DRAWING NO. PE-DG-434-166-A102

CUSTOMER'S DRAWING NO.

FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN MM

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COMPUTER FILE NAME: PE-DG-434-166-A102

05 NOS. ROAD TANKER

BHEL–PEM

05 NOS. U/L HOSE

CUSTOMER

LDO UNLOADING HEADER

9EGA10AZ001 LDU–1
9EGA10AZ002 LDU–2
9EGA10AZ003 LDU–3
9EGA10AZ004 LDU–4
9EGA10AZ005 LDU–5
9EGA10AZ006 LDU–6
9EGA10AZ007 LDU–7

9EGA10BR001 75 LDO 0 0 (TYP)
9EGA10BR002 250 LDO 0 0
9EGA10BR003
9EGA10BR004
9EGA10BR005
9EGA10BR006 50NB
9EGA10BR007 50NB
9EGA10BR008 50NB
9EGA10BR009 50NB

9EGA10AA501 50NB LDU–6
9EGA10AA601 LDU–7
VENT

TO OWS

9EGA20BR001 250 LDO 0 0
9EGA20BR002 250 LDO 0 0

9EGA20CL001 LOW–STOP RUNNING PUMP
9EGA20CL002 LOW–STOP RUNNING PUMP
9EGA20AA301 9EGA20AA302 9EGA20AA303 9EGA20AA304
9EGA20AA305 9EGA20AA306 9EGA20AA307 9EGA20AA308
9EGA20CP501
LDUH–1 9EGA20AA101
LDUH–2 9EGA20AA102
250 LDO 0 0 9EGA20BR001

9EGC10BR001 250 LDO 0 0

DIFF PRES–HI ALARM & PUMP TRIP(TYP)
NOT HIGH PUMP START PERMISSIVE (TYP)

9EGC11CP151 9EGC11CP152 9EGC11CP501
9EGC11AT001 9EGC11AT002 9EGC11AP001
9EGC11BR001 200 LDO 0 0 (TYP)
9EGC11BR002
9EGC11BR003 200 LDO 0 0 (TYP)
9EGC11BR004 150 LDO 0 0 (TYP)
9EGC11BR005 25NB
9EGC11BR007 25NB
9EGR30BR006 25NB
9EGC11BR003 150 LDO 0 0
9EGC11BR008 150 LDO 0 0
LDS–1 9EGC11AA101 LDS–2 9EGC11AA102 LDS–3 9EGC11AA103 LDS–4 9EGC11AA104
LDS–5 9EGC11AA105 LDS–6 9EGC11AA106
LDS–7 9EGC11AA107 LDS–8 9EGC11AA108
LDS–9 9EGC11AA109 LDS–10 9EGC11AA110 LDS–11 9EGC11AA111 LDS–12 9EGC11AA112
LDD–1 9EGC11AA401 LDD–2 9EGC11AA402 LDD–3 9EGC11AA403 LDD–4 9EGC11AA404
LDD–5 9EGC11AA405 LDD–6 9EGC11AA406
LDDR–1 9EGC11AA601 LDDR–2 9EGC11AA602 LDDR–3 9EGC11AA603
LDI–1 9EGC11AA701 LDI–2 9EGC11AA702 LDI–3 9EGC11AA703 LDI–4 9EGC11AA704
LDI–5 9EGC11AA705 LDI–6 9EGC11AA706 LDI–7 9EGC11AA707
9EGC11CG001 9EGC11CG002 9EGC11CG003 9EGC11CG004
ECCENTRIC REDUCER (TYP)
PUMP–1 PUMP–2 PUMP–3 PUMP–4

