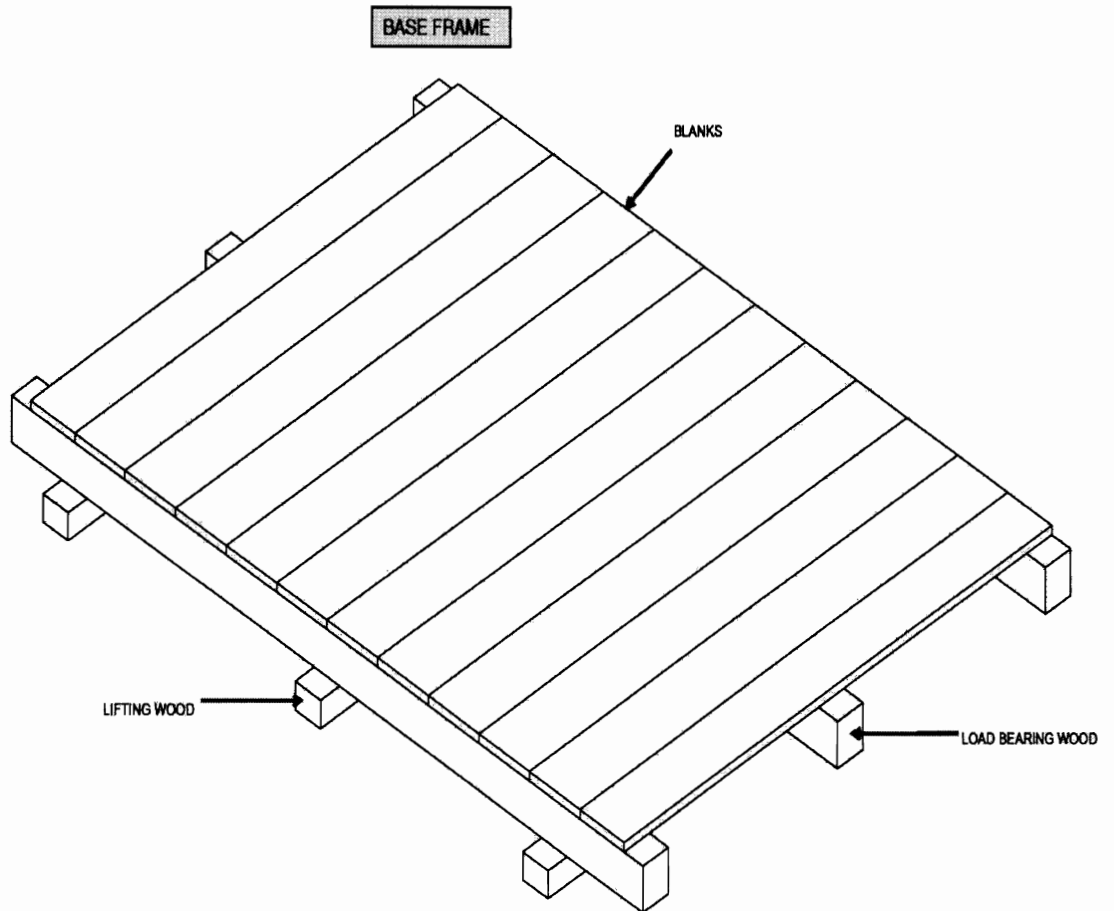


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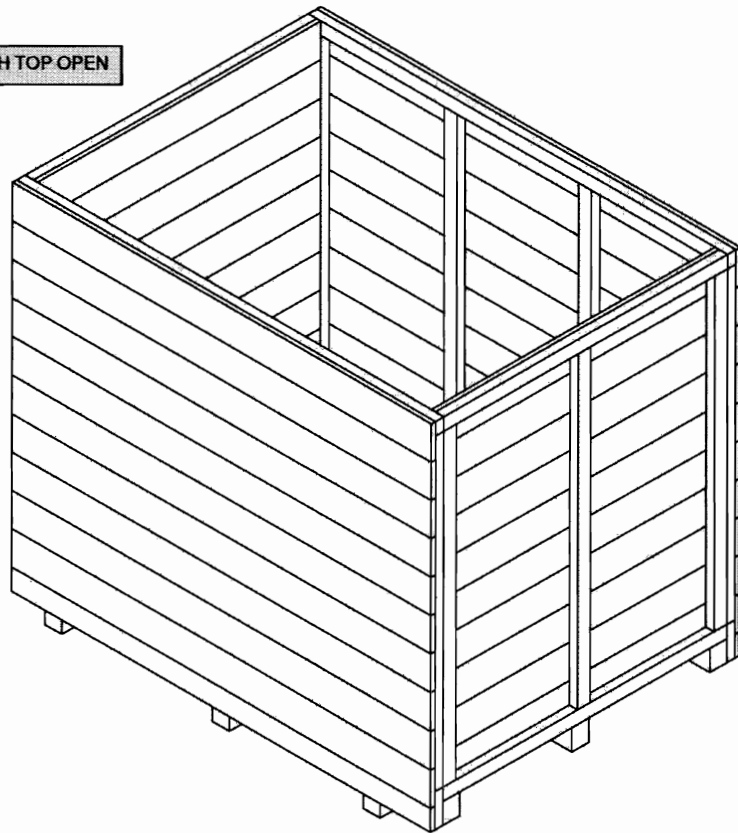


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NAILING TYPE MODEL WITH TOP OPEN



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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

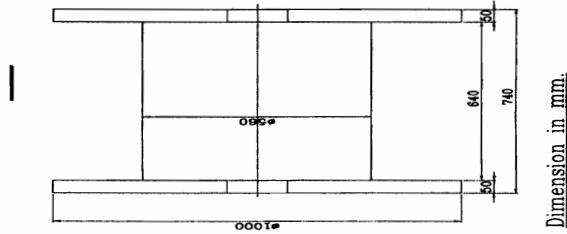
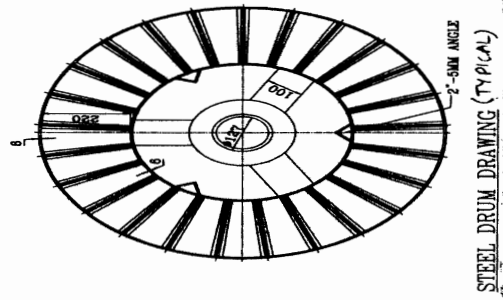
11.1 CABLES


11.1.1 **Type of Equipment**
All type of cables..

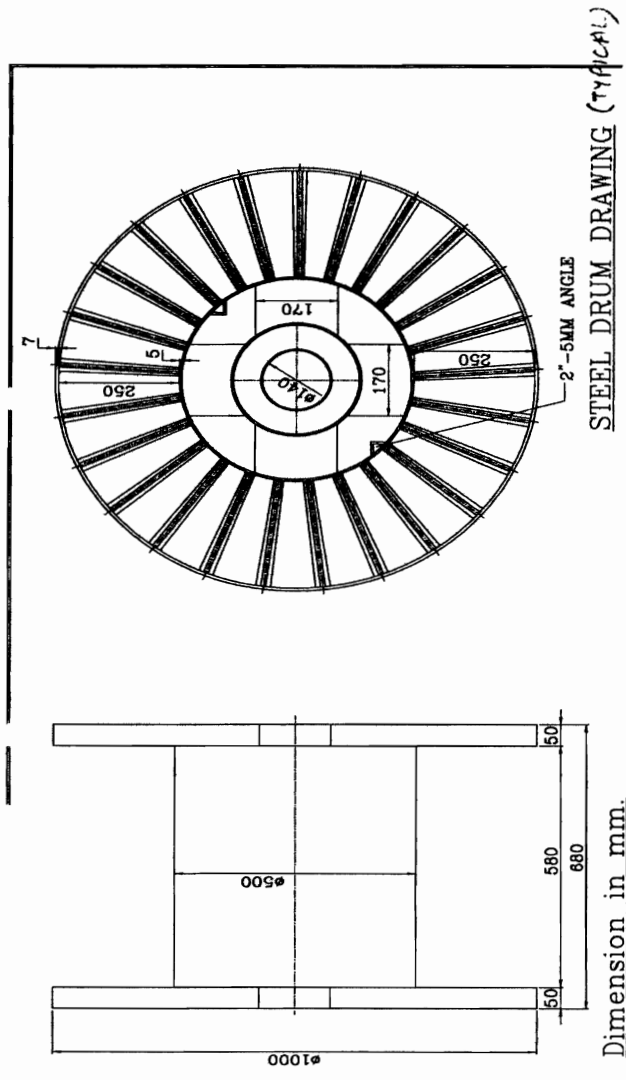
11.1.2 **Type of Construction**

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).

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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.

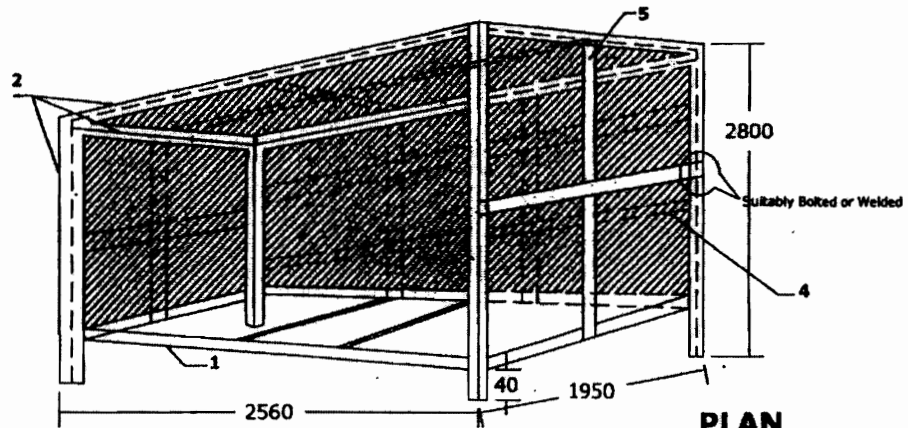
- 1) All Dimensions are in "mm" unless otherwise stated.
- 2) Packing Box shall be fabricated using 50x50x6mm MS Angle, 50x3mm Flat, 2.5 mm thick C Channel, 1mm & 1.6mm Thick sheet.
- 3) Finish of Packing Box Shall be Galvanized.
- 4) Angle & Channel Section forming part of the Main frame shall be welded 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.

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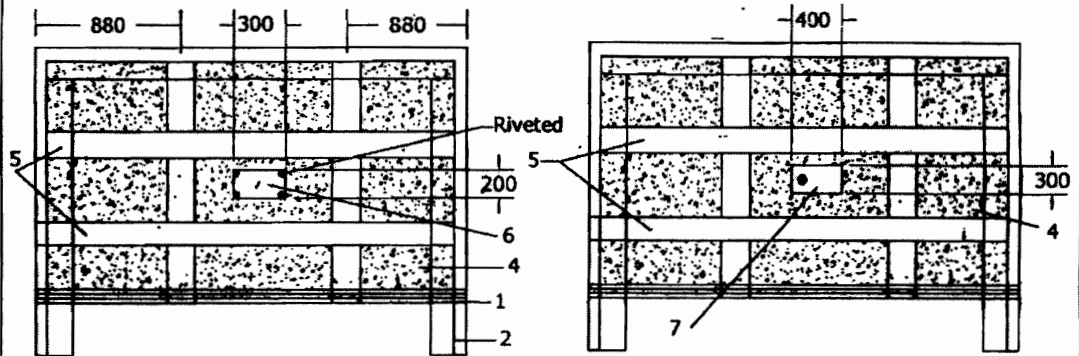
- 6) Welding Portion on galvanized surfaces shall be painted with Zinc Rich Paint.
- 7) Dispatch details such as consignor/consignee address, contract and case details, 'country of origin, port of delivery, stacking instructions shall be written on one of the side of boxes. An anodized aluminium plate 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

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STEEL PACKING (TYPICAL DETAILS)

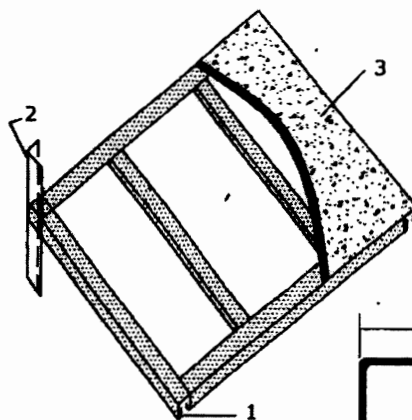


PLAN



FRONT SIDE OF BOX

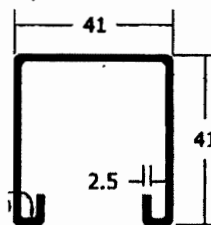
BACK SIDE OF BOX



BOTTOM FRAME ARRANGEMENT


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 Aluminium Plate for Marking.
7. Hinged Inspection Window.



DETAILS OF "C" CHANNEL

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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 DISTRIBUTION 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 COMMISSIONING 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

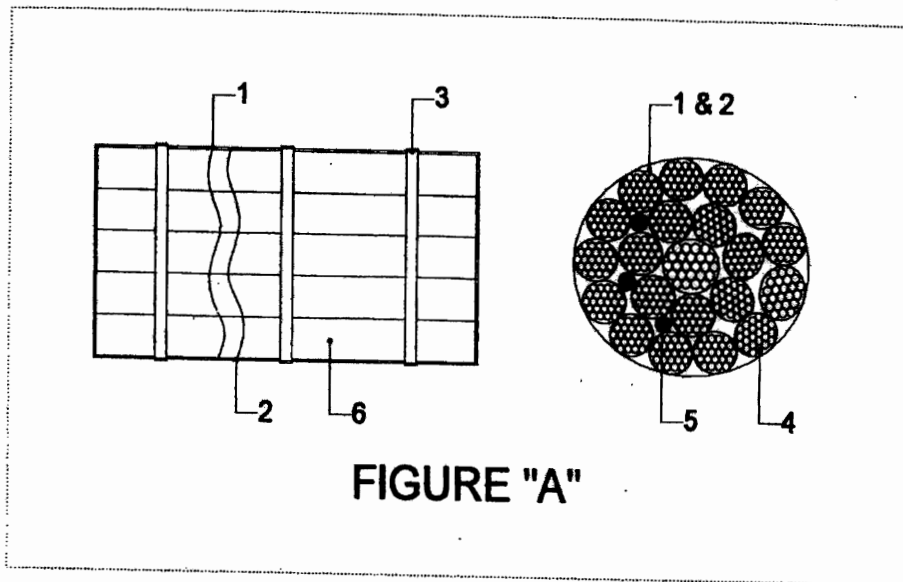
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Structural steel will be different sizes and shapes. Hence it will be packed as per Figure No. B and described as following :


- 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.

