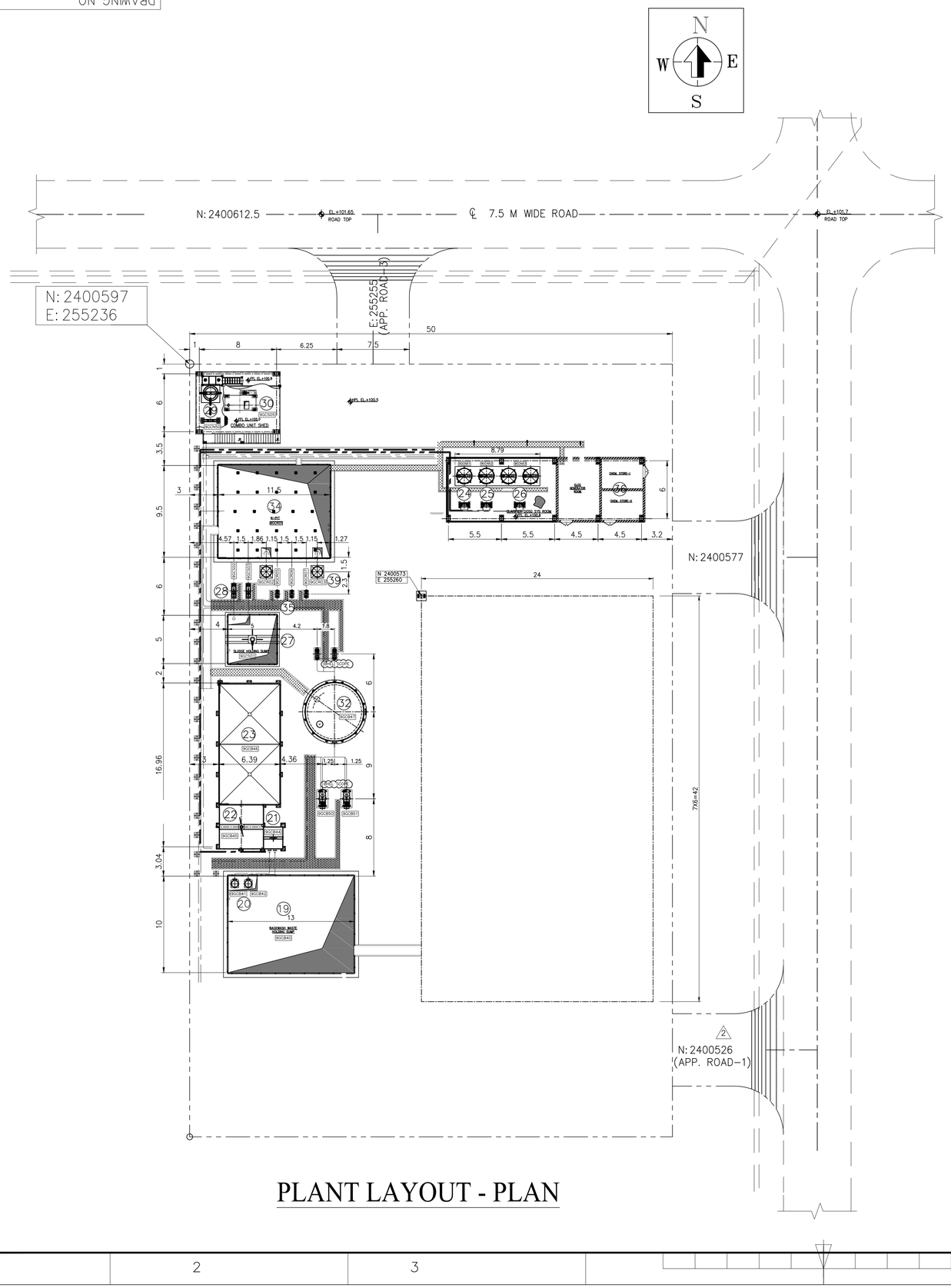
Annexure - C

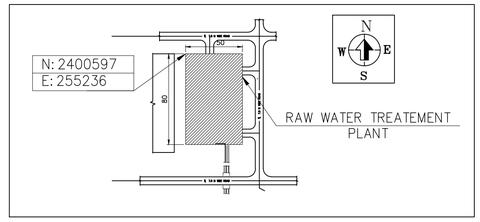
SL NO	DESCRIPTION	W	SB	TOTAL	KW
1	WWS-Lime dosing tank-Agitator	1	0	1	0.37
2	WWS-Poly electrolyte dosing pumps	1	1	2	
3	WWS-Lime dosing pumps	1	1	2	
4	WWS-PAC dosing pumps	1	1	2	
5	WWS-DWPE dosing pumps	1	1	2	
6	WWS-Poly electrolyte dosing system -Agitator	1	0	1	
7	WWS-Lime dosing system - agitator	1	0	1	
8	WWS-PAC dosing system -Agitator	1	0	1	
9	WWS-DWPE dosing system-Agitator	1	0	1	
10	Flash mixer -Agitator	1	0	1	0.75
11	Flocculator-agitator	1	0	1	2.2
12	Sludge holding sump-agitator	1	0	1	
13	Sludge transfer pumps	1	1	2	5.5
14	Neutralized effluent Transfer Pumps	2	1	3	15
15	Centrifuge	1	0	1	22
16	Clarified Water Transfer Pumps	1	1	2	30
17	Backwash waste transfer pumps	1	1	2	

DRAWING NO. **1-WT-220-00463**

ALL DIMENSIONS ARE IN METRES



PLANT LAYOUT - PLAN



KEY PLAN

EQUIPMENT LIST:-

	EQPT. NO	DESCRIPTION	QUANTITY	CAPACITY
	20	BACKWASH WASTE TRANSFER PUMPS	2(1W+1S)	350 m^3/hr
	21	FLASH MIXER	1(1W)	---
	22	FLOCULATOR	1(1W)	---
	23	LAMELLA CLARIFIER	1(1W)	350 m^3/hr
	24	POLYMER DOSING SKID	1(1W)	---
	25	POLY ALUMINUM CHLORIDE DOSING SKID	1(1W)	---
	26	LIME DOSING SKID	1(1W)	---
	28	SLUDGE TRANSFER PUMPS	2(1W+1S)	20 m^3/hr
	29	DW POLY DOSING SKID	1(1W)	---
	30	CENTRIFUGE	1(1W)	---
	31	BELT FILTER PRESS	1(1W)	---
	39	PRIMING CHAMBER	2	1 m3
	35	NEU. EFFULENT TRANSFER PUMPS	3(2W+1S)	50 m^3/hr
BHEL SCOPE	19	BACKWASH WASTE HOLDING SUMP	1	250 m^3
	27	SLUDGE HOLDING SUMP	1	50 m^3
	34	NEUTRLISING PIT	1	200 m^3
	36	CHEM STORES I&II	2	---

NOTES :

1. IN OPaL COMPLEX LEVEL 100.00 CORRESPONDS TO 7.50 M ABOVE MSL AND HPL FOR RWTP-I IS 100.5M
2. THIS DRAWING IS SCHEMATIC ONLY. ALL TECHNICAL POINTS SHALL BE REFERED FROM SPECIFICATION NO : ROS : 6125 .

LEGEND :

HPL – HIGH PAVED LEVEL

PLANT BOUNDRY

PIPE LINE

DRAIN CHANNEL

CABLE/PIPE RACK

PIPE TRENCH

FOR TENDER PUPOSE ONLY

REV	DATE	ALTERED	
01		CHECKED	

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: **RAW WATER TREATMENT PLANT**
ONGC PETRO additions LIMITED VADODARA , INDIA

EPC CONTRACTOR
BHARAT HEAVY ELECTRICALS LTD.
UNIT: BOILER AUXILIARIES PLANT, RANIPET – 632 406.