9EGC12CP151 9EGC12CP152 9EGC12CP501
9EGC12AT001 9EGC12AT002 9EGC12AP001
9EGC12BR001 200 LDO 0 0 (TYP)
9EGC12BR002
9EGC12BR003 200 LDO 0 0 (TYP)
9EGC12BR004
9EGC12BR005 25NB
9EGC12BR007 25NB
9EGC12BR006 25NB
9EGC14BR001 50 LDO 0 0
LDS–5 9EGC12AA101 LDS–6 9EGC12AA102 LDS–7 9EGC12AA103 LDS–8 9EGC12AA104
LDS–9 9EGC12AA105 LDS–10 9EGC12AA106 LDS–11 9EGC12AA107 LDS–12 9EGC12AA108
LDD–4 9EGC12AA401 LDD–5 9EGC12AA402 LDD–6 9EGC12AA403
LDDR–3 9EGC12AA602
LDI–8 9EGC12AA701 LDI–9 9EGC12AA702 LDI–10 9EGC12AA703 LDI–11 9EGC12AA704
LDI–12 9EGC12AA705 LDI–13 9EGC12AA706 LDI–14 9EGC12AA707
9EGC12CG001 9EGC12CG002 9EGC12CG003 9EGC12CG004
PUMP–1 PUMP–2 PUMP–3 PUMP–4

9EGC20CP001 9EGC20CP002
H TRIP RUNNING PUMP
9EGC20BR001 150 LDO 0 0
9EGC20BR002 150 LDO 0 0
9EGC20AA301 9EGC20AA302 9EGC20AA303 9EGC20AA304
9EGC20CF101 Flow Gauge
9EGC20CF001 Flow Meter Cap 5–50 m³/h
LDDH–1 9EGC20AA101 LDDH–2 9EGC20AA102 LDDH–3 9EGC20AA103 LDDH–4 9EGC20AA104

TO DRAIN OIL TANK

LDO UNLOADING PUMPS
CAP. 50 m³/hr.
2 NOS.(1W+1S)

9EGB40BR003 200 LDO 0 0
LDO INTER TANK TRANSFER LINE
9EGB40AA103 LDIT–3
9EGC30BR001 150 LDO 0 0

9EGB10CL001 9EGB10CL002
HH: TRIP THE RUNNING U/L PUMP
H: STOP THE RUNNING U/L PUMP
NOT H: U/L PUMP START PERMISSIVE
L: FOR FORWORDING PUMPS
FOR INLET VALVE POSITION MONITORING (OPEN/CLOSE) (TYP)
LDTI–1 9EGB10AA001
ROOF MANHOLE N10
VENT WITH FLAME ARRESTOR
HEAT DETECTOR 9EGB20AA101 LDHR–1
9EGB10BR001 150 LDO 0 0
9EGB10BR002 150 LDO 0 0
9EGB10BR003 150 LDO 0 0
9EGB10BR004 200 LDO 0 0
9EGB10BR005 200 LDO 0 0
9EGB10BR006 200 LDO 0 0
150NB SPARE INLET
LDO STORAGE TANK #1
CAP. 500 KL
ø 10.0 m x 9.0 m HT.
9EGB10BB001
9EGB10CL501 LI
OVERFLOW N8
FOAM POURER N11
SHELL MANHOLE N9
LDSO–1 9EGB10AA003 SPARE OUTLET N12
LDTD–1 9EGB30AA001
LDDR–1 9EGB80AA101 DRAIN 80NB N3 N4
LDSD–1 9EGB10AA401
LDIT–1 9EGB40AA101
SURFACE DRAIN TO OWS PIT
N1 N2 N5 N6 N10 N13 N14

9EGB11CL001 9EGB11CL002
HH: TRIP THE RUNNING U/L PUMP
H: STOP THE RUNNING U/L PUMP
NOT H: U/L PUMP START PERMISSIVE
L: FOR FORWORDING PUMPS
LDTI–2 9EGB10AA002
ROOF MANHOLE N10
VENT WITH FLAME ARRES.
HEAT DETECTOR 9EGB20AA102 LDHR–2
9EGB11BR001 150 LDO 0 0
9EGB11BR002 150 LDO 0 0
9EGB11BR003 200 LDO 0 0
9EGB11BR004 200 LDO 0 0
9EGB11BR005 200 LDO 0 0
100NB SPARE INLET
LDO STORAGE TANK #2
CAP. 500 KL
ø 10.0 m x 9.0 m HT.
9EGB11BB001
9EGB11CL501 LI
OVERFLOW N8
FOAM POURER N11
SHELL MANHOLE N9
LDSO–2 9EGB11AA001 SPARE OUTLET N12
LDTD–2 9EGB30AA002
LDDR–2 9EGB80AA102 DRAIN 80NB N3 N4
LDSD–2 9EGB11AA401
LDIT–2 9EGB40AA102
SURFACE DRAIN TO OWS PIT
N1 N2 N5 N6 N10 N13 N14