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PACKING PROCEDURE FOR CONDUIT PIPE



- 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

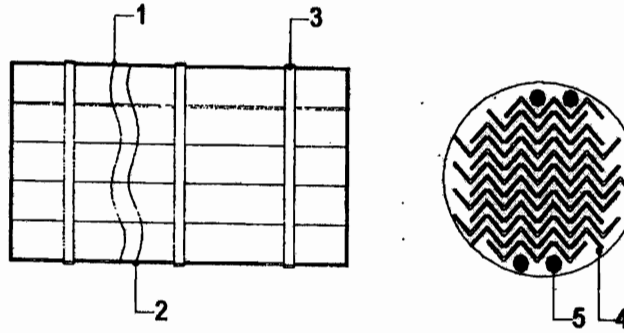



FIGURE "B"

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

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packing procedure for poles

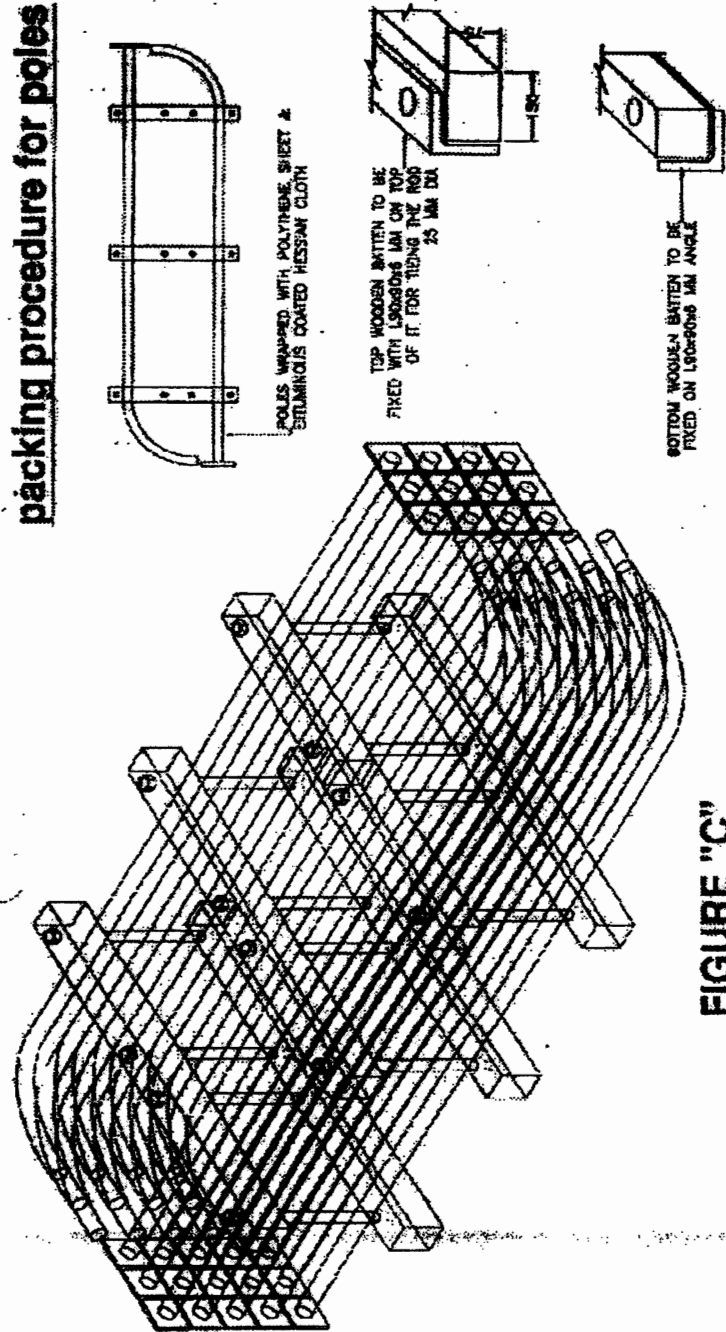



FIGURE "C"

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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 ≥ 0.175 mm) 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

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

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- 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

	TITLE	SPECIFICATION NO. PE-TS-888-100-A001	
	TECHNICAL SPECIFICATION FOR SEAWORTHY PACKING FOR EXPORT JOBS	VOLUME II B	
		SECTION D	
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		SHEET 52	OF 52

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.

2) Class No. and Fluid Designation

CLASS NO.	FLUID NAME	SYMBOL	
AA60	Gypsum Slurry	GS	
	Filtrate Slurry	FS	
	Waste Water	WW	
	Duct Drain	DD	
	Beltfilter Vent Gas	VBG	
BA01	Instrument Air	AI	
	Lube Oil (Low Pressure)	LOL	
CC01	Process Water	WP	Note 1
	Raw Water	WR	
	Cooling Water Supply	WCS	
	Cooling Water Return	WCR	
	Vacuum Pump Vent	VG	
	Antifoam Agent	AA	

Note I

Class AA60 shall be applied for process water service line in contact with corrosive and abrasive media.

3) Abbreviations

Abbreviations used throughout this specification are as follows:

BB	:	Bolted Bonnet
BC	:	Bolted Cover
BE	:	Bevel End
BW	:	Butt Weld
CAL	:	Calculation
CR	:	Chloroprene Rubber
E	:	Electric Resistance Weld
EPDM	:	Ethylene Propylene Diene Methylene Rubber
Eq	:	Equal
FE	:	Flange End
FF	:	Flat Face
G. OP	:	Gear Operation
Gal.	:	Galvanized
HEX.	:	Hexagon
IIR	:	Isobutylene Isoprene Rubber

ISRS	:	Inside Screw Rising Stem
La	:	Larger
L.OP	:	Lever Operation
NB	:	Nominal Bore
NW	:	Nozzle Weld
OS&Y	:	Outside Screw & York
PE	:	Plane End
PP	:	Poly Propylene
PTFE	:	Poly Tetra Fluoro Ethylene
RF	:	Raised Face
R/L	:	Rubber lined or rubber seated
S	:	Seamless
SB	:	Screw Bonnet
SC	:	Screw Cover
SCH	:	Schedule No.
SCR'D	:	Screwed
Sm	:	Smaller
SO	:	Slip On
St.	:	Stellite
SW	:	Socket Weld
W	:	Weld
WN	:	Welding Neck
W/LINING	:	With Lining
V#	:	Valve No.
13 CR	:	13% CHROMIUM

CLASS	Max. Press. (MPaG)		1.1		C. A. mm	CLASS
AA60 (1/1)	Max. Temp. (degC)		65			AA60 (1/1)
FLUID	GYPSUM SLURRY					
ITEM	Size	Thickness	Specification			ITEM No.
PIPING	DN25 – DN50	SCH40	A53-B SML PE (I:R/L) ASME			
	DN65 – DN150	SCH40	A53-B E. R. W BE (I:R/L) ASME			
	DN200 – DN300	SCH20	A53-B E. R. W BE (I:R/L) ASME			
	DN350 – DN400	SCH10	A53-B E. R. W BE (I:R/L) ASME			
	DN450 – DN500	SCH10	A53-B E. R. W BE (I:R/L) ASME			
	DN550 – DN1000	7.9T	A134 (A283-C) EFW BE (I:R/L) ASME			
	DN1100– DN1200	9.5T	A134 (A283-C) EFW BE (I:R/L) ASME			
FITTING	DN25 – DN50	Suit to PIPE	BW A234-WPB (I:R/L) ASME-B16.9			
	DN65 – DN150	Suit to PIPE	BW A234-WPBW (I:R/L) ASME-B16.9			
	DN200 – DN300	Suit to PIPE	BW A234-WPBW (I:R/L) ASME-B16.9			
	DN350 – DN500	Suit to PIPE	BW A234-WPBW (I:R/L) ASME-B16.9			
	DN550 – DN1000	Suit to PIPE	BW A134 (A283-C) EFW (I:R/L) ASME-B16.9			
	DN1100– DN1200	Suit to PIPE	BW A134 (A283-C) EFW (I:R/L) ASME-B16.9			
SMOOTH BEND	DN25 – DN80	Suit to PIPE	BW A53-B (I:R/L)			
FLANGE	DN25 – DN600		SO A105 ASME150 SO FF (I:R/L) ASME-B16.5			
	DN650 – DN1800		SO A105 AWWA CL. B SO FF (I:R/L) AWWA-C207			
PINCH VALVE	DN25 – DN150		PN 16 A126-B TRIM-13CR SLEEVE-CR LINING-IIR FF HAND WHEEL			
GASKET	DN25 – DN600		V-2000 RUBBER RUBBER OR EQ. ASME150 2.0T FLAT RING			
	DN650 – DN1800		V-2000 RUBBER RUBBER OR EQ. AWWA CL. B 2.0T FLAT RING			
BOLT & NUT	ALL SIZE		STUD U HEAVY NUT A307-GR. B/A563-GR. A FINISHED			
Note: I: R/L - Replaceable Wear Resistant Natural Rubber Lining of minimum 6mm thickness. Additional thickness of 2 mm rubber lining shall be provided in bends.						

CLASS	Max. Press. (MPaG)	1		C. A. mm
BA01 (1/1)	Max. Temp. (degC)	45		
FLUID	INSTRUMENT AIR, LUBE OIL			
ITEM	Size	Thicknes s	Specification	
PIPING	DN6- DN50	SCH40S	A312-TP304 SML PE ASME	
	DN65-DN250	SCH20S	A312-TP304 E. R. W BE ASME	
FITTING	DN6 - DN50	Suit to PIPE	3000LB SW A182-F304 ASME-B16.11	
	DN65 - DN250		BW A403-WP304 ASME-B16.9	
FLANGE	DN6 - DN50	Suit to PIPE	SW GR. 304 GR. 304 ASME150 SW RF ASME-B16.5	
	DN65 - DN250		LOOSE A105 ASME150 LOOSE ASME-B16.5	
GATE VALVE	DN6 - DN50		API-602 PN 16 A182-F304 AISI304 SW BB, OS&Y HAND WHEEL	
	DN65 - DN250		ASME-B16.34 PN 16 A351-CF8 AISI304 RF BB, OS&Y HAND WHEEL	
GASKET	DN6 - DN150		V-6500 NON-ASBESTOS OR EQ. ASME150 1.5T FLAT RING	
	DN200- DN250		V-6500 NON-ASBESTOS OR EQ. ASME150 3.0T FLAT RING	
BOLT & NUT	ALL SIZE		STUD U HEAVY NUT A307-GR. B/A563-GR. A FINISHED	

CLASS	Max. Press. (MPaG)	0.11	0.85		C. A. mm
CC01 (1/1)	Max. Temp. (degC)	155	45		
FLUID	WATER, VENT GAS				
ITEM	Size	Thickness	Specification		
PIPING	DN6 - DN50	SCH80	A53-B SML PE ASME		
	DN65 - DN150	SCH40	A53-B E. R. W BE ASME		
	DN200 - DN300	SCH20	A53-B E. R. W BE ASME		
FITTING	DN6 - DN50		3000LB SW A105 ASME-B16.11		
	DN65 - DN150	Suit to PIPE	BW A234-WPB ASME-B16.9		
	DN200 - DN300		BW A234-WPB ASME-B16.9		
FLANGE	DN6 - DN150	Suit to PIPE	SO A105 ASME150 SO RF ASME-B16.5		
	DN200 - DN300		SO A105 ASME150 SO RF ASME-B16.5		
GATE VALVE	DN6 - DN50		API-602 PN16 A105 13CR SEAT STL SW BB, OS&Y HAND WHEEL		
	DN65 - DN300		ASME-B16.34 PN16 A395 13CR RF BB, OS&Y HAND WHEEL		
GLOBE VALVE	DN6 - DN50		API-602 PN16 A105 13CR SEAT STL SW BB, OS&Y HAND WHEEL		
	DN65 - DN300		ASME-B16.34 PN16 A395 13CR RF BB, OS&Y HAND WHEEL		
CHECK VALVE	DN6 - DN50		API-602 PN16 A105 13CR SEAT STL SW BC, LIFT		
	DN65 - DN300		ASME-B16.34 PN16 A395 13CR RF BC, SWING		
BALL VALVE	DN6 - DN100		ASME-B16.34 PN16 A105 AISI304 RF BALL LEVER. FULL BORE		
BUTTERFLY VALVE	DN50 - DN150		ASME-B16.34 PN16 A216-WCB 13CR EPDM RF WAFER WAFER LEVER.		
	DN50 - DN150		ASME-B16.34 PN16 A216-WCB 13CR EPDM RF WAFER WAFER AIR CYLINDER W/L. SWITCH		
	DN50 - DN150		ASME-B16.34 PN16 A216-WCB 13CR EPDM RF WAFER WAFER ELECTRIC MOTOR W/L. SWITCH		
	DN200 - DN300		ASME-B16.34 PN16 A216-WCB 13CR EPDM RF WAFER WAFER WHEEL WITH GEAR		
	DN200 - DN300		ASME-B16.34 PN16 A216-WCB 13CR EPDM RF WAFER WAFER AIR CYLINDER W/L. SWITCH		
	DN200 - DN300		ASME-B16.34 PN16 A216-WCB 13CR EPDM RF WAFER WAFER ELECTRIC MOTOR W/L. SWITCH		
GASKET	DN6 - DN150		V-6500 NON-ASBESTOS OR EQ. ASME150 1.5T FLAT RING		
	DN200 - DN300		V-6500 NON-ASBESTOS OR EQ. ASME150 3.0T FLAT RING		
BOLT & NUT	ALL SIZE		STUD U HEAVY NUT A307-GR. B/A563-GR. A FINISHED		

The Bidder can provide slurry pipes of size lower than 300 NB made up of FRP material (silicon carbide coating on slurry exposed surface) if it has previous experience of providing the same. Outer surface of the pipes should be fire retardant.