	NAME	SIGN	DATE	NO.OF VAR.
DRN	BBS	–sd/–	06.08.14	
DESN	GR	–sd/–	06.08.14	
CHD	GR	–sd/–	06.08.14	
APPD	SK	–sd/–	06.08.14	

DEPT	GRADE OF	SCALE	WEIGHT (KG).	REF. TO ASSY/OLD DRG.	ITEM NO.	NO. OF ITEMS
NP	UNTOL.DIM	–				
CODE	PR: QA: 500					

TITLE: **WASTE WATER SYSTEM LAYOUT**

CARD CODE: U 01

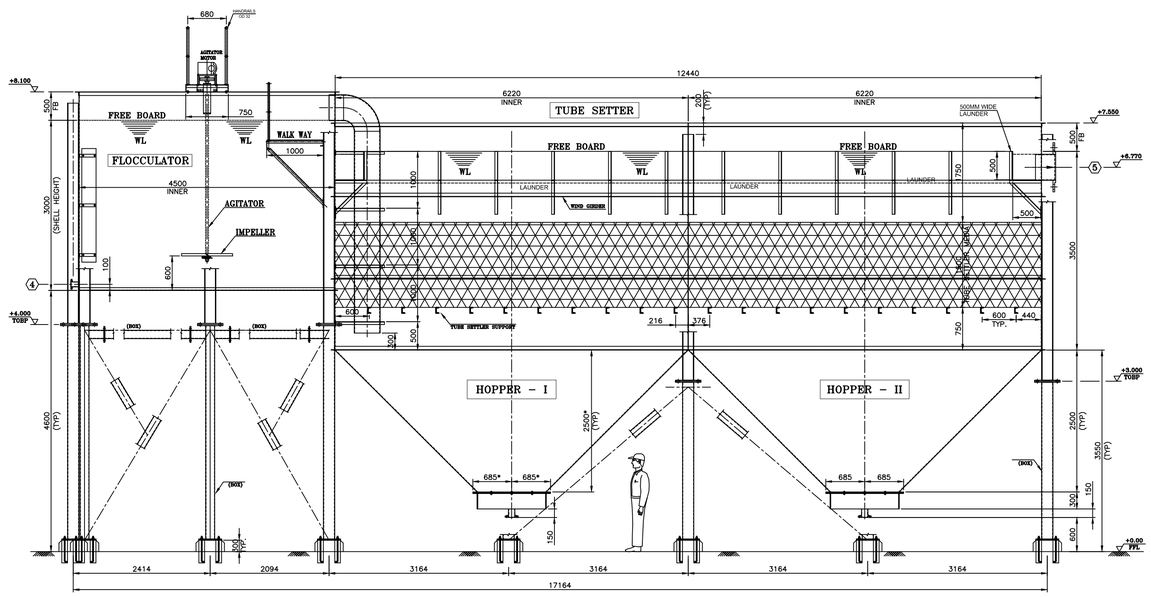
DRAWING NO.: **1-WT-220-00463**

REV: 00

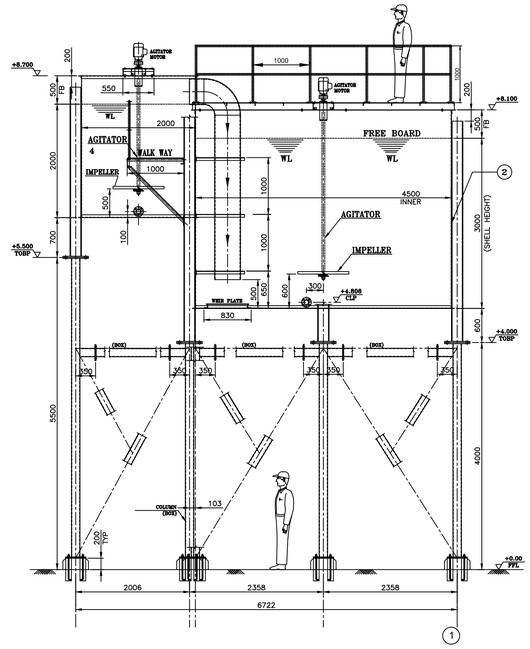
Size A1

DRAWING NO **1-WT-220-00464**

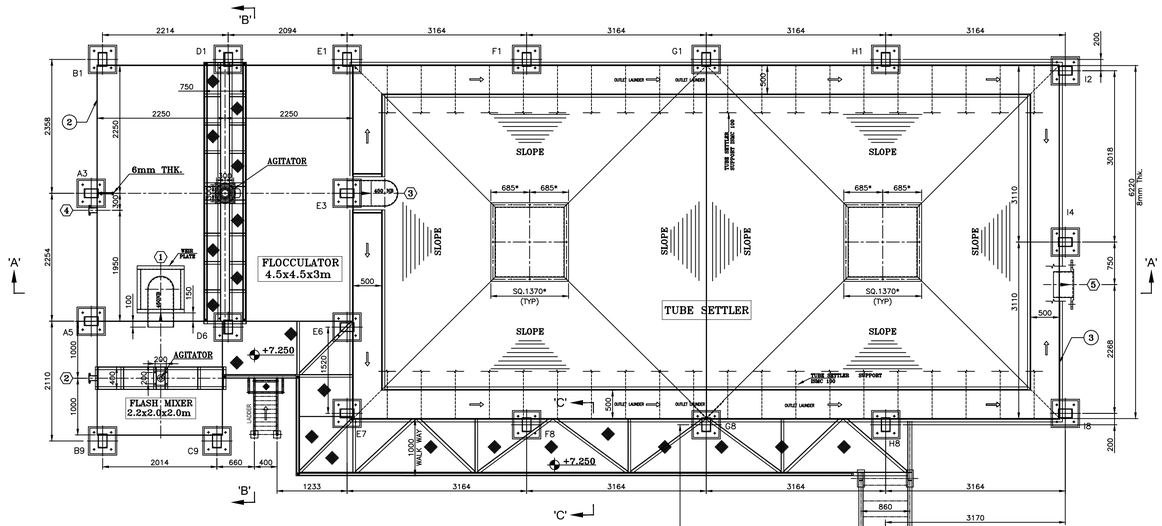
ALL DIMENSIONS ARE IN MILLIMETRES



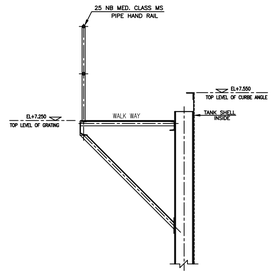
VIEW A-A



VIEW B-B



PLAN



SECTION C–C

NOTES:–

01. ALL DIMENSIONS ARE IN "mm" UNLESS OTHERWISE SPECIFIED.
02. ALL SHARP CORNERS SHALL BE SUITABLY ROUNDED OFF & GROUND FLUSH.
03. ALL MS PARTS SHOULD BE PAINTED AS PER JOB SPEC
05. TOLERANCE FOR TERMINAL POINTS ±5 MM.
06. "FFL" DENOTES FINISHED FLOOR LEVEL.
07. "TOS" DENOTES TOP OF STEEL.
08. "WL" DENOTES WATER LEVEL.
09. "FB" DENOTES FREE BOARD.
10. "CLP" DENOTES CL OF PIPE.
11. "TOBP" DENOTES TOP OF BASE PLATE.
12. "*" MARKED DIMENSIONS CONFORM DURING DETAIL ENGINEERING.

FOR TENDER PURPOSE ONLY

REV	DATE	ALTERED
		CHECKED
ZONE		

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: **RAW WATER TREATMENT PLANT** — **ONGC PETRO additions LIMITED VADODARA , INDIA**

BHARAT HEAVY ELECTRICALS LTD.,
UNIT: BOILER AUXILIARIES PLANT,
RANIPET – 632 406.

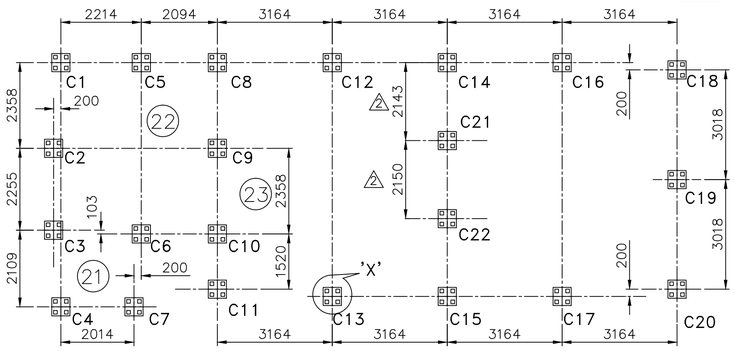
	NAME	SIGN	DATE	NO.OF VAR.
DRN	BBS		06.08.14	
CHD	GR		06.08.14	
APPD	SK		06.08.14	

DEPT	GRADE OF UNTOL.DIM	SCALE	WEIGHT (KG).	REF. TO ASSY/OLD DRG.	ITEM NO.	NO. OF ITEMS
FANS						
CODE 864	PR: QA: 500					

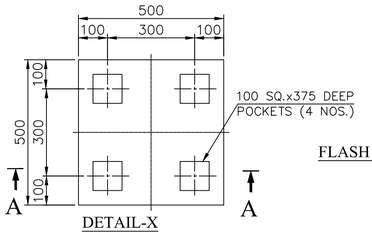
TITLE: **TYPICAL GA - TUBE SETTLER** — CARD CODE: U 01 — DRAWING NO.: **1-WT-220-00464** — REV