9EGB30BR001 200 LDO 0 0
9EGB30BR002 200 LDO 0 0
9EGB30BR003 200 LDO 0 0
9EGB30BR004 200 LDO 0 0
LDO RETURN LINE FROM P&H P/H
LDO SUPPLY LINE TO P&H P/H
FOR FUTURE CONNECTION
9EGB30AA102 LDF–1
9EGB20BR003 100 LDO 0 0
9EGB20BR001 100 LDO 0 0
9EGB20BR002 100 LDO 0 0
BHEL PEM — BHEL TRICHY
TP
FOHS FORWARDING BUILDING
1mtr

DIFF PRES–HI ALARM & PUMP TRIP(TYP)
NOT HIGH PUMP START PERMISSIVE (TYP)

9EGC31CP151 9EGC31CP152 9EGC31CP501
9EGC31AT001 9EGC31AT002 9EGC31AP001
9EGC31BR001 150 LDO 0 0
9EGC31BR002 150 LDO 0 0
9EGC31BR003 150 LDO 0 0
9EGC31BR004 150 LDO 0 0
9EGC31BR005 150 LDO 0 0
9EGC31BR006 100 LDO 0 0
9EGC31BR007 100 LDO 0 0
9EGC31BR008 25NB
9EGC31BR009 25NB
9EGC31BR010 25NB
9EGC31BR011 25NB
9EGC31BR012 25NB
DOPS–1 9EGC31AA101 DOPS–2 9EGC31AA102 DOPS–3 9EGC31AA103 DOPS–4 9EGC31AA104
DOPS–5 9EGC31AA105
DOPD–1 9EGC31AA401 DOPD–2 9EGC31AA402 DOPD–3 9EGC31AA003 DOPD–4 9EGC31AA004
DOPD–5 9EGC31AA005 DOPD–6 9EGC31AA006
DOPI–1 9EGC31AA307 DOPI–2 9EGC31AA308
DOPI–3 9EGC31AA501 DOPI–4 9EGC31AA502
DOPI–5 9EGC31AA503 DOPI–6 9EGC31AA504
DOPI–7 9EGC31AA505 DOPI–8 9EGC31AA506
DOPI–9 9EGC31AA507
DOPI–10 9EGC31AA508
DOPI–11 9EGC31AA509
DOPI–12 9EGC31AA510
DOPI–13 9EGC31AA511
DOPI–14 9EGC31AA512
DOPI–15 9EGC31AA513
DOPI–16 9EGC31AA514
DOPI–17 9EGC31AA515
DOPI–18 9EGC31AA516
9EGC31CG001 9EGC31CG002 9EGC31CG003 9EGC31CG004
ECCENTRIC REDUCER (TYP)
PUMP–1 PUMP–2 PUMP–3 PUMP–4