SUB-SECTION-I-M7

PIPING

LOT-3 PROJECTS
FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE

TECHNICAL SPECIFICATION
SECTION-VI
BID DOCUMENT NO.: CS-0011-109(3)-9

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-467-571-A901 REV 00



CLAUSE NO.	TECHNICAL REQUIREMENTS																																													
1.04.00	The pipes shall be sized for the worst (i.e. maximum flow, temp. and pressure values) operating conditions.																																													
1.05.00	Based on the inside dia. so established, thickness calculation shall be made as per ANSI B 31.1 OD and thickness of pipes shall than be selected as per ANSI B 36.10/IS-1239 Heavy grade/IS-3589/ASTM-A-53/API-5L/ANSI B 36.19 as the case may be.																																													
1.06.00	Corrosion allowance of 1.6 mm will be added to the calculated thickness being considered (except stainless steel piping).																																													
1.07.00	Bend thinning allowance/manufacturing allowance etc. shall be as per the requirement of the design code provision.																																													
1.08.00	High points in piping system shall be provided with vents along with valves as per the system requirement. Low points shall be provided with drains along with drain valves as per the system requirement. Drain lines shall be adequately sized so as to clear condensate in the lines. Material for drain and vent lines shall be compatible with that of the parent pipe material.																																													
1.09.00	Material of construction for pipes carrying various fluids shall be as specified elsewhere.																																													
1.10.00	Compressed air pipe work shall be adequately drained to prevent internal moisture accumulation and moisture traps shall be provided at strategic locations in the piping systems.																																													
1.11.00	Depending upon the size and system pressure, joints in compressed air pipe work shall be screwed or flanged. The flange shall be welded with the parent pipe at shop and shall be hot dip galvanized before dispatch to site. Alternatively, the flanges on GI pipes may be screwed-on flanges also.																																													
1.12.00	Threaded joints shall be provided with Teflon sealant tapes.																																													
1.13.00	<p>Following types of valves shall be used for the system/service indicated.</p> <table border="1" data-bbox="386 1213 1235 1556"> <thead> <tr> <th data-bbox="386 1213 500 1241">SYSTEM</th> <th colspan="6" data-bbox="927 1213 1162 1241">TYPES OF VALVES</th> </tr> <tr> <th data-bbox="386 1268 500 1295"></th> <th data-bbox="659 1268 753 1295">Butterfly</th> <th data-bbox="818 1268 873 1295">Gate</th> <th data-bbox="964 1268 1036 1295">Globe</th> <th data-bbox="1084 1268 1156 1295">Check</th> <th data-bbox="1198 1268 1237 1295">Ball</th> <th data-bbox="1286 1268 1357 1295">Plug</th> </tr> </thead> <tbody> <tr> <td data-bbox="386 1331 457 1358">Water</td> <td data-bbox="659 1331 672 1358">x</td> <td data-bbox="818 1331 831 1358">x</td> <td data-bbox="964 1331 977 1358">x</td> <td data-bbox="1084 1331 1097 1358">x</td> <td data-bbox="1198 1331 1211 1358">x</td> <td data-bbox="1286 1331 1299 1358"></td> </tr> <tr> <td data-bbox="386 1386 425 1413">Air</td> <td data-bbox="659 1386 672 1413"></td> <td data-bbox="818 1386 831 1413">x</td> <td data-bbox="964 1386 977 1413">x</td> <td data-bbox="1084 1386 1097 1413">x</td> <td data-bbox="1198 1386 1211 1413">x</td> <td data-bbox="1286 1386 1299 1413"></td> </tr> <tr> <td data-bbox="386 1440 555 1467">Drains & vents</td> <td data-bbox="659 1440 672 1467"></td> <td data-bbox="818 1440 831 1467">x</td> <td data-bbox="964 1440 977 1467">x</td> <td data-bbox="1084 1440 1097 1467">x</td> <td data-bbox="1198 1440 1211 1467"></td> <td data-bbox="1286 1440 1299 1467"></td> </tr> <tr> <td data-bbox="386 1516 555 1543">Fuel oil (if any)</td> <td data-bbox="659 1516 672 1543"></td> <td data-bbox="818 1516 831 1543">x</td> <td data-bbox="964 1516 977 1543">x</td> <td data-bbox="1084 1516 1097 1543">x</td> <td data-bbox="1198 1516 1211 1543">x</td> <td data-bbox="1286 1516 1299 1543">x</td> </tr> </tbody> </table>				SYSTEM	TYPES OF VALVES							Butterfly	Gate	Globe	Check	Ball	Plug	Water	x	x	x	x	x		Air		x	x	x	x		Drains & vents		x	x	x			Fuel oil (if any)		x	x	x	x	x
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1.14.0	Recirculation pipes along with valves, breakdown orifices etc. shall be provided for important pumping systems as indicated in respective process and instrumentation diagrams (P&IDs). The recirculation pipe shall be sized for minimum 30% design flow of single pump operation or the recommended flow of the pump manufacturer whichever is higher.																																													
<p align="center">LOT-3 PROJECTS FLUEGAS DESULPHURISATION(FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: CS-0011-109(3)-9</p>	<p align="center">SUB-SECTION-I-M7 (LOW PRESSURE PIPING)</p>	<p align="center">PAGE 2 OF 16</p>																																											



CLAUSE NO.	TECHNICAL REQUIREMENTS		
2.00.00	TECHNICAL SPECIFICATION		
2.01.00	<p>GENERAL</p> <p>Specific technical requirements of low-pressure piping, fittings, supports, valves, specialties and tanks etc. have been covered under this Sub-section. It includes details pertaining to design and material of construction for piping, fittings, valves, equipment, etc. cleaning/surface preparation application of primer and painting on over ground piping. It also includes detailed technical requirement of laying underground/buried piping including water proofing/anti corrosive protection. It also covers design, engineering, manufacturing, fabrication, technical details of piping, valves, specialties, piping hangers / supports, tanks etc.</p>		
2.02.00	Pipes and fittings		
2.02.01	<p>All low pressure piping systems shall be capable of withstanding the maximum pressure in the corresponding lines at the relevant temperatures. However, the minimum thickness as specified in the following clauses and or respective codes for pipes and fittings shall be adhered to. The bidder shall furnish the pipe sizing/ thickness calculation as per the criteria mentioned above under LP piping equipment sizing criteria of this Technical Specification.</p>		
2.02.02	<p>Piping and fittings coming under the purview of IBR shall be designed satisfying the requirements of IBR as a minimum.</p>		
2.02.03	<p>Supporting arrangement of piping systems shall be properly designed for systems where hydraulic shocks and pressure surges may arise in the system during operation. Bidder should provide necessary protective arrangement like anchor blocks/anchor bolt etc. for the safeguard of the piping systems under above mentioned conditions. The requirement will be, however, worked out by the contractor and he will submit the detailed drawings for thrust/anchor block to the Employer. External, and internal, attachments to piping shall be designed so as not to cause flattening of pipes and excessive localized bending stresses.</p>		
2.02.04	<p>Bends, loops, off sets, expansion or flexible joints shall be used as required in order to prevent overstressing the piping system and to provide adequate flexibility. Flexibility analysis (using software packages such as Caesar-II etc.) shall be carried out for sufficiently long piping (straight run more than 300M).</p>		
2.02.05	<p>Wherever Bidder's piping coming under this specification, terminates at an equipments or terminal point not included in this specification, the reaction and the thermal movement imposed by bidder's piping on equipment terminal point shall be within limits to be approved by the Employer.</p>		
2.02.06	<p>The hot lines shall be supported with flexible connections to permit axial and lateral movements. Flexibility analysis shall be carried out for pipelines which have considerable straight run as indicated above and necessary loops/ expansion joint etc. shall be provided as may be necessary depending on layout.</p>		
2.02.07	<p>Piping and fittings shall be manufactured by an approved manufacturer of repute. They should be truly cylindrical of clear internal diameter, of uniform thickness, smooth and strong, free from dents, cracks and holes and other defects.</p>		
2.02.08	<p>For rubber lined ERW pipes, beads shall be removed for pipe size 80 NB and above.</p>		
2.02.09	<p>Inspection holes shall be provided at suitable locations for pipes 800 Nb and above as required for periodic observations and inspection purposes.</p>		
<p align="center">LOT-3 PROJECTS FLUEGAS DESULPHURISATION(FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: CS-0011-109(3)-9</p>	<p align="center">SUB-SECTION-I-M7 (LOW PRESSURE PIPING)</p>	<p align="center">PAGE 3 OF 16</p>



CLAUSE NO.	TECHNICAL REQUIREMENTS															
2.02.10	At all intersection joints, it is Contractor's responsibility to design and provide suitable reinforcements as per the applicable codes and standards.															
2.02.11	<p>For large size pipes/ducts, at high point and bends/change of direction of flow, air release valves shall be provided as dictated by the system requirement and operation philosophy & tripping conditions of pumping system. Sizing criteria for air release valves shall be generally on the basis of valve size to pipe diameter ratio of 1:8. Requirement shall be decided as per relevant code.</p> <p>Transient analysis /surge analysis where ever specified and required shall be conducted in order to determine the location , number and size of the Air-Release valve on certain long distance/high volume piping systems, if applicable within the scope of work of the package.</p>															
2.03.00	Material															
2.03.01	Alternate materials offered by Bidder against those specified. shall either be equal to or superior to those specified, The responsibility for establishing equality or superiority of the alternate materials offered rests entirely with the Bidder and any standard code required for establishing the same shall be in English language.															
2.03.02	No extra credit would be given to offers containing materials superior to those specified. Likewise no extra credit would be given to offers containing pipe thickness more than specified.															
2.03.03	All materials shall be new and procured directly from the manufacturers. Materials procured from traders or stockists are not acceptable.															
2.03.04	All materials shall be certified by proper material test certificates. All material test certificates shall carry proper heat number or other acceptable references to enable identification of the certificate that certifies the material.															
2.03.05	<p>Material of construction for pipes carrying various fluids shall be as follows:</p> <table border="1" data-bbox="397 1192 1409 1690"> <thead> <tr> <th data-bbox="397 1192 451 1224">Sl No</th> <th data-bbox="451 1192 878 1224">Type of Fluid</th> <th data-bbox="878 1192 1409 1224">Material</th> </tr> </thead> <tbody> <tr> <td data-bbox="397 1224 451 1423">1.</td> <td data-bbox="451 1224 878 1423">i) Ordinary Water (Raw Water, Clarified Water, etc.) ii) Equipment cooling water including Both primary & secondary circuit (DMCW pH-corrected & ACW drain water)</td> <td data-bbox="878 1224 1409 1423">IS-2062 Gr.-E-250B/ASTM A-36/ASTM A-53 type 'E'Gr.B/IS-3589 Gr. 410 /IS-1239 Heavy.</td> </tr> <tr> <td data-bbox="397 1423 451 1560">2.</td> <td data-bbox="451 1423 878 1560">i) Demineralised water, ii)Alkaline solution (ECW system chemical dosing)</td> <td data-bbox="878 1423 1409 1560">Stainless Steel to ASTM A312, Gr. 304 welded for sizes 65 mm NB and above. Stainless steel to ASTM A312, Gr. 304 sch.40s seamless for sizes 50mm and below</td> </tr> <tr> <td data-bbox="397 1560 451 1690">3.</td> <td data-bbox="451 1560 878 1690">i) Drinking (potable) water ii)Compressed air (Instrument & service air)</td> <td data-bbox="878 1560 1409 1690">ASTM A-53 type E Gr. B galvanized/ IS 1239 Gr heavy galvanized/IS 3589 Gr 410 galvanized. Galvanized shall be to IS- 4736 or equivalent.</td> </tr> </tbody> </table>			Sl No	Type of Fluid	Material	1.	i) Ordinary Water (Raw Water, Clarified Water, etc.) ii) Equipment cooling water including Both primary & secondary circuit (DMCW pH-corrected & ACW drain water)	IS-2062 Gr.-E-250B/ASTM A-36/ASTM A-53 type 'E'Gr.B/IS-3589 Gr. 410 /IS-1239 Heavy.	2.	i) Demineralised water, ii)Alkaline solution (ECW system chemical dosing)	Stainless Steel to ASTM A312, Gr. 304 welded for sizes 65 mm NB and above. Stainless steel to ASTM A312, Gr. 304 sch.40s seamless for sizes 50mm and below	3.	i) Drinking (potable) water ii)Compressed air (Instrument & service air)	ASTM A-53 type E Gr. B galvanized/ IS 1239 Gr heavy galvanized/IS 3589 Gr 410 galvanized. Galvanized shall be to IS- 4736 or equivalent.	
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3.	i) Drinking (potable) water ii)Compressed air (Instrument & service air)	ASTM A-53 type E Gr. B galvanized/ IS 1239 Gr heavy galvanized/IS 3589 Gr 410 galvanized. Galvanized shall be to IS- 4736 or equivalent.														
2.03.06	In water lines, pipes upto 150mm Nb shall conform to ANSI B36.10/ASTM-A-53, Type-E Gr.B /IS:1239 Gr. Heavy and minimum selected thickness shall not be less than IS:1239 Grade Heavy except for demineralized water, drinking water .															
LOT-3 PROJECTS FLUEGAS DESULPHURISATION(FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: CS-0011-109(3)-9	SUB-SECTION-I-M7 (LOW PRESSURE PIPING)	PAGE 4 OF 16												