Size A1

DRAWING NO. **1-WT-220-00482**



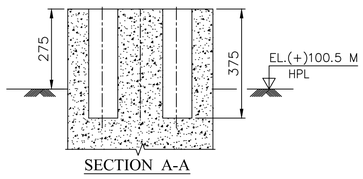
COLUMN FOUNDATION LAYOUT



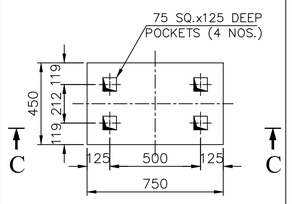
DETAIL-X

FLASH MIXER, FLOCCULATOR & CLARRIFIER

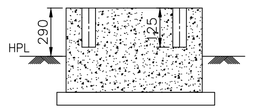
21 22 23



SECTION A-A

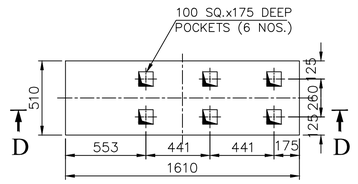


PLAN

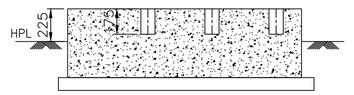


SECTION C-C

35 NEU. EFFU. TRANSFER PUMPS

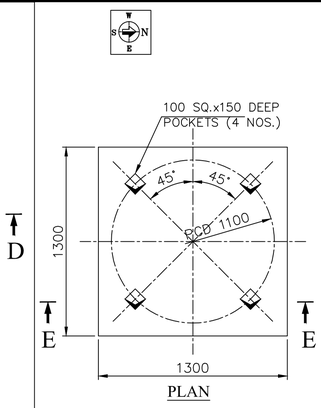


PLAN

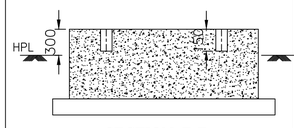


SECTION D-D

28 SLUDGE TRANSFER PUMPS

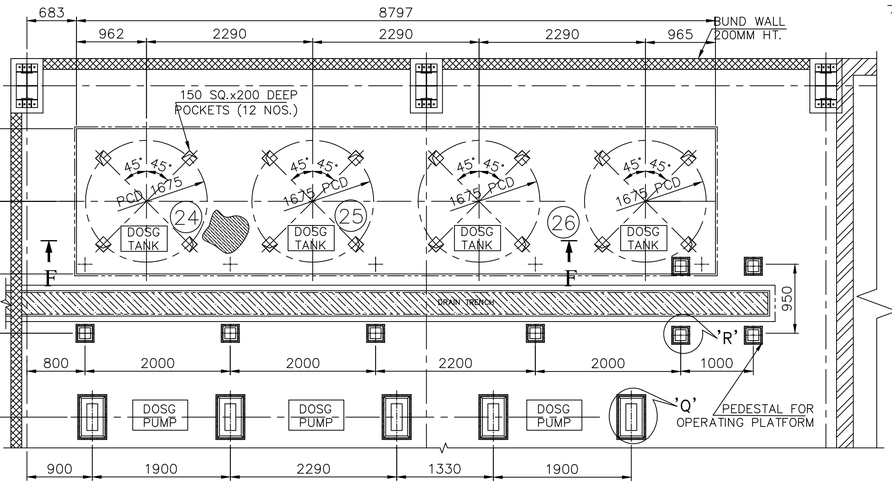


PLAN

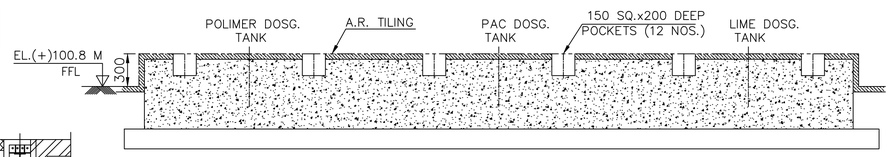


SECTION E-E

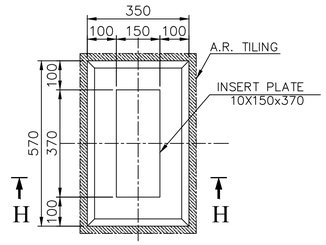
39 PRIMING CHAMBER



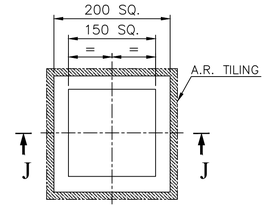
24 25 26 POLYMER , PAC & LIME DOSING SYSTEM



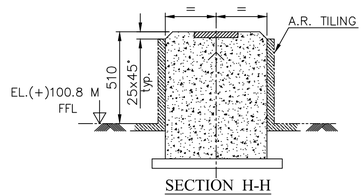
SECTION F-F



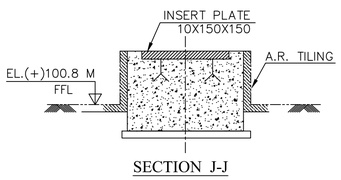
DETAIL-Q



DETAIL-R



SECTION H-H



SECTION J-J

LEGEND :

ACID RESISTANT TILES

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: **RAW WATER TREATMENT PLANT PH. - I**
ONGC PETRO additions LIMITED
VADODARA , INDIA

EPC CONTRACTOR
BHARAT HEAVY ELECTRICALS LTD.
UNIT: BOILER AUXILIARIES PLANT,
RANIPET – 632 406.

	NAME	SIGN	DATE	NO.OF VAR.
DRN	BBS		20.09.14	
CHD	GR		20.09.14	
APPD	SK		20.09.14	

DEPT	GRADE OF	SCALE	WEIGHT (KG).	REF. TO VENDOR DRG.	ITEM NO.	NO. OF ITEMS
NP/DES	UNTOL.DIM					
CODE	PR: QA: 500					

TITLE: **WASTE WATER SYSTEM EQPT. FOUNDATION DEAILS**

CARD CODE: U 01

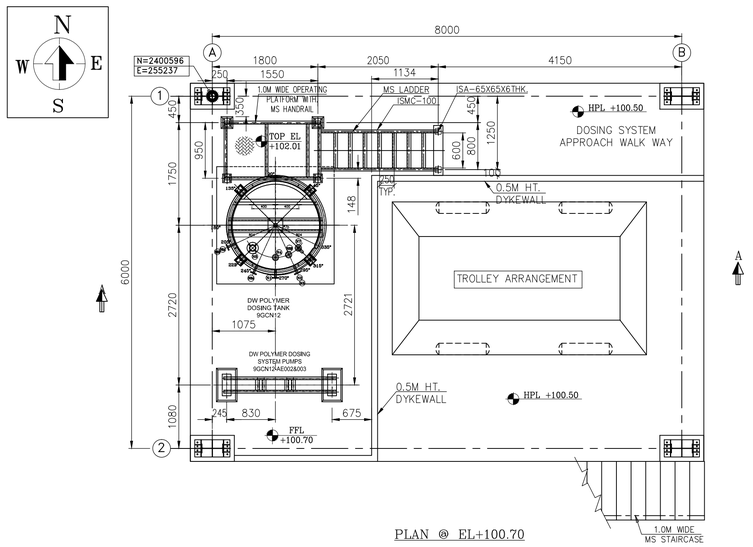
DRAWING NO.: **1-WT-220-00482**

REV: 00

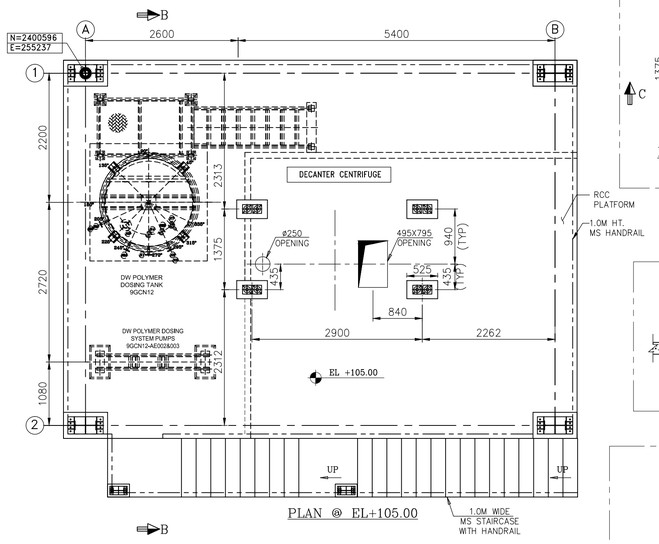
Size A2

DRAWING NO. **1-WT-220-00483**

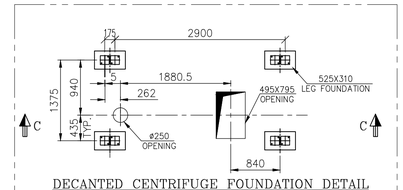
ALL DIMENSIONS ARE IN MILLIMETRES



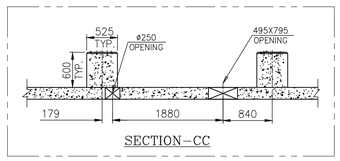
PLAN @ EL+100.70



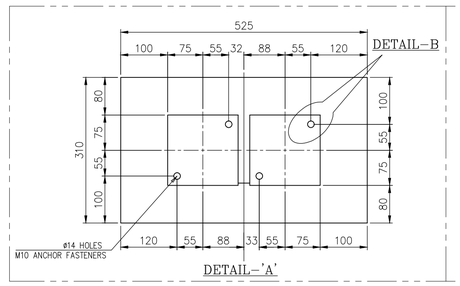
PLAN @ EL+105.00



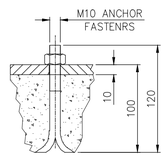
DECANTED CENTRIFUGE FOUNDATION DETAIL



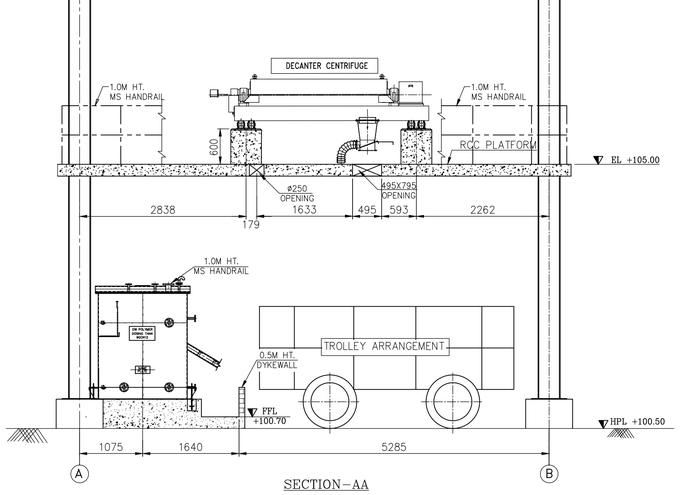
SECTION–CC



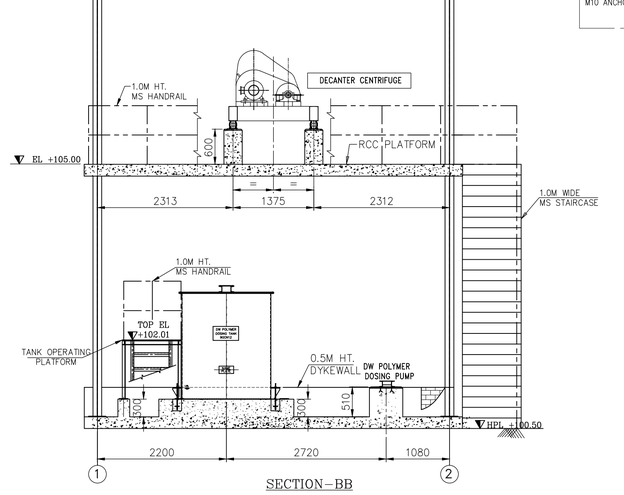
DETAIL–'A'