9EGB12CL001 9EGB12CL002
HH: TRIP THE RUNNING U/L PUMP
H: STOP THE RUNNING U/L PUMP
NOT H: U/L PUMP START PERMISSIVE
L: FOR FORWORDING PUMPS
DOTI–1 9EGB50AA001
ROOF MANHOLE N10
VENT WITH FLAME ARRES.
HEAT DETECTOR 9EGB90AA101 DOTR–2
9EGB50BR001 100 LDO 0 0
100NB SPARE INLET N6
DAY OIL TANK
CAP. 100 KL
ø 6.0 m x 5.0 m HT.
9EGB12BB001
9EGB12CL501 LI
OVERFLOW N8
40NB SPARE RETURN N14
FOAM POURER N15
100NB SPARE OUTLET N12
SHELL MANHOLE N9
DOS–1 9EGB12AA001 DOS–2 9EGB12AA002
DOTS–1 9EGB70AA001 DOTS–2 9EGB12AA401
DOTD–1 9EGB12AA402 DOTD–2 9EGB12AA403
DRAIN 80NB N4
SURFACE DRAIN TO OWS PIT
N1 N2 N3 N10 N13

9EGB60BR001 50 LDO 0 0
TO DRAIN OIL TANK
9EGB60AA101 LDDR–3
FROM LDO DRAIN TO DRAIN OIL TANK
REFER BHEL DRG No. PE-DG-434-166-A001-SH2

LDO RETURN LINE FROM AUXILIARY BOILER PUMPS
9EGB90BR001 40 LDO 0 0
LDO SUPPLY LINE TO AUXILIARY BOILER PUMPS
9EGB70BR001 100 LDO 0 0
9EGB80BR001 50 LDO 0 0
9EGB80BR002 50 LDO 0 0
9EGB80BR003 50 LDO 0 0

LDO TRANSFER PUMPS
CAP. 25 m3/hr.
2 NOS.(1W+1S)

TENDER DRAWING

NTPC DRG No.	9585–001–130–PVM–L–001
CUSTOMER	NTPC Limited (A GOVT. OF INDIA ENTERPRISE)
PACKAGE:	FUEL OIL UNLOADING AND STORAGE SYSTEM.
PROJECT: –	3x800 MW Patratu Super Thermal Power Station Expansion Phase-I

434

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REV.	DATE	ALTD	CHD	APPD

BHARAT HEAVY ELECTRICALS LTD, POWER SECTOR, PROJECT ENGINEERING MANAGEMENT, NOIDA.

DEPT CODE		NAME	SIGN	DATE
M	DRN	SC	Sd/–	23.06.2018
	DESN	SC/RG	Sd/–	23.06.2018
	CHD	HK	Sd/–	23.06.2018
	APPD	SKB	Sd/–	23.06.2018

TITLE: PROCESS & INSTRUMENTAION DIAGRAM FOR LDO SYSTEM

DEPT. | SIGN | DATE | SCALE

DRAWING No. PE-DG-434-166-A001

SHEET 04 OF 06 | REV 00

SIZE-A1

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COMPUTER FILE NAME: PE-DG-434-166-A101

LEGEND

SYMBOL	DESCRIPTION
– – – –	STEAM LINE WITH INSULATION
~~	HOSE
●–●–●–●	CONDENSATE LINE WITH INSULATION
\\\\\\	INSTRUMENT AIR LINE
———	DM WATER LINE
	COIL HEATER
	HEATING COIL
	LOCAL DRAIN
TE+TT	TEMPERATURE ELEMENT + TEMPERATURE TRANSMITTER
TI	TEMPERATURE INDICATOR
PI	PRESSURE INDICATOR
PT	PRESSURE TRANSMITTER
TE	TEMPERATURE ELEMENT
D	SIGNAL TO DCS
T	TRAP WITH INBUILT STRAINER
	SIMPLEX STRAINER
	Y–TYPE STRAINER
CS	CONTROL STATION
	GLOBE VALVE (NORMALLY OPEN/ NORMALLY CLOSED)
	PLUG VALVE (NORMALLY OPEN/ NORMALLY CLOSED)
	BALL VALVE (NORMALLY OPEN/ NORMALLY CLOSED)
	GATE VALVE (NORMALLY OPEN/ NORMALLY CLOSED)
	NON RETURN VALVE
	PRESSURE RELIEF VALVE
	DISC CHECK VALVE
	CONTROL VALVE
SP	SMART POSITIONER
	REDUCER/EXPENDER