CLAUSE NO.	TECHNICAL REQUIREMENTS		
2.03.07	<p>Pipes of above 150mm Nb shall be to AWWA-C200/ANSI B 36.10/ASTM A-53/IS 3589 Gr.410. Pipe to be fabricated by the bidder shall be rolled and butt welded from plates conforming to ASTM A-53 type 'E' Gr. B/IS 2062 Gr.E-250B/ASTM-A-36. However, larger pipes, i.e. 1000mm Nb and above shall be made from plates conforming to ASTM A 36/IS 2062 Gr.E-250B and shall meet the requirements of AWWA-M-11 (for deflection & buckling criteria considering water filled pipe as well as vacuum condition that may prevail during transient/surge conditions, truck-load, rail-load and weight density for compacted soil or any other load as the case may be).</p>		
2.03.08	<p>In demineralised water service, the pipes upto 50 Nb shall be of stainless steel ASTM A 312, Gr. 304 sch. 40 Seamless. The size for these pipes shall be to ANSI B 36.19. These shall be socket welded. The material for pipe from 65mm NB upto and including 400 NB shall be to ASTM A 312, Gr. 304 (welded). In no case the thickness of fittings shall be less than parent pipe thickness.</p> <p>Bidder/Contractor shall note that pipes offered as per a particular code shall conform to that code in all respects i.e. Dimension, tolerances, manufacturing methods, material, heat treatment, testing requirements, etc. unless otherwise mentioned elsewhere in the specification.</p>		
2.03.09	<p>Instrument air, Plant (service) air lines and Drinking water lines shall be to ASTM A 53 type E grade B/ANSI B 36. 10/IS 3589, Gr. 410 / IS: 1239 Heavy (in case thickness calculated is more than gr. Heavy, ANSI B 36.10 Schedule numbers shall be followed) and galvanized to IS 4736 or any equivalent internationally reputed standard. The material of the pipes shall be to ASTM A 53 type 'E' Gr. B / IS: 3589, Gr. 410 / IS: 1239 Gr. Heavy. The fittings shall be of either same as parent material or malleable iron to IS-1879 (galvanized).</p>		
2.03.10	<p>Spiral welded pipes as per API-5L/IS-3589 are also acceptable for pipe of size above 150 NB. However minimum thickness of the pipes shall be as elaborated in above clauses.</p>		
2.03.11	<p>Condensate lines shall be to ASTM A 106 Gr. B and dimension to ANSI B 36.10 schedule "standard" as minimum to be maintained.</p>		
2.03.12	<p>If carbon steel plates of thickness more than 12 mm are used for manufacture of pipes, fittings and other appurtenances, then the same shall be control-cooled or normalized as the case may be following the guidelines of the governing code.</p>		
2.04.00	<p>Field routed pipes:</p>		
2.04.01	<p>Pipe lines of NB 50 size and below are regarded as field run piping. It is Bidder's responsibility to plan suitable layouts for these system insitu. Bidder shall prepare drawings indicating the layout of field run pipe work. These drawings shall be approved by Project Manager to the installation of the field run pipe work. Based on these approved layouts the Bidder shall prepare the BOQ of field run-pipes and submit to Employer for approval.</p>		
2.05.00	<p>Slope/Drains and Vents</p>		
2.05.01	<p>Suitable slope shall be provided for all pipelines towards drain points. It is Bidder responsibility to identify the requirements of drains and vents, and supply the necessary pipe work, valves, fittings, hangers and supports etc. As per the system requirement low points in the pipelines shall be provided with suitable draining arrangement and high points shall be provided with vent connections where air or gas pockets may occur. Vent for use during hydrostatic test shall be plugged after the completion of the test. Vent shall not be less than 15mm size. Drains shall be provided at low points and at pockets in piping such that complete drainage of all systems is possible. Drain shall not be less than 15mm for line size up to 150mm, not less than 20mm up to 300mm and not less than 25mm for 350mm to 600mm pipes and not less than 50mm for 600mm and above pipes.</p>		
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CLAUSE NO.	TECHNICAL REQUIREMENTS		
2.05.02	Air piping shall be sloped so that any part of the system can be drained through the shut-off drain valve or drain plugs.		
2.06.00	<p>Pipe Joints</p> <p>In general all water lines 65mm NB and above, are to be joined generally by butt welding except the locations where valves/fittings are to be installed with flanged connections and 50mm and below by socket welding unless mentioned otherwise specifically. All air lines shall be of screwed connection and rubber lined pipes of flanged connections.</p>		
2.06.01	<p>Screwed Joints</p> <p>(a) Threading of pipes shall be carried out after bending, heat treatment etc. If not possible, threading may be done prior to these operations but proper care should be taken to protect them from damage. Threads shall be to ANSI B 2.1 (taper) NPT/ ANSI B1.20.1 (taper) NPT / IS: 554 unless specified otherwise.</p> <p>(b) Galvanized pipe shall generally be joined by screwing into sockets. The exposed threaded portion on the outside of the pipes shall be given a zinc silicate coating. Galvanized pipes shall not be field joined by welding for protection of Galvanising Zinc layer. Screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before jointing. For galvanized pipe sizes above 150 mm NB, screw & socket jointing as per ASTM-A-865 shall be employed for both pipe-to-pipe and pipe-to-fitting jointing. For pipe to fitting connection since no direct threading can be done on the fittings (supplied as per ASTM-A-234 Gr. WPB and ANSI B-16.9) necessary straight pipe lengths acting as match pieces shall be welded to the fitting at both ends and subsequently the free ends of the straight lengths shall be threaded as per ASTM A-865 for jointing with main pipe. Once welding of fittings with match pieces and threading of free ends of match pieces are over, the entire fabricated piece shall be galvanized, or in case match pipes and fittings are already galvanized before the above mentioned fabrication then suitable application of Zinc-Silicate paste adequately at the welded surface (both in side & out side) after welding with zinc rich electrode, along with the nascent threaded metal portions at both free ends given the same application of Zinc Silicate paste. Alternatively flanged jointing may be employed for pipe sizes 100 NB and above. However, the bidder shall ensure the galvanized pipe joints do not fail during hydro test.</p> <p>(c) Teflon tapes shall be used to seal out screwed joints and shall be applied to the male threads only. Threaded parts shall be wiped clean of oil or grease with appropriate solvent if necessary and allowing proper time for drying before applying the sealant. Pipe ends shall be reamed and all chips shall be removed. Screwed flanges shall be attached by screwing the pipe through the flange and the pipe and flange shall be refaced accurately.</p> <p>(d) For pipe sizes from 350 mm NB to 550 mm NB (including 350 NB & 550 NB) the GI pipes shall be of flanged connection. However, the pipes after welding of flanges shall be completely galvanized. Any site welding done on galvanized pipes shall be done with zinc-rich special electrodes and the welded surfaces whether inside or outside shall be coated with zinc-silicate paste. Seal welding of flanges with zinc-rich electrode will be permitted only when any flange is leak-prone during hydro testing.</p> <p>(e) For pipe sizes 600 mm NB and above, the GI pipes shall be of welded connection (with zinc-rich special electrodes) followed by application of zinc silicate coating at welded surfaces both inside and outside the pipe, except for the last blank/blind flange, or, equipment connection where application of zinc-silicate paste after welding cannot be done due to inaccessibility of the inside welded surface and where galvanic protection has been impaired due to welding of pipe-to-pipe joint. Thus the last erection joint shall be flanged joint.</p>		
<p align="center">LOT-3 PROJECTS FLUEGAS DESULPHURISATION(FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: CS-0011-109(3)-9</p>	<p align="center">SUB-SECTION-I-M7 (LOW PRESSURE PIPING)</p>	<p align="center">PAGE 6 OF 16</p>



CLAUSE NO.	TECHNICAL REQUIREMENTS		
2.06.02	<p>Welded Joints</p> <p>(a) For making up welded joints (butt weld or socket weld) the welding shall be performed by manual shielded metal arc process in accordance with the requirements specified elsewhere in the spec. Any welder employed for carrying butt welding shall be qualified as per ASME section IX for the type of joints he is going to weld. Jointing by butt weld, or socket weld shall depend upon the respective piping material specifications.</p>		
2.06.03	<p>Flanged Joints</p> <p>(a) Flanged connections for pipes are to be kept to the minimum and used only for connections to vessel, equipments, flanged valves and other fittings like strainer/traps/orifices etc. for ease of connection and maintenance etc. Rubber lined pipes shall be flange joined only.</p> <p>(b) All flanged valves intended for installation on steel piping system, shall have their flanges drilled to ANSI B 16.5 (or equivalent) and according to the pressure class stated in their respective piping material specification.</p> <p>(c) Drilling on flanges of flanged valves must correspond to the drilling of flanges on the piping system on which the valves are installed.</p>		
2.07.00	<p>Bends/elbows/mitre bends/ Tees/ Reducers & other fittings</p>		
2.07.01	<p>For pipe fittings such as elbows (long radius), reducers, tees, etc. the material shall be to ASTM-A-234 Gr. WPB/ASTM-105 up to 300 NB. For pipe fittings above 300 NB, the fittings may be fabricated conforming to parent pipe material. Provision of compensation pads shall be kept as per ANSI B 31.1. The fitting shall conform to the dimensional standard of ANSI B-16.9/ 16.11. Further branching in pipes for sizes 65nb and above is also acceptable (ANSI B 31.1).</p> <p>However, for pipes up to 150 NB, pipe fittings may be supplied with material and dimension conforming to IS 1239 in case parent pipes also conform to IS 1239.</p>		
2.07.02	<p>For pipe size 350Nb and above mitre bends may be used for all pipes except rubber lined pipes. However, mitre bends are also acceptable for rubber lined pipes above 1200 NB. The bend radius shall be 1½ times the nominal pipe diameter. 90 deg. bends (mitre) shall be in 4 pieces (3 cuts) and 45 deg. mitre bends shall be in 3 pieces 22½ deg. Fabrication of mitre bends shall be as detailed in BS 2633/BS534.</p>		
2.07.03	<p>For pipes, above 1200 NB, reducer and tees shall be to dimensional standard of AWWA-C-208.</p>		
2.07.04	<p>Stainless steel fittings shall conform to either ASTM-A-182 Gr. 304 or ASTM-A-403 Grade WP. 304 Class-S, for sizes upto and including 50 mm NB, i.e. the fittings shall be of seamless construction. However, for stainless fittings above 50 mm NB, the same shall conform to ASTM-A-403 Gr. WP 304 Class W i.e. the fittings shall be of welded construction strictly in accordance with ASTM-A-403.</p>		
2.07.07	<p>In no case, the thickness of fittings shall be less than the thickness of parent pipe, irrespective of material of construction.</p>		
2.08.00	<p>Flanges</p>		
2.08.01	<p>Flanges shall be slip on type or weld neck type. Welding of flanges in tension is not permitted.</p>		
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CLAUSE NO.	TECHNICAL REQUIREMENTS		
2.08.02	All flanges and-flanged drilling shall be to ANSI B 16.5 / BS EN-1092 / AWWA C - 207 of relevant pressure/temperature class. Flanges shall be fabricated from steel plates conforming to ASTM A 105/IS 2062 Gr. E-250B. However stainless steel flanges shall be fabricated from SS plates to ASTM-A-240, Gr. 304 or equivalent.		
2.09.00	<p>Specific technical requirement of laying buried pipe with anti-corrosive treatment</p> <p>The pipe in general shall be laid with the top of the pipe minimum 1.0 (one) meter below finished general ground level.</p>		
2.09.01	<p>Trenching</p> <p>(a) The trench shall be cut true to the line and level and shall follow the gradient of the pipeline. The width of the trench shall be sufficient to give free working space on each side of the pipe. Trenches shall conform to IS 5822 or any international standard.</p>		
2.09.02	<p>Preparation and cleaning of piping</p> <p>(a) The pipeline shall be thoroughly cleaned of all rust, grease, dirt, weld scales and weld burrs etc. moisture or other foreign matter by power cleaning method such as sand or grit blasting, power tool cleaning, etc. Grease or heavy oil shall be removed by washing with a volatile solvent such as gasoline. Certain inaccessible portions of the pipeline (which otherwise not possible to be cleaned by power cleaning methods) may be scrubbed manually with a stiff wire brush and scrapped where necessary with specific permission of the Project Manager.</p> <p>(b) On the internal surface for pipes 1000 Nb and above, a coat of primer followed by a hot coal-tar enamel or coal tar epoxy painting (cold) shall be applied.</p>		
2.09.03	<p>Coating and wrapping/ Anti corrosive Protection Coal tar tape</p> <p>a. Buried piping shall be coated and wrapped, as per specification, after completion of welded and/or flanged connections, and after completion and approval of Hydro testing. Materials to be used for coating and wrapping of underground pipelines are:</p> <ol style="list-style-type: none"> (1) Coating primer (coal tar primer) (2) Coating enamel (coal tar enamel) (3) Wrapping materials. <p>All primer/coating/wrapping materials and methods of application shall conform to IS: 10221 except asphalt/bitumen material. Materials (primer/coating/wrapping) as per AWWA-C-203 are also acceptable.</p> <p>Protective coating shall consist of coal tar primer, coal tar enamel coating, glass fiber, tissue inner wrap followed by glass fiber or coal tar impregnated Kraft outer wrap or finish coat.</p> <p>Number of coats and wraps, minimum thickness for each layer of application shall be as per IS-10221. Number of Coats and wraps shall be decided based on soil corrosivity/resistivity as indicated in IS-10221. Soil data-for this purpose shall be made available.</p> <p>Total thickness of completed coating and wrapping shall not be less than 4.0 mm.</p> <p>b. Alternatively, the anti-corrosive protection for buried pipes can consist of anti-corrosive protection Coal-tar tapes. Material and application of tapes shall conform to</p>		
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	<p>IS 15337 or equivalent. These-tapes shall be applied hot over the cold coal tar primer in steps of 2mm thickness so as to cover the spiral edges of the first tape by the application of second tape. The total thickness of the finished protective coating shall be 4.0 mm minimum.</p>		
2.09.04	<p>Trench bed preparation and back filling</p> <p>Prior to lowering and laying pipe in any excavated trench, the bottom of the trench may require to be back filled and compacted (or as the case may be) to provide an acceptable bed for placing the pipe. Bed preparation in general shall be as per IS: 5822.</p>		
2.09.05	<p>Laying of galvanized steel (GI) pipes</p> <p>All the joints shall be screwed with socket or flanged. Screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before jointing Threaded portion on either side of the socket joint shall be applied with Zinc silicate paste.</p> <p>All the provisions for trenching' bed preparation' laying the pipe application of primer' coating' wrapping with tapes and back filling etc. as indicated for "laying of buried piping" and " anti corrosive protection for buried piping" are applicable for buried galvanized steel (GI) pipes also.</p>		
2.10.00	<p>Cleaning and flushing</p>		
2.10.01	<p>All piping shall be cleaned by the Bidder before and after erection to remove grease, dirt, dust, scale and welding slag.</p>		
2.10.02	<p>Before erection all pipe work, assemblies, sub-assemblies, fittings, and components, etc. shall be thoroughly cleaned internally and externally by blast cleaning or by power driven wire brushes and followed by air-blowing . However for pipe sizes below 100nb the pipes may be cleaned internally by compressed air blowing as an alternative to internal blast cleaning. The brushes shall be of the same or similar material as the metal being cleaned. Cleaning of Galvanized pipes shall be done by air blowing only.</p>		
2.10.03	<p>After erection, all water lines shall be mass flushed with water. The cleaning velocities in water lines shall be 1.2-1.5 times the operating velocities in the pipelines.</p>		
2.10.04	<p>All compressed air pipe work shall be cleaned by blowing compressed air.</p>		
2.11.00	<p>Specification for hangers and supports</p>		
2.11.01	<p>All supports and parts shall conform to the requirement of power piping code ANSI B 31.1 or approved equivalent.</p>		
2.11.02	<p>The maximum spans of the supports of straight length shall not exceed the recommended values indicated in ANSI B 31.1.</p>		
2.11.03	<p>At all sliding surfaces of supports suitable arrangement is to be provided to minimize sliding friction.</p>		
2.12.00	<p>Design/Construction/Material Particulars of Gate/ Globe /Check /Butterfly / Ball / Air release /Float valves / Moisture Traps.</p>		
2.12.01	<p>GENERAL</p> <p>(a) All valves shall have indicators or direction clearly marked on the hand-wheel so that the valves opening/closing can be readily determined.</p>		
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CLAUSE NO.	TECHNICAL REQUIREMENTS		
2.12.02	<p>(b) Special attention shall be given to operating mechanism for large size valves with a view to obtaining quick and easy operation ensuring that a minimum of maintenance is required.</p> <p>(c) The valves coming in vacuum lines shall be of extended gland type and/or water sealed.</p> <p>(d) The actuator-operated valves shall be designed on the basis of the following:</p> <ol style="list-style-type: none"> (1) The internal parts shall be suitable to support the pressure caused by the actuators; (2) The valve-actuator unit shall be suitably stiff so as not to cause vibrations, misalignments, etc. (3) All actuator-operated valves shall be provided with hand operated gearing mechanism also. (4) All actuators operated valves shall open/ close fully within time required by the process. <p>(e) Valves coming under the purview of IBR shall meet IBR requirements.</p> <p>(f) All valves shall be provided with embossed name plate giving details such as tag number, type, size etc.</p> <p>(g) Wherever required valves shall be provided with chain operator, extension spindles and floor stands or any other arrangement approved by employer so that they can be operated with ease from the nearest operating floor. Wherever necessary for safety purpose locking device shall be provided. Further, necessary small platforms for facilitating easy valve operation shall be provided by the contractor wherever necessary in consultation with project manager within the bid price at no extra cost to employer</p> <p>VALVE BODY MATERIAL</p> <p>Valve body material for various services shall be as follows:</p> <p>Valve body material for water application like Secondary circuit auxiliary cooling water of ECW system, clarified water, DM cooling water (pH corrected), drinking water etc. shall be cast iron for sizes 65NB and above; gun-metal for sizes 50 Nb and below.</p> <p>For compressed air application, valve body material shall be cast carbon steel or forged carbon steel for sizes 65 mm NB & above and Gun metal for sizes 50 NB and below.</p> <p>DM water: SS body and disc along with SS internals. However for butterfly valves, Cast Iron /Ductile Iron/SG iron/carbon steel body and disc with elastomer lining are also acceptable.</p>		
2.12.03	<p>The design, material, construction, manufacture, inspection, testing and performance of valves shall comply with all currently applicable statutes, regulations and safety codes in the locality where the valves will be installed. The valves shall conform to the latest editions of applicable codes and standards as mentioned elsewhere. Nothing in this specification shall be construed to relieve the Bidder of his responsibility. Valves in general shall conform to the requirements of the following standards.</p>		
<p align="center">LOT-3 PROJECTS FLUEGAS DESULPHURISATION(FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: CS-0011-109(3)-9</p>	<p align="center">SUB-SECTION-I-M7 (LOW PRESSURE PIPING)</p>	<p align="center">PAGE 10 OF 16</p>