DETAILS – B



SECTION–AA



SECTION–BB

FOR TENDER PURPOSE ONLY

REV	DATE	ALTERED
ZONE		CHECKED

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: **RAW WATER TREATMENT PLANT** — **ONGC PETRO additions LIMITED VADODARA , INDIA**

BHARAT HEAVY ELECTRICALS LTD.,
UNIT: BOILER AUXILIARIES PLANT,
RANIPET – 632 406.

	NAME	SIGN	DATE	NO.OF VAR.
ORN	BBS		24.09.14	
CHD	GR		24.09.14	
APPD	SK		24.09.14	

DEPT	GRADE OF UNTOL.DIM	SCALE	WEIGHT (KG).	REF. TO ASSY/OLD DRG.	ITEM NO.	NO. OF ITEMS
FANS						
CODE 864	PR:QA:500					

TITLE: **FOUNDATION DETAILS - CENTRIFUGE**

CARD CODE: U 01

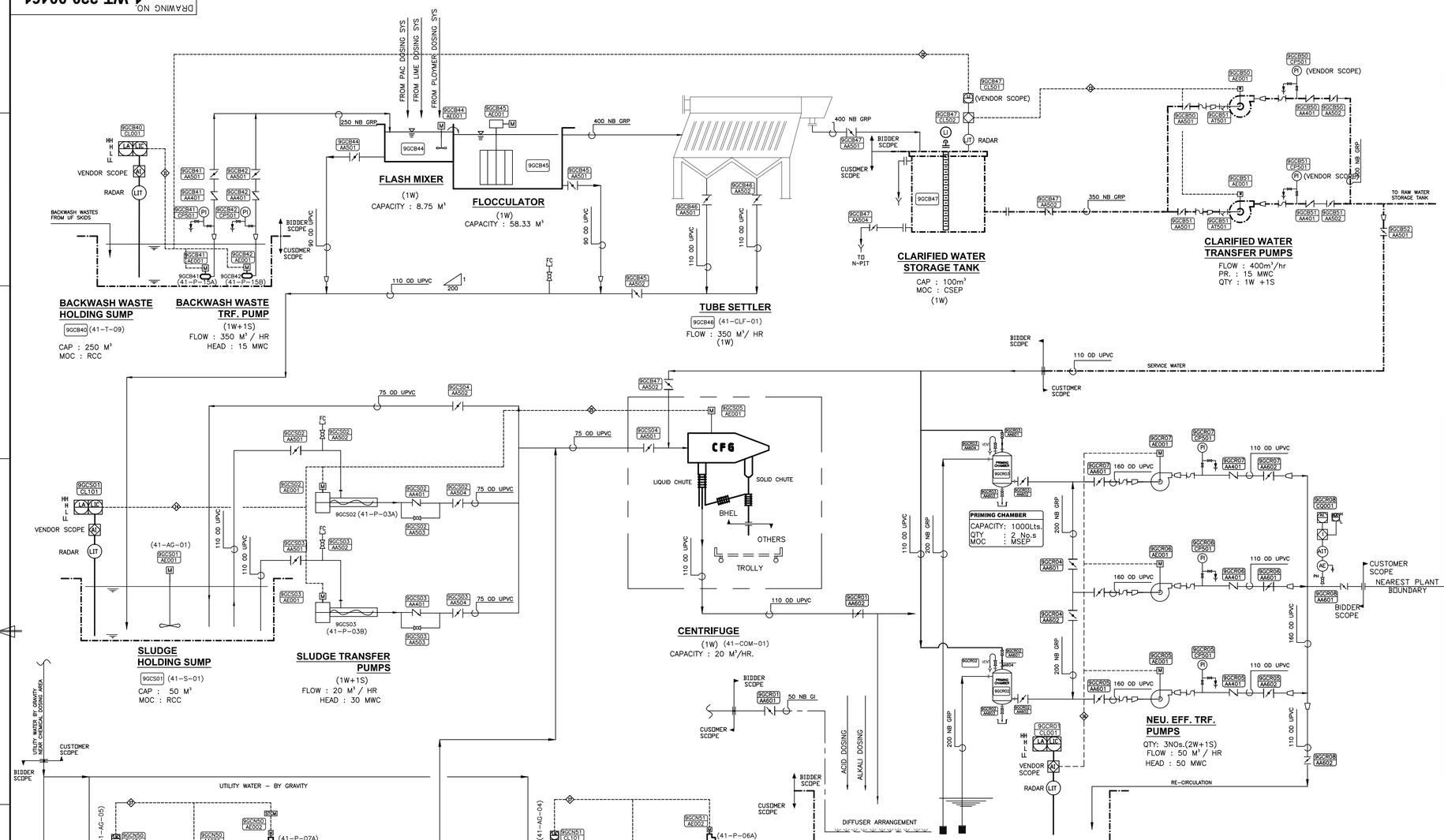
DRAWING NO.: **1-WT-220-00483**

REV

Size A1

DRAWING NO. **1-WT-220-00461**

ALL DIMENSIONS ARE IN MILLIMETRES



LEGEND :

- BALL VALVE
- RUBBER BELLOW
- NON RETURN VALVE
- BUTTERFLY VALVE MANUAL
- BUTTERFLY VALVE PNEUMATIC
- CENTRIFUGAL PUMP
- DOSING PUMP
- PULSATION DAMPER
- Y – TYPE STRAINER
- AIR VENT
- LEVEL INDICATOR
- LEVEL TRANSMITTER
- LEVEL SWITCH
- CALIBRATION CYLINDER
- FLOW ELEMENT MAGNETIC
- FLOW ELEMENT PADDLE WHEEL
- ECCENTRIC REDUCER
- CONCENTRIC ENLARGER
- MOTORIZED
- STROKE CONTROLLED MOTOR
- FOOT VALVE WITH STRAINER

KKS CODING SYSTEM

x xxx xx
xx xxx

- UNIT KEY (9–COMMON)
- FUNCTION KEY
- AREA KEY
- EQUIPMENT / INSTRUMENT NO. KEY
- EQUIPMENT KEY

FUNCTION KEY

GCB – CLARIFIER, PSF, ACF, UF & CF.
GCF – CF OUTLET TO DM WATER TANK
GCN – CC SYSTEM, DOSING SYSTEM
GCP – REGENERATION, FLUSHING EQUIPMENT
GCR – RESIDUAL REMOVAL & NEUTRALISATION
GCS – CLARIFIER /UF SLUDGE DISPOSAL

EXAMPLE

REFERS TO INSTRUMENTS WITH CODE NOS.

GCB 10 CP101–103 FROM GCB 10 CP101 TO GCB 10 CP 103

EQUIPMENT KEY

AA – VALVES
AE – MOTORS
AH – HEATERS
AM – MIXERS
AT – FILTERING ELEMENT
BN – EJECTOR
CF – FLOW MEASUREMENT
CP – PRESSURE MEASUREMENT
CT – TEMPERATURE MEASUREMENT
CQ – ANALYTICAL MEASUREMENT
CL – LEVEL MEASUREMENT
CD – DENSITY MEASUREMENT
PD – DIFF. PR. MEASUREMENT

EQUIPMENT/INSTRUMENT NO. KEY

FIELD INSTRUMENTS :

001 TO 099 ANALOG INSTRUMENTS – REMOTE
101 TO 199 PROCESS SWITCHES – LOCAL
501 TO 599 PROCESS INDICATORS – LOCAL

VALVES :

051 TO 099 MOTORISED VALVE (INCHING DUTY)
101 TO 150 PNEU. ACTUATED VALVES
201 TO 299 SOLENOID OPERATED VALVES
401 TO 499 NON RETURN VALVES
501 TO 599 MANUAL VALVES – UF & RO SYSTEM
601 TO 699 MANUAL VALVES – MB, DOSING & CC SYSTEM
701 TO 799 PR. RELIEF VALVES

REFERENCE DRAWING/DOCUMENT:

1. LEGEND FOR P&ID : 1–WT–220–00462 REV. 00

LEGEND :

–·–·– CUSTOMER SCOPE ——— BIDDER SCOPE

FOR TENDER PURPOSE ONLY

REV	DATE	ALTD :
		CHD :

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: **RAW WATER TREATMENT PLANT PH. - I**
ONGC PETRO additions LIMITED VADODARA , INDIA

BHARAT HEAVY ELECTRICALS LTD.,
UNIT: BOILER AUXILIARIES PLANT,
RANIPET – 632 406.