EQUIPMENTS DETAIL:–

S.No.	TAG No.	NAME OF EQUIPMENT	QTY
1	9ENB10BB001, 9ENB11BB001	HFO STORAGE TANK	2
3	9ENB20BB001	DRAIN OIL TANK	1
4	9ENC11AP001, 9ENC12AP001, 9ENC13AP001	HFO UNLOADING PUMPS	3
5	9ENC11AT001, 9ENC11AT002, 9ENC12AT001, 9ENC12AT002, 9ENC13AT001, 9ENC13AT002	HFO SUCTION STRAINER	6
6	9ENB10AC001, 9ENB11AC001	HFO SUCTION HEATER	2
7	9ENB10AH001, 9ENB11AH001, 9ENR10AH001	FLOOR COIL HEATER	3

EQUIPMENTS DETAIL:–

S.No.	TAG No.	NAME OF EQUIPMENT	QTY
1	9ENB10BB001, 9ENB11BB001	HFO STORAGE TANK	2
2	9ENR10BB001	OIL WATER SEPARATOR TANK	1
3	9ENC11AP001, 9ENC12AP001, 9ENC13AP001, 9ENC14AP001, 9ENC15AP001	HFO UNLOADING PUMPS	5
4	9ENC11AT001, 9ENC11AT002, 9ENC12AT001, 9ENC12AT002, 9ENC13AT001, 9ENC13AT002, 9ENC14AT001, 9ENC14AT002, 9ENC15AT001, 9ENC15AT002	HFO SUCTION STRAINER	10
5	9ENB10AC001, 9ENB11AC001	HFO SUCTION HEATER	2
6	9ENB10AH001, 9ENB11AH001	FLOOR COIL HEATER	2
7	9ENR10AP001, 9ENR10AP002	OWS SUMP PUMPS	2
8	9ENB30AP001, 9ENB30AP002	HFO U/L P/H SUMP PUMP	2
9	ENB31AP001, ENB31AP002, ENB32AP001, ENB32AP002	U/L HEADER TRENCH AND DRAIN TRENCH SUMP PUMP	4

NOTES:

1. ALL STEAM/CONDENSATE LINES SHALL BE INSULATED.
2. STEAM TRAPS FOR SUCTION HEATER & FLOOR COIL HEATER OF STORAGE TANKS SHALL BE OF IB TYPE. ALL OTHER STEAM TRAPS SHALL BE OF TD TYPE.
3. FOR STEAM LINES & TRACER LINES, TRAPS SHALL BE PROVIDED AT EVERY 30 TO 35 MTR.
4. SHELL SURFACE OF F.O. STORAGE TANKS SHALL BE INSULATED.
5. PIPE SIZES FOR ALL STEAM LINES, TRACER LINES, CONTROL STATIONS, CONDENSATE LINES ETC. SHALL BE PROVIDED AS PER APPROVED CALCULATION.
6. ALL CONTROL VALVES SHALL BE PROVIDED WITH ISOLATION VALVES AND WITH A DRAIN VALVE IN UPSTREAM AND DOWNSTREAM.
7. FOR CONTROL STATION REFER DETAIL B.
8. BTPN WAGONS ARE NOT EQUIPPED WITH HEATING FACILITY, SO NO HEATING ARRANGEMENT IS PROVIDED FOR WAGON HEATING. ONLY UNLOADING HEADER TRACING WILL BE DONE IN U/L AREA
9. MODULATING TYPE CONTROL VALVE FOR FLOOR COIL HEATER AND SUCTION HEATER SHALL BE PROVIDED.
10. INSTRUMENTS SHALL BE PROVIDED AS PER P&ID.
11. DRAIN FROM FLASH TANK SHALL BE DISCHARGED TO OIL WATER SEPARATOR.
12. FOR OTHER DETAILS, REFER P & ID FOR HFO SYSTEM, PE–DG–434–166–A001–SH2.
13. THE INSTRUMENTS AND VALVES FURNISHED IN THE P&ID IS A MINIMUM REQUIREMENT, HOWEVER ANY INSTRUMENT/VALVE REQUIRED FOR COMPLETENESS OF THE SYSTEM SHALL BE PROVIDED BY BIDDER WITHOUT ANY COST IMPLICATION. FOR REDUNDANCY CRITERIA, VENDOR TO FOLLOW THE CLAUSE PERTAINING TO REDUNDANCY CRITERIA MENTIONED IN THE SPECIFIC TECHNICAL REQUIREMENT OF C&I.