CLAUSE NO.	TECHNICAL REQUIREMENTS		
2.12.04	<p>Standards and Codes</p> <p>AWWA-C-504 Rubber seated butterfly valves.</p> <p>BS-5155/EN-593 Cast iron and steel body butterfly valves for general purpose.</p> <p>IS-778 Gun-metal gate, globe and check valves for general purpose.</p> <p>BS-5154 Copper alloy globe/globe stop and check and gate valves for general purpose.</p> <p>IS-780 Sluice valves for water works purpose (50-300 mm size)</p> <p>IS-2906 Sluice valves for water works purpose (350-1200 mm size)</p> <p>IS-5150 Cast iron wedge and double disc gate for general purpose.</p> <p>BS-5152 Specification for cast iron globe valves.</p> <p>BS-5153 Cast iron check valves for general purpose.</p> <p>IS-5312 Swing check type reflux (non-return) valves.</p> <p>ANSI B 16.34 Standard for valves.</p> <p>API-594 Standard for Dual-check valves.</p> <p>API-600 Steel gate valves.</p> <p>ANSI-B-16.10 Valves face to face and other relevant dimension.</p> <p>API-598 Valves inspection test.</p> <p>End Connections</p> <p>The end connections, shall comply with the following:</p> <p>Socket welding (SW) - ANSI B 16.11</p> <p>Butt Welding (BW) - ANSI B 16.25.</p> <p>Threaded (SC) - ANSI B 2.1</p> <p>Flanged (FL) - ANSI B 16.5& AWWA-C-207 (steel flanges), ANSI B 16.1 (Cast Iron flanges).</p>		
2.13.00	<p>Gate/Globe/Check Valves</p> <p>(a) All cast iron body valves (gate, globe and non-return) shall have flanged end connections; (screwed ends for Ductile D.2NI body valves are not acceptable).</p> <p>(b) All steel and stainless steel body valves of sizes 65 mm and above shall have flanged or butt welding ends. Valves of sizes below 65mm shall have flanged or socket welded ends. Compatibility of welding between valve body material and connecting pipe material is a pre-requisite in case of butt-welded joints.</p>		
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	<p>(c) All gun metal body valves shall have screwed ends.</p> <p>(d) All flanged end valves/specialties. shall be furnished along with matching counter flanges, fasteners, gaskets etc. as required to complete the joints.</p> <p>(e) Gate/slucice valves shall be used for isolation of flow. All gate valves shall be of the full-way type, and when in the full open position the bore of the valve shall not be constricted by any part of the gate.</p> <p>Gate valves shall be of the solid/elastic or articulated wedge disc. Gate valves shall be provided with the following accessories in addition to other standard items:</p> <p>(1) Hand wheel</p> <p>(2) Position indicator (for above 50 mm NB valve size)</p> <p>(3) Draining arrangement wherever required.</p> <p>(f) Globe valves shall be used for regulation purposes. They shall be provided with hand wheel, position indicator, draining arrangement (wherever required) and arrow indicating flow direction. Preferably, the valves shall be of the vertical stem type. Globe valves shall preferably have radiused or spherical seating and discs shall be free to revolve on the spindle.</p> <p>The pressure shall preferably be under the disc of the valve. However, globe valves, with pressure over the disc shall also be accepted provided (i) no possibility exists that flow from above the disc can remove either the disc from stem or component from disc (ii) manual globe valves can easily be operated by hand. If the fluid load on the top of the disc is higher than 40-60 KN, bypass valve shall be provided which permits the downstream system to be pressurized before the globe valve is opened.</p> <p>(g) Check valves shall be used for non-return service. They shall be swing. check type or double door (Dual plate)check type with a permanent arrow inscription on the valve body indicating the fluid flow direction. In long distance pipes lines with possibility of surge-occurrence, dual plate check valves are preferable for its spring controlled opening /closing of flaps/doors against flow reversals. However, dual plate check valves shall not be used for sizes more than 600mm NB.</p> <p>(h) For bore greater than 2" the valves must be swing check type or dual plate check type suitable for installation in all positions (vertical and horizontal);</p> <p>(i) For bore smaller than or equal to 2" the valves must be of the piston type to be installed, in horizontal position.</p> <p>(j) All gate and globe valves shall be provided with back seating arrangement to enable on line changing of gland packing. The valves shall be preferably outside screw & yoke type.</p> <p>(k) All gate and globe valves shall be rising stem type and shall have limit switches for full OPEN and full CLOSED indication wherever required. This will include motor-operated valves also wherever required. In such cases the limit switches shall form an integral part of the valve. Stop-gap arrangement in this respect is not acceptable.</p> <p>(l) All valves except those with rising stems shall be provided with continuous mechanical position indicators; rising stem valves shall have only visual indication through plastic/metallic stem cover for sizes above 50 mm nominal bore.</p> <p>(m) For CI gate, globe and check valves wherever thickness of body/bonnet is not mentioned in the valves standards, thickness mentioned in IS- 1538 for fitting shall be applicable.</p>		
<p align="center">LOT-3 PROJECTS FLUEGAS DESULPHURISATION(FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: CS-0011-109(3)-9</p>	<p align="center">SUB-SECTION-I-M7 (LOW PRESSURE PIPING)</p>	<p align="center">PAGE 12 OF 16</p>



CLAUSE NO.	TECHNICAL REQUIREMENTS																															
2.13.01	<p>MATERIAL OF CONSTRUCTION (GATE/GLOBE/CHECK VALVE)</p> <p>(a) The materials shall generally comply with the following:</p> <p>(1) Cast Steel Valves</p> <table border="0" style="width: 100%;"> <tr> <td style="padding-left: 40px;">Body & bonnet</td> <td style="padding-left: 100px;">ASTM A 216 Gr. WCB/ ASTM A 105</td> </tr> <tr> <td style="padding-left: 40px;">Disc for non-return Valves</td> <td style="padding-left: 100px;">ASTM A 216 Gr. WCB/ ASTM A 105</td> </tr> <tr> <td style="padding-left: 40px;">Trim.</td> <td style="padding-left: 100px;">ASTM A 182 Gr. F6 or Equivalent</td> </tr> </table> <p>(2) Stainless steel valves</p> <table border="0" style="width: 100%;"> <tr> <td style="padding-left: 40px;">Body & Bonnet</td> <td style="padding-left: 100px;">SS 304</td> </tr> <tr> <td style="padding-left: 40px;">Disc</td> <td style="padding-left: 100px;">-do-</td> </tr> <tr> <td style="padding-left: 40px;">Trim.</td> <td style="padding-left: 100px;">SS 316</td> </tr> </table> <p>(3) Cast iron valves</p> <table border="0" style="width: 100%;"> <tr> <td style="padding-left: 40px;">Body & bonnet</td> <td style="padding-left: 100px;">BS 1452 Gr. 14/ IS-210 Gr. FG 260</td> </tr> <tr> <td style="padding-left: 40px;">Seating surfaces and rings</td> <td style="padding-left: 100px;">13% chromium steel/ 13% Chrome overlay</td> </tr> <tr> <td style="padding-left: 40px;">Disc for non-return valves</td> <td style="padding-left: 100px;">BS 1452 Gr. 14/IS-210 Gr FG 260</td> </tr> <tr> <td style="padding-left: 40px;">Hinge pin for non-return valves</td> <td style="padding-left: 100px;">AISI 316</td> </tr> <tr> <td style="padding-left: 40px;">Stem for gate globe valves</td> <td style="padding-left: 100px;">13% chromium steel or Equivalent</td> </tr> <tr> <td style="padding-left: 40px;">Back seat</td> <td style="padding-left: 100px;">13 % chromium steel / 13% Chrome overlay</td> </tr> </table> <p>(4) Gun Metal valves</p> <table border="0" style="width: 100%;"> <tr> <td style="padding-left: 40px;">Body and bonnet</td> <td style="padding-left: 100px;">IS 318 Gr. 2/ Equivalent Standard</td> </tr> <tr> <td style="padding-left: 40px;">Trim.</td> <td style="padding-left: 100px;">-do-</td> </tr> </table> <p>(b) Cast iron body valves shall have high alloy steel stem and seat.</p> <p>(c) Material for counter flanges shall be the same as for the piping.</p> <p>(d) Forged carbon steel valves are also acceptable in place of Gun metal valves.</p>				Body & bonnet	ASTM A 216 Gr. WCB/ ASTM A 105	Disc for non-return Valves	ASTM A 216 Gr. WCB/ ASTM A 105	Trim.	ASTM A 182 Gr. F6 or Equivalent	Body & Bonnet	SS 304	Disc	-do-	Trim.	SS 316	Body & bonnet	BS 1452 Gr. 14/ IS-210 Gr. FG 260	Seating surfaces and rings	13% chromium steel/ 13% Chrome overlay	Disc for non-return valves	BS 1452 Gr. 14/IS-210 Gr FG 260	Hinge pin for non-return valves	AISI 316	Stem for gate globe valves	13% chromium steel or Equivalent	Back seat	13 % chromium steel / 13% Chrome overlay	Body and bonnet	IS 318 Gr. 2/ Equivalent Standard	Trim.	-do-
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Body and bonnet	IS 318 Gr. 2/ Equivalent Standard																															
Trim.	-do-																															
2.14.00	<p>Air Release Valve</p> <p>(a) The air release valves shall be of automatic double air valve with two orifices and two floats. The float shall not close the valve at higher air velocities. The orifice contact joint with the float shall be leak tight joint.</p>																															
<p align="center">LOT-3 PROJECTS FLUEGAS DESULPHURISATION(FGD) SYSTEM PACKAGE</p>		<p align="center">TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: CS-0011-109(3)-9</p>	<p align="center">SUB-SECTION-I-M7 (LOW PRESSURE PIPING)</p>	<p align="center">PAGE 13 OF 16</p>																												



CLAUSE NO.	TECHNICAL REQUIREMENTS									
<p>2.15.00</p> <p>2.15.01</p> <p>2.15.02</p>	<p>(b) The valve shall efficiently discharge the displaced air automatically from ducts/pipes while filling them and admit air automatically into the ducts/pipes while they are being emptied. The valve shall also automatically release trapped air from ducts/pipes during operation at the normal working pressure.</p> <p>(c) Body material of automatic air release valves shall comply generally with BS 1452 Gr. 14/IS: 210 Gr. FG 260. and spindle shall conform to high tensile brass.</p> <p>(d) Air release valves shall not have any integral isolation device within them. Each Air release valve shall be mounted, preceded by a separate isolation gate/ butterfly valve.</p> <p>Butterfly valves</p> <p>Design/Construction</p> <p>(a) The valves shall be designed for the design pressure/temperature of the system on which it is installed and in accordance with AWWA-C-504, EN-593 or any other approved equivalent standard latest edition. Fabricated steel (IS: 2062 GR. E-250B) butterfly valves instead of cast iron body valves are also acceptable for size above 300 mm nb diameter.</p> <p>(b) The valves shall be suitable for installation in any position (horizontal/vertical etc.) and shall be generally of double-flanged construction. However for sizes 600 NB and below the valves of Wafer construction are also acceptable</p> <p>(c) Valves-350Nb and above shall have pressure equalizing bypass valves, wherever system parameters warrant the same.</p> <p>(d) Valves-200Nb and above shall also be provided with gear operator arrangement as a standard practice suitable for manual operation. Manual operation of valve shall be through gear arrangement having totally enclosed gearing with hand wheel diameter and gear ratio designed to meet the required operating torque It shall be designed to hold the valve disc in intermediate position between full open and full closed position without creeping or fluttering. Adjustable stops shall be provided to prevent over travel in either direction.</p> <p>Limit and torque switches (if applicable) shall be enclosed in water tight enclosures along with suitable space heaters for motor actuated valves, which may be either for On-Off operation or inching operation with position transmitter.</p> <p>Material of Construction (Butterfly Valves)</p> <p>Materials and other design details shall be as indicated below :</p> <p>(a) Cast Iron Butterfly Valves</p> <table border="0" data-bbox="386 1591 1414 1871"> <tr> <td style="padding-right: 20px;">Body & Disc</td> <td>ASTM A48, Gr. 40 with 2% Ni / IS: 210. Gr. FG-260, with 2% Ni / SG iron BSEN 1563, Gr EN GJS-400-15 with 2%Ni and epoxy coated</td> </tr> <tr> <td>Shaft</td> <td>BS 970 431 S: 291 / EN 57, or AISI-410 or AWWA-permitted shaft material equivalent to EN-57/AISI-410 or better.</td> </tr> <tr> <td>Seat ring</td> <td>18-8 Stainless steel</td> </tr> </table>	Body & Disc	ASTM A48, Gr. 40 with 2% Ni / IS: 210. Gr. FG-260, with 2% Ni / SG iron BSEN 1563, Gr EN GJS-400-15 with 2%Ni and epoxy coated	Shaft	BS 970 431 S: 291 / EN 57, or AISI-410 or AWWA-permitted shaft material equivalent to EN-57/AISI-410 or better.	Seat ring	18-8 Stainless steel	<p>LOT-3 PROJECTS</p> <p>FLUEGAS DESULPHURISATION(FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: CS-0011-109(3)-9</p>	<p>SUB-SECTION-I-M7 (LOW PRESSURE PIPING)</p> <p>PAGE 14 OF 16</p>
Body & Disc	ASTM A48, Gr. 40 with 2% Ni / IS: 210. Gr. FG-260, with 2% Ni / SG iron BSEN 1563, Gr EN GJS-400-15 with 2%Ni and epoxy coated									
Shaft	BS 970 431 S: 291 / EN 57, or AISI-410 or AWWA-permitted shaft material equivalent to EN-57/AISI-410 or better.									
Seat ring	18-8 Stainless steel									