	NAME	SIGN	DATE	NO.OF VAR.
DRN	N.SB		06.08.14	
CHD	GR		06.08.14	
APPD	SK		06.08.14	

DEPT NP	GRADE OF UNTOL.DIM	SCALE	WEIGHT (KG).	REF. TO ASSY/OLD DRG.	ITEM NO.	NO. OF ITEMS
CODE 9776	PR:QA:500	---	---			

TITLE: **P & ID FOR WASTE TREATMENT SYSTEM**

CARD CODE: U 01

DRAWING NO.: **1-WT-220-00461**

REV: 00

Size A1

DRAWING NO. 1-WT-220-00462

ALL DIMENSIONS ARE IN MILLIMETRES

VALVES & FITTINGS

- NEEDLE VALVE
- GLOBE VALVE
- BALL VALVE
- BALL CHECK VALVE
- BUTTERFLY VALVE
- CHECK VALVE
- DIAPHRAGM VALVE
- SOLENOID VALVE
- RELIEF VALVE
- 3 WAY VALVE
- REDUCER
- ENLARGER
- STRAINER
- 'T' TYPE STRAINER
- 'Y' TYPE STRAINER
- FLEXIBLE CONNECTOR
- PUMP FOOT VALVE

ACCESSORIES

- PULSATION DAMPENER
- MOTOR DRIVEN MIXER
- MANUAL MIXER
- DRAIN TO WASTE
- VENT
- MOTOR OPERATED
- PNEUMATIC ACTUATOR
- PISTON OPERATED
- SOLENOID OPERATED
- AIR RELEASE
- THREE VALVE MANIFOLD
- ORIFICE PLATE
- HEATING ELEMENT
- CHEMICAL SEALED DIAPHRAGM
- PNEU. ACTUATED BFV NORMALLY OPEN
- PNEU. ACTUATED BFV NORMALLY CLOSED
- DOUBLE COIL SOLENOID VALVE

LINES

- FLOW LINE
- EXISTING LINE
- INSTRUMENT AIR LINE
- AIR LINE
- DRAIN LINE TO NEUTRALISING PIT
- ACID LINE
- CAUSTIC LINE
- MANIFOLD
- FLEXIBLE HOSE

ACCESSORIES (CONTD)

- MOTORISED VALVE (INCHING)
- MANUAL VALVE WITH LIMIT SWITCH
- FEED CONTROL VALVE (PNEU. CONTROLLED BFV)
- FEED CONTROL VALVE (PNEU. CONTROLLED GLOBE VALVE)
- CALIBRATION POT

EQUIPMENTS

- CENTRIFUGAL PUMP (HORIZONTAL)
- CENTRIFUGAL PUMP (VERTICAL)
- SUBMERSSIBLE PUMP
- SELF CLEANING STRAINER
- CHEMICAL DOSING PUMP
- RO MEMBRANES
- AIR BLOWER
- STATIC MIXER
- RESIN TRAP
- MEDIA TRAP
- EJECTOR
- FUME ABSORBER
- UF MEMBRANES–SUBMERGED
- UF MEMBRANES–PRESSURIZED
- TANK – TOP CLOSED
- TANK – TOP OPEN

EQUIPMENTS (CONTD.)

- LAMELLA CLARIFIER
- BELT GRAVITY THICKNER
- FILTER PRESS
- CENTRIFUGE
- SCREW PUMP

INSTRUMENTS

- LOCAL INSTRUMENT INCLUDING TRANSMITTER FOR SINGLE MEASURED VARIABLE
- RO – DM PLC PANEL DISPLAY
- TO PLC
- RO – DM PLC PANEL INTERLOCK
- ROTAMETER
- DIRECT FLOW MEASUREMENT (PADDLE WHEEL SENSOR)
- DIRECT FLOW MEASUREMENT (MAGNETIC SENSOR)
- REMOTE INSTRUMENT FOR SINGLE MEASURED VARIABLE
- VFD – VARIABLE FREQUENCY DRIVE

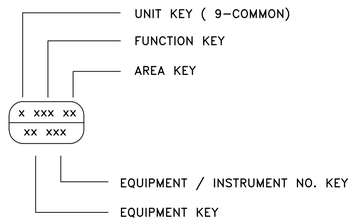
TUR – TURBIDITY
ORP – OXIDATION REDUCTION POTENTIAL
SDI – SILT DENSITY INDEX
COND – CONDUCTIVITY
SiO2 – SILICA
pH – pH

CL – RESIDUAL CHLORINE
ZSO – POSITION LIMIT SWITCH OPEN
ZSC – POSITION LIMIT SWITCH CLOSE
BCV – BRINE CONTROL VALVE
FCV – FLOW CONTROL VALVE
BBV – BCV BYPASS VALVE
NO–DA – NORMALLY OPEN DOUBLE ACTING.
NC–DA – NORMALLY CLOSE DOUBLE ACTING.
NO–SA – NORMALLY OPEN SINGLE ACTING.
NC–SA – NORMALLY CLOSE SINGLE ACTING.

INSTRUMENT IDENTIFICATION

AR – ANALYTICAL RECORDER
L – ALARM LOW
LL – ALARM LOW LOW
TW – THERMO WELL
TI – TEMPERATURE INDICATOR
PI – PRESSURE INDICATOR
PIT – PRESSURE INDICATING TRANSMITTER
AE – ANALYZER ELEMENT
AIT – ANALYZER INDICATING TRANSMITTER
AI – ANALYSER INDICATOR
AA – ANALYSER ALARM
FE – FLOW ELEMENT
FIT – FLOW INDICATING TRANSMITTER
FIQ – FLOW INDICATING TOTALISER
DPI – DIFFERENTIAL PRESSURE INDICATOR
DPS – DIFFERENTIAL PRESSURE SWITCH
DPIT – DIFFERENTIAL PRESSURE INDICATING TRANSMITTER
DPA – DIFFERENTIAL PRESSURE ALARM
LS – LEVEL SWITCH
LI – LEVEL INDICATOR
LIT – LEVEL INDICATING TRANSMITTER
LA – LEVEL ALARM
PA – PRESSURE ALARM
TA – TEMPERATURE ALARM
DI – DENSITY INDICATOR
FS – FLOW SWITCH
FA – FLOW ALARM
W – WORKING
S – STAND BY
(S) – SAMPLE

KKS CODING SYSTEM



EXAMPLE

REFERS TO INSTRUMENTS WITH CODE NOS.

GCB 10 CP101–103 FROM GCB 10 CP 101 TO GCB 10 CP 103

FUNCTION KEY

GCB – CLARIFIER, PSF, ACF, UF & CF.
GCF – CF OUTLET TO DM WATER TANK
GCN – CC SYSTEM, DOSING SYSTEM
GCP – REGENERATION, FLUSHING EQUIPMENT
GCR – RESIDUAL REMOVAL & NEUTRALISATION
GCS – CLARIFIER /UF SLUDGE DISPOSAL

EQUIPMENT KEY

AA – VALVES
AE – MOTORS
AH – HEATERS
AM – MIXERS
AT – FILTERING ELEMENT
BN – EJECTOR
CF – FLOW MEASUREMENT
CP – PRESSURE MEASUREMENT
CT – TEMPERATURE MEASUREMENT
CQ – ANALYTICAL MEASUREMENT
CL – LEVEL MEASUREMENT
CD – DENSITY MEASUREMENT
PD – DIFF. PR. MEASUREMENT

EQUIPMENT/INSTRUMENT NO. KEY

FIELD INSTRUMENTS :

001 TO 099 ANALOG INSTRUMENTS – REMOTE
101 TO 199 PROCESS SWITCHES – LOCAL
501 TO 599 PROCESS INDICATORS – LOCAL

VALVES :

051 TO 099 MOTORISED VALVE (INCHING DUTY)
101 TO 150 PNEU. ACTUATED VALVES
201 TO 299 SOLENOID OPERATED VALVES
401 TO 499 NON RETURN VALVES
501 TO 599 MANUAL VALVES – UF & RO SYSTEM
601 TO 699 MANUAL VALVES – MB, DOSING & CC SYSTEM
701 TO 799 PR. RELIEF VALVES

OWNER R4G2: ONGC PETRO additions LIMITED, VADODARA , INDIA

OWNER'S CONSULTANT: ENGINEERS INDIA LIMITED

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: RAW WATER TREATMENT PLANT

BHARAT HEAVY ELECTRICALS LTD., UNIT: BOILER AUXILIARIES PLANT, RANIPET – 632 406.

	NAME	SIGN	DATE	NO.OF VAR.
DRN	BBS		25.11.13	
CHD	GR/SALAI/AT		25.11.13	
APPD	SK		25.11.13	

DEPT NP	GRADE OF UNTOL DIM	SCALE	WEIGHT (KG).	REF. TO ASSY/OLD DRG.	ITEM NO.	NO. OF ITEMS
CODE 976	PR: QA: 500	---	---			

TITLE: LEGEND FOR P&ID

CARD CODE: U 01

DRAWING NO.: 1-WT-220-00462

REV: 00

Size A1

ANNEXURE-3(8 pages)

AGITATOR					
PROJECT : RWTS, DAHEJ PETROCHEMICAL COMPLEX					
JOB NO. :6987	**CLIENT : OPaL**			**ITEM NO : 017-AG-xxx**	
SERVICE :					
PROCESS DATA					
PURPOSE					
OPERATION (BATCH/CONTINUOUS)					
FLOW RATE (m^3/hr)					
OPERATING PRESSURE (kg/cm^2 abs.)					
OPERATING TEMPERATURE (^0C)					
SOLIDS PRESENT (YES/NO, TYPE & SIZE)					
FOAM TENDENCY (YES/NO)					
SOLUBILITY (HIGH / MEDIUM / LOW / NIL)					
ABRASION (HIGH / MEDIUM / LOW / NIL)					
SETTLING (HIGH / MEDIUM / LOW / NIL)					
DEGREE OF AGITATION (MILD / MEDIUM / VIOLENT)					
CORROSIVE PRODUCTS (YES / NO, TYPE)					
PROCESS LIMITATION (NONE / HP / TIP SPEED / SPACE)					

S. NO.	COMPONENT	PERCENT COMPOSITION		VISCOSITY (Cs)	SP. GRAVITY
		BY VOLUME	BY WEIGHT		
1					
2					
AVERAGE PROPERTIES OF MIXTURE					

MECHANICAL DATA		
IMPELLER	TYPE (TURBINE / PROPELLER)	
	NUMBER	
	DIAMETER (mm)	
	SPEED (RPM)	
	M.O.C.	
BLADES	TYPE (TURBINE / PROPELLER)	
	NUMBER	
	PITCH	
	WIDTH (mm)	
	M.O.C.	
SHAFT	M.O.C.	
MAKE OF MIXER	*(EIL APPROVED MAKE)	

POWER NO. USED	
MOUNTING SPACE AVAILABLE (AMPLE/RESTRICTED)	
MIXER ENTRY (TOP / SIDE /BOTTOM / PORTABLE)	
MOUNTING (CLAMPED / FLANGED, MOUNTING ANGLE)	
SHAFT SEAL (MECAHNICAL / STUFFING BOX / LABYRITGH SEAL / VAPOUR SEAL)	
DRIVE TYPE	
DRIVE UNIT TRANSMISSION TYPE (GEAR / BELT / DIRECT)	
TYPE OF MOTOR	
PROBABLE MOTOR RATING (H.P.)	
MAKE OF MOTOR	

NOTES	

NO.	**DATE**	**REVISION**	**PREPARED**	**CHECKED**	**APPROVED**

	ENGINEERS INDIA LIMITED NEW DELHI	**AGITATOR**	**PROCESS DATA SHEET**	**REV.**

CHEMICAL DOSING PUMPS		
PROJECT : RWTS, DAHEJ PETROCHEMICAL COMPLEX PROJECT		
JOB NO. : 6987	**CLIENT : OPaL**	**ITEM NO. : 017-P-XXX**
SERVICE :		
TYPE :		
PROPERTIES OF LIQUID		
LIQUID HANDLED		
PUMPING TEMPERATURE (^{0}C)		
VISCOSITY AT PUMPING TEMPERATURE (cp)		
LIQUID DENSITY (kg/m^3)		
PRESENCE OF CORROSIVE / TOXIC COMPONENTS		
SOLIDS IN SUSPENSION (YES / NO)		
SIZE OF SOLID PARTICLES (mm)(MAX)		
OPERATING CONDITIONS		
FLOW RATE	NORMAL(M3/HR)	
	MAX. (M3/HR)	
	MIN.(M3/HR)	
SUCTION PRESSURE (kg/cm2.a)		
DISHARGE PRESSURE (kg/cm2.a)		
DIFFERENTIAL PRESSURE (kg/cm2.g)		
DIFFERENTIAL HEAD (m)		
NPSH AVAILABLE (m) MIN.		
NO. OF PUMPS		
CAPACITY CONTROL FOR VOLUMETRIC PUMPS		
CONTINUOUS / DISCONTINUOUS / MANUAL / AUTOMATIC		
TYPE		
RANGE (%)		
PRECISION AT MIN. RATE (%)		
MECHANICAL DATA		
DESIGN PRESSURE (kg/cm2.g)		
DESIGN TEMPERATURE (^{0}C)		
MATERIAL CODE	CASING	
	IMPELLER	
SEAL TYPE (MECHANICAL / PACKING)		
LINE RATING IN / OUT		
DRIVER		
MOTOR TYPE		
PROBABLE MOTOR RATING (HP)		
NOTES:		

NO.	DATE	REVISION	PREPARED	CHECKED	APPROVED

इंआइपल	**ENGINEERS INDIA LIMITED NEW DELIII**	**CHEMICAL DOSING PUMPS**	**PROCESS DATA SHEET**	**REV.**

इंजीनियर्स इंडिया लिमिटेड ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)	TUBE SETTLER / LAMELLA CLARIFIER / HIGH RATE CLARIFIER PROCESS DATA SHEET	Document No. Rev. No.

ITEM NO.	017-CLF-XXX	SERVICE			
OPERATING		STANDBY	-		

PROPERTIES OF LIQUID		
FLUID HANDLED		
INFLUENT TEMPERATURE	°C	
SPECIFIC GRAVITY		
SUSPENDED SOLIDS (DESIGN)	mg/l	
TOTAL SUSPENDED SOLIDS REMOVAL EFFICIENCY	%	
ADDITION OF CHEMICALS	YES/NO	
FLOW RATE		
DESIGN FLOW PER UNIT	m^3/hr	
OVERFLOW PER UNIT	m^3/hr	
UNDERFLOW PER UNIT (PEAK)	m^3/hr	
WATER LOSSES IN DESLUDGING		
SUSPENDED SOLIDS CONCENTRATION		
INFLUENT (NOR/MAX)	mg/l	
OVERFLOW	mg/l	
UNDERFLOW	mg/l	
DESIGN CRITERIA (CLARIFIER SECTION)		
SIZE OF SETTLER PLATES/TUBES		
ANGLE OF INCLINATION OF SETTLER PLATES/TUBES		
UNIT SPECIFICATION		
NO. OF UNITS		
VELOCITY IN INLET PIPE	m/s	
AREA REQUIRED	m^2	
INLET PIPE DIA REQUIRED	m	
INLET PIPE DIA PROVIDED	m	
NO. OF COMPARTMENTS PER UNIT		
FLOCCULATOR MECHANISM		
DETENTION IN FLOCCULATION ZONE (minutes)		
VOLUME IN FLOCCULATION ZONE (m3)		
SWD PROVIDED IN FLOCCULATION ZONE (m)		
FREE BOARD PROVIDED (m)		
AREA OF FLOCCULATION ZONE - REQUIRED(m2)		
TOTAL AREA OF FLOCCULATION ZONE -PROVIDED (m2)		
FLOCCULATOR WALL THICKNESS (m)		
O.DIA/ TOTAL LENGTH OF FLOCCULATION ZONE (m)		
OUTER AREA OF FLOCCULATION ZONE (m2)		
CLARIFICATION ZONE		
DETENTION IN CLARIFICATION ZONE (minutes)		
VOLUME IN CLARIFICATION ZONE (m3)		
SURFACE LOADING RATE IN CLARIFICATION ZONE		
AREA OF CLARIFICATION ZONE (m2)		
SWD PROVIDED IN CLARIFICATION ZONE (m)		
FREE BOARD PROVIDED (m)		
TOTAL AREA REQUIRED FOR PLATE/ TUBE SETTLER (m2)		
DIA / WIDTH x LENGTH REQUIRED FOR PLATE/ TUBE SETTLER (m/ m x m)		
DIA/ WIDTH x LENGTH PROVIDED FOR CLARIFICATION ZONE		
AREA PROVIDED FOR CLARIFICATION ZONE (m2)		
SHAPE OF INCLINED PLATES/ TUBES		
SECTION OF INDIVIDUAL INCLINED PLATE/ TUBE (L x B / DIA)		
CROSS SECTION OF PLATES/ TUBE MODULE (m x m)		
INCLINED PLATES/ TUBE ENTRANCE AREA (m2)		
NUMBER OF PLATES/ TUBES REQUIRED		
LENGTH OF PLATES/ TUBE MODULE (m)		
HEIGHT OF PLATES/ TUBE MODULE (m)		
THICKNESS OF INDIVIDUAL PLATES/ TUBES		
SLOPE OF BOTTOM		
SLUDGE REMOVAL MECHANISM		
LAUNDER TYPE		
MATERIAL OF CONSTRUCTION		
INCLINED PLATE/ TUBE SETTLER & FLOCCULATOR TANK		
PLATES/ TUBES		
OVER FLOW WEIR - V NOTCH TYPE		
WALKWAY BRIDGE (WIDTH AS PER EIL SPECS.)		
SLUDGE REMOVAL MECHANISM (RAKE ARM/ CONVEYOR)		
FLOCCULATOR MECHANISM (PADDLES, SHAFT ETC)		
HANDRAILINGS		
ACCESS STAIR		
PANTING/ COATING		
INTERNAL SURFACE		
EXTERNAL SURFACE		

NOTES:

Rev.	Description	Prepared	Checked	Approved	Date

CHEMICAL DOSING TANK		
PROJECT : RWTS, DAHEJ PETROCHEMICAL COMPLEX		
JOB NO. : 6987	**CLIENT : OPaL**	**ITEM NO. : 017-TK-XXX**
SERVICE :		
PROCESS DATA		
LIQUID STORED		
NOMINAL CAPACITY OF EACH TANK (m^3)		
EFFECTIVE LIQUID HOLD UP OF EACH TANK (m^3)		
STORAGE TEMPERATURE (^0C)		
DESIGN TEMPERATURE (^0C)		
SP. GR. OF LIQUID AT STORAGE TEMPERATURE (^0C)		
VISCOSITY AT STORAGE TEMPERATURE (Cp)		
DESIGN PRESSURE (kg/cm^2 abs.)		
DESIGN VACUUM PRESSURE		
UNIT DESCRIPTION		
NO. OF TANKS		
TYPE		
DIAMETER OF EACH TANK (m)		
EFFECTIVE LIQUID DEPTH		
DVD (m) + FREE BOARD ABOVE TWL (m)		
TOTAL HEIGHT (m)		
SLOPE FOR TANK BOTTOM		
OVERFLOW ARRANGEMENT REQUIRED (YES / NO)		
BOTTOM DRAIN REQUIRED (YES / NO)		
HEATING COIL (YES / NO)		
VENT		
SLUDGE WITHDRAWL PITS (YES / NO)		
GAUGING AND SAMPLING HATCH		
LEVEL INDICATION REQUIRED (YES / NO)		
LEVEL TRANSMITTER (YES / NO)		
LEVEL SWITCHES (YES / NO)		
LEVEL TRANSMITTER / SWITCH PLATFORM (YES / NO)		
LEVEL ALARM (YES/NO)		
CORROSION ALLOWANCE (mm)		
MATERIAL OF CONSTRUCTION		
TANK		
PAINTING/LINING		
STAIRS / HANDRAILINGS / OPERATING PLATFORM		
NOTES:		

NO.	DATE	REVISION	PREPARED	CHECKED	APPROVED

	ENGINEERS INDIA LIMITED NEW DELHI	**CHEMICAL DOSING TANK**	**PROCESS DATA SHEET**	**REV.**

PUMPS			
PROJECT : RWTS, DAHEJ PETROCHEMICAL COMPLEX			
JOB NO. : 6987	**CLIENT : OPaL**		**ITEM NO. : 017-P-xxx**
SERVICE :			
TYPE :			
PROPERTIES OF LIQUID			
LIQUID HANDLED			
PUMPING TEMPERATURE (^{0}C)			
VISCOSITY AT PUMPING TEMPERATURE (cp)			
LIQUID DENSITY (kg/m^3)			
PRESENCE OF CORROSIVE / TOXIC COMPONENTS			
SOLIDS IN SUSPENSION (YES / NO)			
SIZE OF SOLID PARTICLES (mm)(MAX)			
OPERATING CONDITIONS			
FLOW RATE	NORMAL(m3/hr)		
	MAX. (m3/hr)		
	MIN. (m3/hr)		
SUCTION PRESSURE (kg/cm2.a)			
DISHARGE PRESSURE (kg/cm2.a)			
DIFFERENTIAL PRESSURE (kg/cm2.g)			
DIFFERENTIAL HEAD (m)			
NPSH AVAILABLE (m) MIN.			
NO. OF PUMPS			
CAPACITY CONTROL FOR VOLUMETRIC PUMPS			
CONTINUOUS / DISCONTINUOUS / MANUAL / AUTOMATIC			
TYPE			
RANGE (%)			
PRECISION AT MIN. RATE (%)			
MECHANICAL DATA			
DESIGN PRESSURE (kg/cm2.g)			
DESIGN TEMPERATURE (^{0}C)			
MATERIAL CODE	CASING		
	IMPELLER		
SEAL TYPE (MECHANICAL / PACKING)			
LINE RATING IN / OUT			
DRIVER			
MOTOR TYPE			
MINIMUM PUMP EFFICIENCY AT RATED POINT			
PROBABLE MOTOR RATING (HP)			
NOTES:			

NO.	DATE	REVISION	PREPARED	CHECKED	APPROVED

	ENGINEERS INDIA LIMITED NEW DELHI	**PUMPS**	**PROCESS DATA SHEET**	**REV.**

1	**GENERAL**									
2	Project: **Dahej Petrochemical Complex**						Job No.:**6987**			
3	Owner: **ONGC Petro Additive Limited**						Site: **Dahej , Gujarat**			
4	Purchaser: Max./Min. Ambient °C:						Unit:		Unit No:	
5	Item No.:						Service:			
6	No. Reqd.:	Working:		Standby:			Parallel Operation Required:	☐ Yes	☐ No	
7	Applicable to	■ Proposal	☐ Purchase					☐ As Built		
8	■ Scope option & Information specified by purchaser ☐ Information Reqd. from & option left to vendor. Vendor to cross ☒ the selected option.									
9	Driver: Working		Standby				Driver Supplied & Mounted By:	☐ Pump Mfr.	☐ Other	
10	**OPERATING CONDITIONS(Refer Process data sheet enclosed elsewhere)**									
11	Liquid Handled						Capacity (m^3/hr): Min/Nor/Rated:			
12	Pumping Temp. (°C):	Normal		Max.			Discharge Pressure (kg/cm²,A):			
13	Specific Gravity at P.T./15°C:						Suction Pressure: Nor./ Max. (kg/cm²,A):			
14	Vapour Pressure at P.T. (kg/cm²,A):						Diff. Pressure (kg/cm²) @ Rated Capacity:			
15	Viscosity at P.T. (cP/~~cst~~):		Corr./Eros. By:				Diff. Head (m) @ Rated Capacity:			
16	Solids in suspension	☐ Yes ☐ No	Size:		%		NPSH Available (m):			
17	**MANUFACTURERS SPECIFICATIONS**									
18	Pump Manufacturer:						Model No.:			
19	**CONSTRUCTION**						**PERFORMANCE**			
20	Casing Mounting:	☐ Centerline	☐ Foot	☐ Inline			Proposal Curve No.			
21	Casing Split:	☐ Axial	■ Radial				Visc. Corr. Factor: C_0	C_Q	C_H	
22	Type:	■ Single Volute	☐ Double Volute	☐ Diffuser			NPSH Reqd. (Water) (m):	F/L Speed (rpm):		
23	Casing Connection:	■ Vent	■ Drain	☐ Gauge			No. of stages:	Efficiency (%):		
24	Nozzles	Size	ANSI Rating	Facing	Position		Rated BKW(0% Tol.): kW	BKW @MCF(SG=1.0): kW		
25	Suction						Max.BKW rtd. Imp.: kW	Rec. Driver Rating: kW		
26	Discharge						Max.head@ rtd imp.(m):	Cap@ BEP(m^3/hr):		
27	Imp. N (mm)	Max:	Rated:	Min:	Type: **Closed**		MCF (m^3/hr):Stable	Thermal		
28	Brg.: Type/No. Radial:		Thrust:	Lub: **Oil**			M.A.W.P @ 15°C/P.T./Design Temp.(kg/cm²,G):			
29	Cplg.:Make/Type:	**Flexmetl w spacer**	Nonspark Guard	■ Yes	☐ No		Hydrostatic Test pressure (kg/cm²,G):			
30	Driver Half cplg. mounted by:	■ Pump Mfr.	☐ Others				Rotation facing coupling end:	☐ CW	☐ CCW	
31	Packing Type:	Size:	No. of rings:				Seal flush/ Quench plan:	Material:		
32	Mech. Seal: Make	Model:	API Code:				Ext. seal flush fluid:	LPM: @ Kg/cm²G/ EC		
33	Base Plate :	☐Yes ☐ No	Fdn. Bolts:	■ Yes	☐ No		Seal Barrier fluid:	LPM: @ Kg/cm²G/ EC		
34	Throat Bush:	■ Yes ☐ No	Matl.:	Bal. Device:	☐ Yes ☐ No		Ext. quench fluid:	LPM: @ Kg/cm²G/ EC		
35	**Materials (API-610 Matl. Class)**			MOC	ASTM Grades		C.W. Plan :	LPM: @ Kg/cm²G/ EC		
36	I - Cast Iron (Ductile)	Casing					Weight(kg): Pump+Base+Coupling:		Driver:	
37	B – Bronze	Impeller					**AUXILIARY PIPING INTERFACE CONNECTIONS**			
38	S - Carbon Steel	Inner Case parts					(All interface conn.shall be termntd.with a flng. block valves)			
39	C - 11-13% Chr. Stl.	Sleeve Packed						**Size**	**Rating(ANSI)**	**Facing**
40	h – Hardened	Sleeve Seal					Lantern Ring Inlet/Outlet			
41	f – Faced	Casing ring	)H-BHN				Ext. Seal flush fluid Inlet/Outlet			
42	K -SS 304	Impeller ring	50(min)				Seal Quench fluid Inlet			
43	L -SS 316	Shaft					Seal pot vent/ drain			
44	X - AISI 410	Throttle Bush					Casing vent/ drain			
45	Y	Throat Bush					C.W Inlet/ Outlet			
46	Z	Balance Drum					Base plate drain (only flanged)			
47	☐ Driver suitable for Pump starting with open Disc. Valve condition.						Casing steam jacket			
48	**INSPECTION & TESTS (EACH PUMP) (Also refer Engineering Design Basis)**									
49			Witness	Observe				Witness	Observe	
50	■ Shop Test / Inspection		☐	☐	■ NPSH As Reqd. ■ Per Spec. ☐ Mandatory			■	☐	
51	■ Material Certificates		☐	☐	■ Dismantle Insp. & Re-assembly after Test			■	☐	
52	■ Hydrostatic		■	☐	☐ Unitisation/Dimensional Check			☐	☐	
53	■ Performance/Sound Level		■	☐	■ Check for direction of rotation of pump & driver.			■	☐	
54	**Applicable Specification: Engineering Design basis (6987-00-16-45-DB-01)**									
55	**REMARKS:-** 1) Max. allowable casing working pressure shall not be less than _____ kg/cm²g @_____ °C. MAWP shall not be less than pressure temp. rating of ASME/ ANSI B16.1 Class 125 or ANSI B16.5 Class 150 flanges for the materials offered.									
56	2) Down Stream Design Pressure is _____kg/cm²g. Maximum shut-off pressure considering max suction pressure and max specific gravity & including all tolerances shall not exceed this value.									
57	3) This is Typical datasheet , Contractor to fill for each item.									
58										