CLAUSE NO.	TECHNICAL REQUIREMENTS			
2.15.03	Seal (b) Stainless Steel Butterfly Valves Body & Disc Shaft Seat Rings (c) Carbon steel Butterfly Valves Body & Disc Shaft Disc & Seat Rings (d) Elastomer lined Butterfly Valves Body & Disc Shaft	Nitrile Rubber SS 304 SS 316 EPT/BUNA-N/Neoprene ASTM A 216, Gr. WCB SS 304 EPT/BUNA-N/Neoprene ASTM A48, Gr. 40 / IS: 210. Gr. FG-260 / SG Iron (ductile iron) IS 1865 Gr 400-15 or BSEN 1563, Gr EN GJS-400-15 / ASTM A 216, Gr. WCB with elastomer lining. SS 316		
2.16.00	<p>Proof of Design Test (Type Test) for Butterfly Valves</p> <p>Proof of Design (P.O.D.) test certificates shall be furnished by the bidder for all applicable size-ranges and classes of Butterfly valves supplied by him, in the absence of which actual P.O.D. test shall be conducted by the bidder.</p> <p>All valves that are designed and manufactured as per AWWA-C-504 / AWWA-C-516 shall be governed by the relevant clauses of P.O.D test in AWWA-C-504/AWWA-C-516. For Butterfly valves, designed and manufactured to EN-593 or equivalent, the P.O.D. test methods and procedures shall generally follow the guidelines of AWWA-C-504 in all respect except that Body & seat hydro test and disc-strength test shall be conducted at the pressures specified in EN-593 or the applicable code. Actuators shall also meet requirements of P.O.D. test of AWWA-C-504/AWWA-C-516.</p> <p>Float operated valves</p> <p>(a) Valve shall automatically control the rate of filling and will shut off when a predetermined level is reached and close to prevent over flow on pre-set maximum water level. Valve shall also open and close in direct proportion to rise or fall of water level.</p> <p>(b) DESIGN AND CONSTRUCTION FEATURES</p> <p>The following design and construction feature of the valve shall be the minimum acceptable.</p> <p>(c) Valves shall be right-angled or globe pattern.</p> <p>(d) Valves shall be balance piston type with float ball.</p> <p>(e) Leather liner shall not be provided.</p>			
LOT-3 PROJECTS FLUEGAS DESULPHURISATION(FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: CS-0011-109(3)-9	SUB-SECTION-I-M7 (LOW PRESSURE PIPING)	PAGE 15 OF 16	



CLAUSE NO.	TECHNICAL REQUIREMENTS		
	<p>(f) The body and cover material shall be cast iron conforming to ASTM-A 126 Grade 'B' or IS: 210 Grade 200 or equivalent, and Float shall be of copper with epoxy painting of two (2) coats.</p> <p>(g) Valves shall be suitable for flow velocities of 2 to 2.5 m/sec.</p> <p>(h) The valves shall have flanged connections.</p> <p>2.17.00 Surface preparation and Painting for external piping surfaces (non-coastal projects)</p> <p>a) Surface preparation - Power tool cleaning / Shot blasting/ abrasive blasting</p> <p>b) Type of Primer - Red Oxide Zinc Phosphate primer (Alkyd base) to IS 12744 (2 X 25 microns)</p> <p>c) Intermediate Coat – Synthetic Enamel (long oil alkyd) to IS2932 (1 X 30 microns)</p> <p>d) Final Coat - Synthetic Enamel (long oil alkyd) to IS2932 (2 X 35 microns)</p> <p>Min. Total DFT (Microns) to be maintained – 150 (Min) and Color shall be as per NTPC Color Coding Scheme</p> <p>Note: No painting is required on Galvanized, Stainless Steel, Gun Metal surfaces</p> <p>2.18.00 Surface preparation and Painting for external piping surfaces (coastal projects)</p> <p>a) Surface preparation - Near white metal blast cleaning with surface profile 35-50 microns as per surface preparation specification SSPC.SP10 of Society of Protective coatings , USA</p> <p>b) Type of Primer – Inorganic zinc (ethyl) silicate primer coat(1 X 70 microns): Self-curing Inorganic Zinc (ethyl) Silicate Primer Coat (having minimum 80% of metallic Zinc content in dry film , Solid by Volume Minimum 60% ±2%) to be applied over blast cleaned surface.</p> <p>c) Intermediate Coat (2 X 90 microns)– Polyamide Cured pigmented Micaceous Iron Oxide Epoxy based Paint (containing lamellar MIO minimum 30% on pigment, Solid by Volume Minimum 80% ±2%) Polyamide Cured pigmented Micaceous Iron Oxide Epoxy based Paint (containing lamellar MIO minimum 30% on pigment, Solid by Volume Minimum 80% ±2%).</p> <p>d) Final Coat (1 X 70 microns) - Acrylic Aliphatic Polyurethane, two pack, isocyanate based color pigmented Paint (Solid by Volume Minimum 55% ±2%)</p> <p>Min. Total DFT (Microns) to be maintained – 320 (Min) and Color shall be as per NTPC Color Coding Scheme</p> <p>Note:</p> <ol style="list-style-type: none"> 1.) For external surfaces (galvanized steel), proper surface preparation with power tool cleaning up to grade ST2, ISO:8501-01 followed by zinc phosphate primer with 50 microns DFT, again followed by Acrylic Aliphatic Polyurethane coat of 40 microns DFT. 2.) If final shade of 9002 (off white) is required then Micaceous Iron Oxide (MIO) color shall be grey. 3.) No painting is required on Stainless Steel, Gun Metal surfaces. 		
<p align="center">LOT-3 PROJECTS FLUEGAS DESULPHURISATION(FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: CS-0011-109(3)-9</p>	<p align="center">SUB-SECTION-I-M7 (LOW PRESSURE PIPING)</p>	<p align="center">PAGE 16 OF 16</p>



**NTPC RAMAGUNDAM - I & II
(3x200 MW + 3x500 MW)**

GYPSUM DEWATERING EQUIPMENT

TECHNICAL SPECIFICATION

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SECTION II

STANDARD TECHNICAL SPECIFICATION


THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-467-571-A901 REV 00

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1.0	STANDARD TECHNICAL REQUIREMENTS – EQUIPMENTS/ COMPONENTS OF GDWE
I	DESIGN CONSTRUCTION –VACUUM BELT FILTERS
1.	The vacuum belt filter shall be proven design in operation for similar capacities. The filter cloth shall be polyester or polypropylene as per the proven design of the supplier and shall be guaranteed for a minimum life of not less than 7000 hrs.
2.	The complete frame of the filter and all parts in contact with gypsum shall be made of corrosion resistant material.
3.	In case, the contractor offers a design with an underlying belt for carrying the filter cloth, the same shall be endless, factory vulcanized rubber belts. The belt shrouds and the sealing belts shall provide a leak tight arrangement to prevent overflow of gypsum slurry. The sealing belt shall have minimum life of not less than 7000 hrs.
4.	The vacuum box shall ensure tight sealing with the belt/cloth and shall be of proven design. The material of construction of the Vacuum Box shall be preferably UHMW-PE (Ultra High Molecular Weight – Poly Ethylene). Bidder may offer alternate material proven for the specified chloride content of the slurry.
5.	The belt filter shall have an automatic cloth tracking mechanism and shall be provided with all required instrumentation as per the supplier's proven practice. The belt filter shall have an automatic cloth tensioning mechanism.
6.	The filter shall be provided with minimum 2 stages of cake washing for removing impurities in the gypsum. One stage of cloth washing arrangement shall also be provided.
7.	The service factor of the gear unit (if any) shall be minimum 1.5.
8.	Piping and wiring within the skid should be in the vendor's scope.
9.	Nozzles and connections The suction and discharge pipes will be flanged and will have the same nominal test procedure as the body of the pump. Threaded connections are not admitted in these pipes.
10	The flanges shall comply with the following standards: <ul style="list-style-type: none"> - Steel flanges as per ANSI B16.5 (raised face type, at least class 150) - Cast iron flanges as per ANSI 16.1 (flat face type, at least class 125) The pipe shall be designed according to API676 with regards to the force.
II	DESIGN AND CONSTRUCTION OF VACUUM PUMPS
1)	The mechanical vacuum pumps and accessories shall be used for continuous duty, to create and maintain vacuum by removing air and other non-condensable gases with associated water vapour, from the vacuum belt during gypsum dewatering operation. Final selection should consider compatible operation of the Gypsum Dewatering Equipment (GDWE) & pump over the full range of anticipated operation.
2)	The pumps shall be of single stage or two stage liquid ring type with suitable compression ratio, to meet the all operating condition, ensuring no cavitation's under all operating conditions. Bidder shall indicate the arrangement being offered to avoid cavitation.
3)	The pump shall be of liquid ring design with both the stages (if it is a two-stage pump) mounted on a common shaft. The unit shall require no external lubrication and shall not be damaged by slugs of water and entrained gases.
4)	Each pump unit with the accessories shall be furnished as a package unit mounted on a common steel base plate.

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	<p>5) The pumps shall be connected to its motors by flexible couplings. All couplings shall have suitable rigid steel coupling guards having closed ends and anchored to the base plate.</p> <p>6) The materials of construction of all the parts including all accessories shall be suitable to the fluids being handled/ used.</p> <p>7) Impeller Tip speed to be kept in range of 13-22 m/sec.</p> <p>8) Pipe fittings: not less than Schedule 40</p> <p>Material of Construction of Vacuum Pump: MOC of vacuum pump shall be as below mentioned or better material:</p> <p>1) Casting: ~ 2% Ni Cast Iron (GB 9439, HT 250)/ASTM A48, CLASS35</p> <p>2) Shaft: Carbon Steel, En-8 or better</p> <p>3) Impeller: Nodular Iron (ASTM A536, Gr.65-45-12) or better</p> <p>4) Shaft Sleeve :(If applicable) Stainless Steel</p>
b)	<p>Shaft</p> <p>The critical speed shall be well away from the operating speed and in no case less than 130% of the rated speed. The shaft shall be ground and polished to final dimensions and shall be adequately sized to withstand all stresses from rotor weight, hydraulic loads, vibration and torques coming in during operation.</p>
c)	<p>Shaft Sleeves</p> <p>Renewable type fine finished shaft sleeves shall be provided at mechanical seals. Shaft sleeves shall be fastened to the shaft to prevent any leakage or loosening. Shaft and shaft sleeve assembly should ensure concentric rotation.</p>
d)	<p>Bearings</p> <p>Heavy duty bearings, adequately designed for the type of service specified in the enclosed pump data sheet and for long, trouble free operation shall be furnished. The bearings offered shall be capable of taking both the radial and axial thrust coming into play during operation. In case, sleeve bearings are offered additional thrust bearings shall be provided. Antifriction bearings of standard type, if provided, shall be selected for a minimum life 20,000 hrs. of continuous operation at maximum axial and radial loads and rated speed. Proper lubricating arrangement for the bearings shall be provided. The design shall be such that the bearing lubricating element does not contaminate the liquid pumped. Where there is a possibility of liquid entering the bearings suitable arrangement in the form of deflectors or any other suitable arrangement must be provided ahead of bearings assembly. Bearings shall be easily accessible without disturbing the pump assembly. A drain plug shall be provided at the bottom of each bearings housing.</p>
e)	<p>Mechanical Seals</p> <p>Mechanical seals shall be of single type with either sliding gasket or bellows between the axially moving face and shaft sleeves or any other suitable type. The sealing faces should be highly lapped surfaces of materials known for their low frictional coefficient and resistance to corrosion against the liquid being pumped.</p> <p>The pump supplier shall coordinate with the seal maker in establishing the seal chamber of circulation rate for maintaining a stable film at the seal face. The seal piping system shall form an integral part of the pump assembly. For the seals under vacuum service, the seal design must ensure sealing against atmospheric pressure even when the pumps are not operating. Necessary provision for seal water supply along with complete piping fittings and valves as required shall form integral part of pump supply.</p>

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f)	Pump Shaft Motor Shaft Coupling
	The pump and motor shafts shall be connected with an adequately sized flexible coupling of proven design with a spacer to facilitate dismantling of the pump without disturbing the motor. Necessary coupling guards shall also be provided.
g)	Base Plate
	A common base plate mounting both for the pump and motor shall be furnished. The base plate shall be fabricated steel and of rigid construction, suitably ribbed and reinforced. Base plate and pump supports shall be so constructed and the piping unit so mounted as to minimize misalignment caused by mechanical forces such as normal piping strain, internal differential thermal expansion and hydraulic piping thrust. Suitable drain troughs and drip lip shall be provided.
h)	Drive Motor (Prime Mover)
	The kW rating of the drive shall be based on continuously driving the connected equipment for the conditions specified.
III	GYPSUM DISCHARGE CHUTE
a)	The minimum valley angle of chutes shall be 60 degrees at the feeding point to guide the material in the direction of belt travel. Transfer chutes shall be adequately sized and sloped to ensure smooth flow of Gypsum without any accumulation anywhere.
b)	Chutes shall be made of minimum 20 mm thick TISCRAAL / SAILHARD/ LSLAS07 or equivalent material. All chutes should have one inspection door at every floor and for the ones in between the floors (more than 1.5 meter above the operating floor level) suitable access for trouble free maintenance shall be provided. For sealing of inspection doors labyrinth type arrangement to be provided.
c)	Complete chute work in the region of flap gates (if applicable) shall be fabricated from 20 thk TISCRAAL or equivalent. In case of vertical chute (valley angle more than 80 degree) complete chute, work shall be of 20 mm thick TISCRAAL or equivalent material. While finalizing the chute work inside the building, arrangement for shifting and replacing chute legs, proper handling arrangement/wall openings, trolleys, hoists shall also be provided. While fabricating the chute, no welds in between shall be allowed.
	One (1) no. chute blockage switch for each belt filter of proven type (subject to approval of the employer) shall be provided. Chute blockage switch shall trip the feeding conveyor in case of Chute blockage and protect the feeding conveyor equipment.
IV	PIPING
a)	The slurry pipes shall be sized to minimize erosion and avoid settling of the gypsum at all load operation. Slurry pipes shall be designed to keep the velocity above the settling velocity under all operating conditions. The bidder may provide a recirculation line with motorized isolation valve for the above purpose. All the pipes handling slurry shall be provided with replaceable rubber lining of proven quality. The slurry pipes shall be lined with replaceable wear resistant natural rubber lining of minimum 6 mm thickness. Additional thickness of 2 mm in rubber lining shall be provided at bends. The bidder can provide slurry pipes of size lower than 300 NB made up of FRP material (silicon carbide coating on slurry exposed surface) if it has previous experience of providing the same. Outer surface of the pipes should be fire retardant. All the rubber-lined pipes shall be of flanged connection.
b)	Valves shall be of proven type and type contractor shall submit details valve schedule for employer's approval. Reference list for previous installations for similar application shall also be furnished to the employer.
c)	The isolation valves provided in all the slurry lines shall be of knife gate type/butterfly type unless specifically mentioned. Motorized actuators shall be provided for valves requiring frequent operation as indicated in the relevant scheme.