Date	Rev	Job Engineer	Reviewer	Approver

1	**GENERAL**							
2	Project: **Dahej Petrochemical Complex**			Job no.: **6987**				
3	Owner: **ONGC Petro Additives Limited**			Site: **Dahej, Gujarat**				
4	Purchaser:			Unit:		Unit no.:		
5	Item No.:			Service:				
6	No. Required:	Working:	Std by:	Driver:	Working:	Std by:		
7	Applicable to	■ Proposals		☐ Purchase		☐ As Built		
8	■ Scope Option & Information specified by Purchaser ☐ Information required from & options left to vendor. Vendor to cross [:] the selected Option							
9	Manufacturer:			Size & Type:	Model:			
10	**OPERATING CONDITIONS(Refer process data sheets enclosed elsewhere)**							
11	☐ Liquid:			☐ Capacity at PT (l/hr)/(m^3/hr):				
12	☐ Pumping Temperature (EC)(Nor/Max.):			Min:		Nor:		Rated:
13	☐ Specific Gravity at PT:			☐ Discharge Pressure (kg/cm²,a):				
14	☐ Vapour Pressure at PT(kg/cm²,a):			Min:		Nor:		Rated:
15	☐ Viscosity at PT(Cp/Cst):			☐ Suction Pressure (kg/cm²,a):				
16	☐ Corrosion Erosion caused by:			Min:		Nor:		Rated:
17	☐ Presence of Solids:			☐ Differential Pressure (kg/cm²):				
18	☐ NPSH Available (w/o acceleration head) (m):			Min:		Nor:		Rated:
19	**SITE / INSTALLATION DATA(Refer enclosed elsewhere in the bid package..)**							
20	Location: ☐ Indoor ☐ Outdoor w/w/o roof			☐ Heated		☐ Unheated		
21	Site Temperature(EC):	Max:	Min:	☐ Elect. Area Hazard:		Div:	Class:	Group:
22	**APPLICABLE CODES & STANDARDS**							
23	**API STANDARD 675 & Engineering Design Basis (6987-00-16-45-01)**							
24	**PERFORMANCE**							
25	☐ Number of feeds:			☐ Plunger Speed (stroke/min): (# 100)				
26	☐ Rated Capacity (l/hr)/ (m^3/hr):			☐ Plunger Diameter (mm):				
27	☐ Acceleration Head (m):			☐ Cylinder Diameter (mm):		☐ Length of Stroke (mm):		
28	☐ Plunger Linear speed (m/s):			☐ Pump Relief Valve Set Pressure (kg/cm²,g):				
29	☐ Volumetric efficiency (%):[# 90%]			☐ Pump Head MAWP (kg/cm²,g):				
30	☐ Mechanical Eff. (%):	☐ Overall Eff. (%):		☐ Hydro test Pressure (kg/cm²,g):				
31	☐ NPSH Required (m):			☐ Flow Repeatability:				
32	☐ BKW Rated (kW):	☐ BkW at R.V. Set Pr.:		☐ Thrust on plunger (kgf):				
33	☐ Packing Type:	☐ No. Of rings:		☐ Design Plunger Thrust (kgf):				
34	**CONSTRUCTON FEATURES**							
35	**Nozzles**			**Size / ANSI Rating**		**Facing**		**Position**
36	Pump Suction							
37	Pump Discharge							
38	Suction Manifold (for multi head pumps)							
39	Discharge Manifold (for multi head pumps)							
40	Relief Valve	Inlet						
41		Outlet						
42	Pulsation	Inlet						
43	Suction	Outlet						
44	Pulsation	Inlet						
45	Discharge	Outlet						
46	**LIQUID END**							
47	Type: ☐ Diaphragm		☐ Plunger	■ Valves per feed: ■ Suction:**Two**		☐ Discharge:**Two**		
48	No. of Heads: ☐ Simplex; ☐ Duplex; ☐ Multiplex			■ Valve type: **Ball**				
49	Diaphragm Type: _ Single			☐ Double		☐ Sandwich		
50	**MATERIALS (Refer Process data Sheet)**							
51	☐ Liquid End:			☐ Packing:				
52	☐ Contour Plate:			☐ Valve:				
53	☐ Hydraulic Diaphragm:			☐ Valve Guide:				
54	☐ Plunger:			☐ Valve Body:				
55	☐ Lantern Ring:			☐ Valve Gasket:				
56	☐ Packing Gland:			☐ Relief Valve:		Body:		
57	☐ Calibration Pot:			☐ Suction/Discharge Pulsation Dampener:				
58	**Remarks:**							
59								
60								

61	**INSPECTION & TESTING(Remark-7)**					
62	**Description**	**Required**	**Witnessed**	**Description**	**Required**	**Witnesse**
63	Hydrostatic	■	■	Material Certificates	■	--
64	Performance Test	■	■	Shop Inspection	■	☐
65	Steady State Accr.	■	■	Dismantle & Insp. after test	■	■
66	Repeatability	■	■	R.V. Test (Mfr. shop)	■	■
67	Linearity	■	■	Diaphragm Rupture Detection (Functional)	■	■
68	**DRIVER**					
69	■ Type of Driver:		■Elec. Motor:	☐ Steam Driven:	☐ Air Motor:	
70	☐ Driver Supplied & mounted by Pump Manufacturer			☐ Driver Supplied & mounted by others		
71	☐ Driver kW:			☐ Speed (rpm):		
72	**WEIGHTS**					
73	☐ Pump with Driver & Base Frame (Kg):			☐ Relief Valve (Kg):		
74	☐ Skid size (lxbxh) (m):			☐ Total Weight (Kg):		
75	☐ Suction Pulsation Dampener (Kg):			☐ Discharge Pulsation Dampener (Kg):		
76	☐ Skid Size (lxbxh) (m):			☐ Total Weight (Kg):		
77	**CONTROLS**					
78	**Type of Stroke Control:**					
79	■Manual ☐ Automatic			☐ Remote	☐ Local	
80	**Signal:**					
81	☐ Pneumatic (kg/cm²g):			☐ Minimum:	☐ Maximum:	
82	☐ Electronic (mA):			☐ Minimum:	☐ Maximum:	
83	Remarks:					
84	**ACCESSORIES**					
85	■ Speed Reducer supplied & mounted by Pump Manufacturer:			■ Relief Valve supplied & mounted by Pump Manufacturer:		
86	Make:			Make:		
87	■ Integral	☐ Separate		☐ Internal	■ External	
88	☐ Model	☐ Gear Ratio:		■ Suction and Discharge manifold piping supplied &		
89	■ Common Base Plate under: Pump, gear box & driver			mounted by Pump Manufacturer		
90	■ Coupling supplied & mounted by Pump Manufacturer:			☐ Back Pressure Valve		
91	Make:			☐ Calibration Pot: ☐ At Suction ☐ At Discharge		
92	☐ Type:			☐ Common to all pump units	☐ Separate	
93	■ Gas Precharging Kit:			☐ With Level Guage		
94				■ Puls. Dampener (Suct) **(Remark-3)**	Type:	
95				■ Puls. Dampener (Disch) **(Remark -4)**	Type:	
96				■ Diaphragm Rupture Detection System with DPDT contacts:		
97	**REMARKS**					
98	1. Pump casing design pressure shall not be less than kg/cm²,g @ °C					
99	2. Pump manufacturer shall supply & mount Calibration Pot, if the same is specified.					
100	3. Pump manufacturer shall supply & mount Suction pulsation dampener, if the same is required to reduce the NPSHR.					
101	4. Pump manufacturer shall supply & mount Discharge pulsation dampener to limit the pulsations within ±3%					
102	5. Equivalent Suction piping length (m):_____; Suction pipe diameter (mm):_____					
103	6. The pump manufacturer shall supply Controlled Volume pump unit complete with speed reducer, driver, suction pulsation					
104	dampener (if reqd. or specified), discharge pulsation dampener, suction & discharge manifold piping duly prefabricated for multi head -					
105	multi-head pumps, relief valves, instrumentation etc. all duly mounted on a single common base plate, in the pump manufacturer's shop					
106	manufacturer's shop prior to shop testing.					
107	7. Refer Engineering Design Basis (Doc. No. 6987-00-16-45-DB-01).					
108						
109						
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112						
113						
114						

Date	**Rev**	**Job Engineer**	**Reviewer**	**Approver**