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d)	Necessary arrangements for purging & flushing of all the process pipelines, equipments etc. shall be required.
e)	Belt filter washing pumps shall have a minimum flow line to tank with a restriction orifice.
f)	All Lube oil, Instrument Air piping shall be made up of Gr.304 Stainless Steel material.
g)	All process water & Cooling water piping shall be made up of Carbon Steel Pressure Piping.
V	PROCESS/CLARIFIED WATER PUMPS
	<p>The cake/cloth wash pumps shall be horizontal centrifugal type designed for continuous operation with semi-open or closed impeller. Casing, Gland and Stuffing Box shall be of 2.5 Ni Cast Iron to IS:210 Grade FG 260 or equivalent. Impeller, wearing rings (as applicable) shall be of Stainless Steel -316 grade and Shaft & Shaft sleeves shall be of SS-410 grade. Pump re-circulation line shall be provided for pumping system. Pumps shall be provided with accessories such as Y-type suction strainers, Coupling guard, drain plugs, vent valves etc.</p> <p>MOC of Filtrate Extraction Pumps as follows:</p> <p>a) Casing: 1. Ductile Iron (65-45-12, ASTM A536) with replaceable rubber liner-14000 hours to be guaranteed.</p> <p style="text-align: center;">OR</p> <p>2. Ductile Iron with Hi Chrome liner – 14000 hours to be guaranteed.</p> <p style="text-align: center;">OR</p> <p>3.</p> <p>a) Hi Chrome (ASTM 532 Grade IIIA) - 24000 hours to be guaranteed. b) Impeller: Hi Chrome or superior material with 14000 hours guarantee. c) Solid Shaft: Duplex 2205 /EN8D /EN9 d) Shaft sleeve at mechanical seal: CD4MCU ASTM A 743/ Duplex 2205 e) Base Plate: Carbon steel with Epoxy Coating</p> <p>Bidder shall provide MOC of proven design to be approved during detailed engineering as per equipment/system/process requirement. The material and thickness of the liners shall ensure a minimum service life of 2 years before replacement.</p>
VI	GENERAL
a)	<p>Cake/Cloth Wash pump shall be 1500/3000 RPM. The Vacuum Pump is a low speed machine and the RPM shall be selected by the bidder meeting the equipment/ system requirement.</p> <p>Bidder to note that above shall be subject to BHEL/BHEL's Customer approval during contract stage.</p>
b)	For gypsum, the bulk density shall be taken as 900 kg/m ³ for volumetric computation and 1250 kg/m ³ for torque and drive requirements. Refer respective P&IDs for Slurry details.
c)	The slurry pumps shall be provided with motorized/ pneumatic suction and discharge valves. In addition, flushing water lines with motorized valves shall be provided for each pump for automatic flushing of the pump after each shut down. The flushing water for the pumps shall be taken from the process water supply.
d)	The slurry pump casing should be radially split to allow easy removal of impeller.
e)	Customer approval shall be a requirement in case of difference of opinion.

	NTPC RAMAGUNDAM - I & II (3x200 MW + 3x500 MW) GYPSUM DEWATERING EQUIPMENT TECHNICAL SPECIFICATION LIST OF DOCUMENTS TO BE SUBMITTED WITH BID	SPECIFICATION No: PE-TS-467-571-A901	
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ANNEXURE - 1

DRAWINGS / DOCUMENTS TO BE SUBMITTED WITH THE BID

Bidder should submit the filled up (wherever applicable), signed and stamped copy of the following documents along with the offer/ bid for technical evaluation:

Sl. No.	Reference	Description
1.	Annexure-2	COMPLIANCE CUM CONFIRMATION CERTIFICATE
2.	Annexure-3	PRE BID CLARIFICATION SCHEDULE
3.	Annexure-4	DEVIATION SHEET (COST OF WITHDRAWAL)
4.	Annexure-5	SCHEDULE OF GUARANTEES
5.	Annexure-6	LIST OF MAKES OF SUB-VENDOR ITEMS
6.	Annexure-7	LIST OF TOOLS & TACKLES
7.	Annexure-8	EQUIPMENT DATA SHEET / SCHEDULE (TO BE FILLED BY BIDDER)
8.	Annexure-9	LIST OF COMMISSIONING SPARES
9.		UNPRICED SCHEDULE IN THE PRICE FORMAT ISSUED ALONG WITH TENDER
10.		FILLED UP GUARANTEED POWER CONSUMPTION FORMAT ISSUED ALONG WITH PRICE FORMAT IS REQUIRED TO BE NECESSARELY SUBMITTED ALONG WITH BID, FAILING WHICH BID SHALL BE LIABLE FOR REJECTION. VALUE FOR POWER CONSUMPTION QUOTED BY THE BIDDER IN THE SPECIFIED FORMAT, SHALL BE CONSIDERED AS FINAL AND ANY REQUEST BY BIDDER FOR ANY CHANGE IN QUOTED POWER CONSUMPTION AT LATER DATE, SHALL NOT BE CONSIDERED BY BHEL.



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**COMPLIANCE CUM CONFIRMATION
CERTIFICATE**

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COMPLIANCE-CUM-CONFIRMATION CERTIFICATE

The bidder shall confirm compliance with following by signing / stamping this compliance certificate (every sheet) and furnish same with the offer.

- a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions, other than those mentioned under "exclusion and those resolved as per 'Schedule of Deviations', with regard to same.
- b) There are no other deviations w.r.t. specifications other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'.
- c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL / CUSTOMER approval & customer hold points for inspection / testing shall be marked in the QP at the contract stage. Inspection / testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. This is within the contracted price without any extra implications to BHEL after award of the contract.
- d) All drawings/ data-sheets / calculations etc. submitted along with the offer, if not sought/required for bid evaluation shall not be taken cognizance off.
- e) The offered materials shall be either equivalent or superior to those specified in the specification & shall meet the specified / intended duty requirements. In case the material specified in the specifications is not compatible for intended duty requirements, the same shall be resolved by the bidder during the pre-bid discussions, otherwise BHEL/Customer's decision shall be binding on the bidder, whenever the deficiency is pointed out.

For components where materials are not specified, the same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.
- f) The commissioning spares shall be supplied on 'As Required Basis' & prices for same are deemed to be included in the base price.
- g) All sub-vendors shall be subject to BHEL / CUSTOMER approval in the event of order.
- h) Guarantee/Warranty for plant/equipment shall be as per relevant clause of GCC / SCC / other Commercial Terms & Conditions.
- i) In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price even if the same are additional to approved billing break-up, approved drawing or approved Bill of quantities within the



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**GYPSUM DEWATERING EQUIPMENT
TECHNICAL SPECIFICATION
COMPLIANCE CUM CONFIRMATION
CERTIFICATE**

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scope of work as tender specification. This clause will apply in case during site commissioning, additional requirements emerges due to customer and / or consultant's comments. No extra claims shall be put on this account.

- j) Schedule of drawings/documents/quality plans submission, comment incorporation & approval shall be as stipulated elsewhere in the specification. The successful bidder shall depute his design personnel to BHEL's / Customer's / Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.
- k) As-built drawings shall be submitted as and when required during the project execution.
- l) The bidder has not tampered with this compliance-cum-confirmation certificate and if at any stage any tampering in the signed copy of this document is noticed then same shall be treated as breach of contract and suitable actions shall be taken against the bidder.
- m) Successful bidder shall furnish detailed erection/installation manual for each of the equipment supplied under this contract as per the schedule of submission of documents and well before the scheduled erection of the equipment / component concerned.
- n) Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and shall require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.
- o) In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion.



NTPC RAMAGUNDAM - I & II
(3x200 MW + 3x500 MW)

**GYPSUM DEWATERING EQUIPMENT
TECHNICAL SPECIFICATION
PRE-BID CLARIFICATION SCHEDULE**

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ANNEXURE-3

PRE-BID CLARIFICATION SCHEDULE


S. NO.	SECTION/CLAUSE/PAGE NO.	STATEMENT OF THE REFERRED CLAUSE	CLARIFICATION REQUIRED

The bidder hereby clarifies that above mentioned are the only clarifications required on the technical specification for the subject package.

Signature: _____
Name: _____
Designation: _____
Company: _____
Date: _____

Company Seal

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-467-571-A901-REV-00

	NTPC RAMAGUNDAM - I & II (3x200 MW + 3x500 MW) GYPSUM DEWATERING EQUIPMENT TECHNICAL SPECIFICATION DEVIATION SCHEDULE	SPECIFICATION No: PE-TS-467-571-A901	
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DEVIATION SHEET (COST OF WITHDRAWAL)

(TO BE FILLED UP BY BIDDER IN THE FORMAT ATTACHED AS ANNEXURE – II OF GENERAL CONDITIONS OF CONTRACT ISSUED ALONG WITH TENDER. ANY DEVIATION QUOTED ELSEWHERE/ IN OTHER FORMAT SHALL NOT BE CONSIDERED)



**NTPC RAMAGUNDAM - I & II
(3x200 MW + 3x500 MW)**

**GYPHUM DEWATERING EQUIPMENT
TECHNICAL SPECIFICATION**

SCHEDULE OF GUARANTEES

SPECIFICATION No: PE-TS-467-571-A901

SECTION : III


ANNEXURE : 5

REV: 00

SHEET 1 OF 2

SCHEDULE OF GUARANTEES

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-467-571-A901 REV 00

	NTPC RAMAGUNDAM - I & II (3x200 MW + 3x500 MW)	SPECIFICATION No: PE-TS-467-571-A901	
	GYPSUM DEWATERING EQUIPMENT TECHNICAL SPECIFICATION SCHEDULE OF GUARANTEES	SECTION : III	
		ANNEXURE : 5	
		REV: 00	
		SHEET 2 OF 2	

1.0 PERFORMANCE GUARANTEE

- All performance tests for Gypsum Dewatering Equipment (GDWE) shall be carried out in accordance with the relevant latest international codes/standards mentioned elsewhere in this specification.
- 1) Bidder shall furnish Performance guarantee for the design, manufacture, material, safe and trouble-free operation of the complete Gypsum Dewatering Equipment (GDWE) and its accessories.
 - 2) Bidder shall furnish guaranteed power consumption for the Gypsum Dewatering Equipment. **Guaranteed Power Consumption in the applicable format shall be submitted in sealed envelope along with price bid only.** However, along with unpriced format, bidder shall furnish guaranteed power consumption format indicating "Quoted" in the table provided in Annexure-IV of the price schedule.
 - 3) Vendor shall Guarantee and demonstrate each Vacuum Belt Filter capacity of minimum 74.5 TPH wet [≥ 67 TPH (dry)] gypsum cake with an inlet solid concentration of 45% by weight.
 - 4) The bidder shall guarantee and demonstrate that gypsum cake moisture content shall not be more than 10% and chloride content shall not be more than 100 ppm.
 - 5) The filter cloth shall be guaranteed for a minimum life of not less than 7000 hours.
 - 6) The liners in hydro-cyclone shall have a minimum wear life of not less than 7000 hours.
 - 7) Noise level ≤ 85 dB (A) at 1 m horizontal distance from equipment/enclosures & 1.5 m above operating floor is to be guaranteed.
 - 8) Vibration levels measured on the non-rotating parts shall not exceed the zone limit "B" as defined in ISO 10816 at steady conditions and shall not exceed the zone limit "C" as defined in ISO 10816 at transient conditions.
 - 9) Acceptance tests to be carried out as per the procedure defined by the bidder which shall be submitted for BHEL/ NTPC approval.
 - 10) In the event that the performance test is unsuccessful, bidder shall take necessary remedial action at his cost and the performance test shall be repeated.

Bidder shall submit signed & stamped copy of this document.



**NTPC RAMAGUNDAM - I & II
(3x200 MW + 3x500 MW)**

**GYP SUM DEWATERING EQUIPMENT
TECHNICAL SPECIFICATION**

SUB-VENDOR LIST

SPECIFICATION NO. PE-TS-467-571-A901

SECTION : III

ANNEXURE : 6

REV. 00

SHEET 1 OF 1

LIST OF MAKES OF ITEMS

S.N.	ITEM NAME	MANUFACTURER	LOCATION

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-467-571-A901 REV 00



**NTPC RAMAGUNDAM - I & II
(3x200 MW + 3x500 MW)**

**GYPSUM DEWATERING EQUIPMENT
TECHNICAL SPECIFICATION**

LIST OF SPECIAL TOOLS & TACKLES

SPECIFICATION No: PE-TS-467-571-A901

SECTION : III

ANNEXURE : 7


REV. 00

SHEET 1 OF 1

LIST OF SPECIAL TOOLS & TACKLES

S.N.	ITEMS	QUANTITY


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	NTPC RAMAGUNDAM - I & II (3x200 MW + 3x500 MW)	SPECIFICATION No: PE-TS-467-571-A901	
		SECTION : III	
	GYPHUM DEWATERING EQUIPMENT TECHNICAL SPECIFICATION	ANNEXURE : 8	
		REV. 00	
	EQUIPMENT DATA SHEET/SCHEDULE	SHEET 1 OF 8	

EQUIPMENT DATA SHEET/SCHEDULE


S. No.	Description	Data
1.0	GENERAL	
	a. Client	: BHEL-PEM, Noida
	b. Project	: NTPC RAMAGUNDAM - I & II (3x200 MW + 3x500 MW)
	c. End Customer	: NTPC
	d. Location	: Ramagundam , Telangana
	e. Service	: Continuous
	f. Installation	: Indoor
	g. Quantity for all FGD units	: 2 sets (1W+1S)
2.0	MANUFACTURER DETAILS	
	a. Model	: Bidder to Provide
	b. Type	: Bidder to Provide
3.0	OPERATING CONDITION	
	Medium to be handled	: Gypsum Slurry
4.0	Technical Data	
4.1	PRIMARY HYDRO-CYCLONE	
	i. Stage	Bidder to Provide
	ii. Manufacturer	Bidder to Provide
	iii. Number of Hydro cyclone	Bidder to Provide
	iv. Diameter of Hydro cyclone	Bidder to Provide
	v. Diameter of Vortex Finder	Bidder to Provide
	vi. Diameter of Apex Valve	Bidder to Provide
	vii. Diameter of Feed Inlet	Bidder to Provide
	viii. Design Pressure	Bidder to Provide
	ix. Working Pressure	Bidder to Provide
	x. Feed Flow rate	Bidder to Provide
	xi. Overflow Rate	Bidder to Provide

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-467-571-A901 REV 00


	NTPC RAMAGUNDAM - I & II (3x200 MW + 3x500 MW)	SPECIFICATION No: PE-TS-467-571-A901	
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	EQUIPMENT DATA SHEET/SCHEDULE	SHEET 2 OF 8	

	xii. Underflow Rate	Bidder to Provide
	xiii. Mesh of separation (50% Removed)	Bidder to Provide
	xiv. Solid content of feed slurry	Bidder to Provide
	xv. Solid content in underflow of Hydrocyclone	Bidder to Provide
	xvi. Solid content in Overflow of Hydrocyclone	Bidder to Provide
	xvii. Type of cyclone	Bidder to Provide
	a) Cyclone Dia/Height (mm)	Bidder to Provide
	b) Required Liquid Feed Pressure	Bidder to Provide
	c) Cyclone Connection Number/Dia. (mm)	Bidder to Provide
	d) Feed	Bidder to Provide
	e) Overflow	Bidder to Provide
	f) Underflow	Bidder to Provide
	g) Rf Value (Underflow Slurry (m ³ /hr/Feed Slurry (m ³ /hr))	Bidder to Provide
	h) Material	Bidder to Provide
	i) Shell	Bidder to Provide
	j) Internal Structure Part	Bidder to Provide
	k) Lining	Bidder to Provide
	l) Particle Size Distribution	Bidder to Provide
	m) Weight	Bidder to Provide
4.2	VACUUM BELT FILTERS (VBF)	
	a. Manufacturer	: Bidder to Provide
	b. Model No.	: Bidder to Provide
	c. Dimensions (W x L x H) (m x m x m)	: Bidder to Provide
	d. Cloth Width	m : Bidder to Provide
	e. Cloth Length	m : Bidder to Provide
	f. No. Working / Stand-by	: Bidder to Provide

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	NTPC RAMAGUNDAM - I & II (3x200 MW + 3x500 MW)	SPECIFICATION No: PE-TS-467-571-A901	
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	EQUIPMENT DATA SHEET/SCHEDULE	SHEET 3 OF 8	

	g. Capacity (Guaranteed) Gypsum (Dry) Gypsum (Slurry)	Kg/h r m3/kg	:	Bidder to Provide
	h. Inlet Flow Volume	m3/h	:	Bidder to Provide
	i. Gypsum Flow (Dry)	Kg/h r	:	Bidder to Provide
	j. Moisture Removed	%	:	Bidder to Provide
	k. No. of stages of cake washing / water flow	m3/h	:	Bidder to Provide
	l. No. of stages of cloth washing / water flow	m3/h	:	Bidder to Provide
	m. Design Pressure of Vacuum Chamber		:	Bidder to Provide
	n. Operating Pressure of Vacuum Chamber		:	Bidder to Provide
	o. Material / Thickness	mm	:	Bidder to Provide
	i. Casing		:	Bidder to Provide
	ii. Cloth		:	Bidder to Provide
	iii. Gypsum Discharge Hopper		:	Bidder to Provide
	iv. Vacuum Box		:	Bidder to Provide
	p. Life of Cloth (hours)		:	Bidder to Provide
	q. Type /Material of Carrying Belt		:	Bidder to Provide
	r. Type / Material of Sealing Belt		:	Bidder to Provide
	s. Life of Carrying Belt	(hrs)	:	Bidder to Provide
	t. Life of Sealing Belt	(hrs)	:	Bidder to Provide
	u. Automatic Cloth Tensioning Mechanism Provided		:	Yes / No - Bidder to confirm
4.3	VACUUM RECEIVER TANK			
	a. No. of Tank for each VBF		:	Bidder to Provide
	b. Capacity (m3)		:	Bidder to Provide
	c. Dimensions (Dia x Height) (mm x mm)		:	Bidder to Provide
	d. Material / Thickness (mm)		:	Bidder to Provide
	e. Lining Material / Thickness mm		:	Bidder to Provide

	NTPC RAMAGUNDAM - I & II (3x200 MW + 3x500 MW)	SPECIFICATION No: PE-TS-467-571-A901	
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	EQUIPMENT DATA SHEET/SCHEDULE	SHEET 4 OF 8	


4.4	Vacuum Pumps		
a.	Manufacturer	:	Bidder to Provide
b.	Make/Model		
c.	Type	:	Bidder to Provide
d.	No. of Pumps for each Vacuum Belt Filter	:	Bidder to Provide
e.	Rated Capacity Flow (m ³ /hr)	:	Bidder to Provide
	Rated Capacity Head (mWCI)	:	Bidder to Provide
	Rated Capacity Power (KW)	:	Bidder to Provide
f.	Power consumption (KW)	:	Bidder to Provide
g.	Pump Speed (rpm)	:	Bidder to Provide
h.	Motor Rating (KW)	:	Bidder to Provide
i.	Motor Speed (rpm)	:	Bidder to Provide
j.	Margins (Flow/Head) (%/%)	:	Bidder to Provide
k.	Operation Pressure	:	Bidder to Provide
l.	Design Pressure	:	Bidder to Provide
m.	Material/Thickness (mm) of	:	Bidder to Provide
	Base/Lining	:	Bidder to Provide
	Casing	:	Bidder to Provide
	Shaft	:	Bidder to Provide
	Impeller	:	Bidder to Provide
n.	Type of seal	:	Bidder to Provide
o.	Sealing Water Flow (m ³ /hr)	:	Bidder to Provide
p.	Bearing	:	Bidder to Provide
	No. of Bearings	:	Bidder to Provide
	Type Of Bearings	:	Bidder to Provide
q.	Type of coupling	:	Bidder to Provide
r.	Whether silencer provided at outlet	:	Yes/No
4.5	SLURRY PIPES		
a.	Pipe size (mm)	:	Bidder to Provide
b.	Type of Joints	:	Bidder to Provide

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	Pipe to Pipe/Pipe to Fittings		Bidder to Provide
	Fittings		Bidder to Provide
c.	Material / Thickness (mm)of Pipe	:	Bidder to Provide
d.	Material Thickness of lining	:	Bidder to Provide
e.	Estimated Life of liners (hrs.)	:	Bidder to Provide
f.	Slurry Solid concentration (w/w %)	:	Bidder to Provide
g.	Slurry Settling Velocity (m/s)		Bidder to Provide
h.	Pipe Velocity (m/s)		Bidder to Provide
4.6	BELT FILTER WASH PUMPS		
a.	No. for each VBF		
b.	No. of stand-by pumps for each VBF		
c.	Make / Model		
d.	Impeller Type		
e.	Material / Thickness (mm) of Impeller and lining		
f.	Casing Type		
g.	Material/Thickness of Casing/Lining		
h.	Rated Flow/Head (m3/hr./mWCI)		
4.7	CAKE WASH PUMPS		
i.	No. for each VBF		
j.	No. of stand-by pumps for each VBF		
k.	Make / Model		
l.	Impeller Type		
m.	Material / Thickness (mm) of Impeller and lining		
n.	Casing Type		
o.	Material/Thickness of Casing/Lining		
p.	Rated Flow/Head (m3/hr./mWCI)		
4.8	BELT ACCESSORIES		
4.8.1	Bearing		
a.	Carrying	:	Bidder to Provide
b.	Return	:	Bidder to Provide

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	NTPC RAMAGUNDAM - I & II (3x200 MW + 3x500 MW)	SPECIFICATION No: PE-TS-467-571-A901	
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	EQUIPMENT DATA SHEET/SCHEDULE	SHEET 6 OF 8	

4.8.2	Material		
a.	Roller	:	Bidder to Provide
b.	Spindle	:	Bidder to Provide
4.8.3	Pulleys		
i)	General (for all types of Pulleys)	:	Bidder to Provide
a.	Pulley Shaft Diameter	:	Bidder to Provide
ii)	Drive Pulleys		
a.	Lagging	:	Bidder to Provide
b.	Lagging thickness	:	Bidder to Provide
c.	Minimum angle of wrap	:	Bidder to Provide
d.	Maximum out of roundness	:	Bidder to Provide
iii)	Other Pulleys		
a.	Lagging	:	Bidder to Provide
b.	Lagging thickness	:	Bidder to Provide
iv)	Rubber for lagging		
a.	Type	:	Bidder to Provide
b.	Hardness	:	Bidder to Provide
c.	Elongation	:	Bidder to Provide
d.	Strength	:	Bidder to Provide
e.	Abrasion Loss	:	Bidder to Provide
f.	Specific Gravity	:	Bidder to Provide
g.	Adhesion Strength	:	Bidder to Provide
v)	Bearings for Pulleys		
a.	Type	:	Bidder to Provide
b.	Casing	:	Bidder to Provide
c.	Sealing	:	Bidder to Provide
d.	Lubrication	:	Bidder to Provide
e.	Pulley Material	:	Bidder to Provide
f.	Shaft Material	:	Bidder to Provide

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	EQUIPMENT DATA SHEET/SCHEDULE	SHEET 7 OF 8	

4.9	Chutes and Hoppers		
a.	Minimum Valley Angle	:	Bidder to Provide
b.	Material :	:	Bidder to Provide
	i) Chute work	:	Bidder to Provide
	ii) Sliding zones & adjacent sides	:	Bidder to Provide
	iii) No striking/ Non sliding zones	:	Bidder to Provide
	iv) Chute with valley angle 80 degree and above	:	Bidder to Provide
	v) In the zone of magnetic field	:	Bidder to Provide
	vi) In the zone of flap gates	:	Bidder to Provide
	vii) Discharge Hoods overhead pulleys	:	Bidder to Provide
c.	Inspection Doors	:	Bidder to Provide
d.	Chute Construction	:	Bidder to Provide
	i) Corners	:	Bidder to Provide
	ii) Joints Bolted	:	Bidder to Provide
	iii) Bolt size	:	Bidder to Provide
	iv) Bolts spacing	:	Bidder to Provide
	v) Fixing Arrangement	:	Bidder to Provide
4.9.1	Skirt Boards		
a.	Length	:	Bidder to Provide
b.	Height	:	Bidder to Provide
c.	Width	:	Bidder to Provide
	Side plate		
	Top cover		
4.9	Secondary (Waste Water) Hydrocyclone	:	Bidder to Provide
	i) Stage	:	Bidder to Provide
	ii) Manufacturer	:	Bidder to Provide
	iii) Number of Hydrocyclone	:	Bidder to Provide
	iv) Diameter of Hydrocyclone	:	Bidder to Provide
	v) Diameter of Vortex Finder	:	Bidder to Provide
	vi) Diameter of Apex Valve	:	Bidder to Provide
	vii) Diameter of Feed Inlet	:	Bidder to Provide

	NTPC RAMAGUNDAM - I & II (3x200 MW + 3x500 MW)	SPECIFICATION No: PE-TS-467-571-A901	
	GYPHUM DEWATERING EQUIPMENT TECHNICAL SPECIFICATION	SECTION : III	
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		SHEET 8 OF 8	
EQUIPMENT DATA SHEET/SCHEDULE			

	viii) Design Pressure	:	Bidder to Provide
	ix) Working Pressure	:	Bidder to Provide
	x) Feed Flow rate	:	Bidder to Provide
	xi) Overflow Rate	:	Bidder to Provide
	xii) Underflow Rate	:	Bidder to Provide
	xiii) Mesh of separation (50% Removed)	:	Bidder to Provide
	xiv) Solid content of feed slurry	:	Bidder to Provide
	xv) Solid content in underflow of Hydro-cyclones	:	Bidder to Provide
	xvi) Solid content in Overflow of Hydro-cyclones	:	Bidder to Provide
	xvii) Type of cyclone	:	Bidder to Provide
	a. Cyclone Dia/ Height (mm)	:	Bidder to Provide
	b. Required Liquid Feed Pressure	:	Bidder to Provide
	c. Cyclone Connection Number/Dia. (mm)	:	Bidder to Provide
	d. Feed	:	Bidder to Provide
	e. Overflow	:	Bidder to Provide
	f. Underflow	:	Bidder to Provide
	g. Rf Value (Underflow Slurry (m ³ /hr/Feed Slurry (m ³ /hr)	:	Bidder to Provide
	h. Material	:	Bidder to Provide
	i. Shell	:	Bidder to Provide
	j. Internal Structure Part	:	Bidder to Provide
	k. Lining	:	Bidder to Provide
	l. Particle Size Distribution	:	Bidder to Provide
	m. Weight	:	Bidder to Provide

Note:

The information as above and provided in the drawings/ datasheets shall be kept for information only. Any undeclared deviation therein shall stand null and void. This shall not be used for evaluation, unless specified. The same shall be submitted to BHEL's customer for the approval during the detail engineering/ execution stage. Explanations/ justifications shall be provided by bidder and the drawings/ documents shall be revised meeting contract specifications without any cost/ delivery implication to BHEL.



**NTPC RAMAGUNDAM - I & II
(3x200 MW + 3x500 MW)**

**GYP SUM DEWATERING EQUIPMENT
TECHNICAL SPECIFICATION**

LIST OF COMMISSIONING SPARES

SPECIFICATION No: PE-TS-467-571-A901

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LIST OF COMMISSIONING SPARES

S.N.	ITEMS	QUANTITY

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