PIPE NOMENALATURE

350	HFO	3	50

- 350 → PIPE SIZE IN NB
- HFO → SERVICE FLUID
- 3 → NO. OF STEAM TRACERS
- 50 → INSULATION THICKNESS (IN MM)

KKS NOMENALATURE

9	ENC	10	AA	001

- 9 → Unit number identifier
- ENC → Function key
- 10 → Area key
- AA → Equipment/Instrument Key
- 001 → Instrument number key

TENDER DRAWING

NTPC DRG No.	9585–001–130–PVM–L–001
CUSTOMER	NTPC Limited (A GOVT. OF INDIA ENTERPRISE)
PACKAGE:	FUEL OIL UNLOADING AND STORAGE SYSTEM.
PROJECT: –	**3x800 MW Patratu Super Thermal Power Station Expansion Phase-I**

434

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	CHD	HK	Sd/–	23.06.2018
	APPD	SKB	Sd/–	23.06.2018

TITLE: PROCESS & INSTRUMENTATION DIAGRAM FOR STEAM AND CONDENSATE SYSTEM

DEPT. / SIGN / DATE

SCALE

DRAWING No. PE–DG–434–166–A103

SHEET 05 OF 06 | REV 00

SIZE–A1

FIRST ANGLE PROJECTION
ALL DIMENSIONS ARE IN MM
DRAWING No. PE-DG-L07-166-A103
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SUMP PIT HEATING UNLOADING AREA

BHEL

60 NOs. STEAM HOSES

BHEL

VENT

CUST.

CUST.

VENT

OWS PIT HEATING TANK FARM AREA

HFO UNLOADING PUMP HEATING

HFO UNLOADING PUMP #1 9ENC11AP001

HFO UNLOADING PUMP #2 9ENC12AP001

HFO UNLOADING PUMP #3 9ENC13AP001

HFO UNLOADING PUMP #4 9ENC13AP001

HFO UNLOADING PUMP #5 9ENC13AP001

STRAINER SET FOR HFO UNLOADING PUMP #1 9ENC11AT001

STRAINER SET FOR HFO UNLOADING PUMP #1 9ENC11AT002

STRAINER SET FOR HFO UNLOADING PUMP #2 9ENC12AT001

STRAINER SET FOR HFO UNLOADING PUMP #2 9ENC12AT002

STRAINER SET FOR HFO UNLOADING PUMP #3 9ENC13AT001

STRAINER SET FOR HFO UNLOADING PUMP #3 9ENC13AT002

STRAINER SET FOR HFO UNLOADING PUMP #4 9ENC13AT001

STRAINER SET FOR HFO UNLOADING PUMP #4 9ENC13AT002

STRAINER SET FOR HFO UNLOADING PUMP #5 9ENC13AT001

STRAINER SET FOR HFO UNLOADING PUMP #5 9ENC13AT002

CONDESATE FLASH TANK

(PIPING CENTER SCOPE)

FOR MONITORING

LINE TEMP. MONITORING & DE-SUPERHEATER CV ACTUATION

DE-SUP

FOS VENDOR DM WATER SUPPLIER

DM WATER FOR DE-SUPER HEATING 37.0 KG/CM2 (G) SIZE AS PER P&ID OF COND. SYSTEM.

FOS VENDOR AUX. STEAM SUPPLIER

REFER BHEL DRG No. PE-DG-434-100-N107

16 kg/cm^2(a) @290°C SIZE AS PER P&ID OF AUX SYSTEM.

SELF ACTUATED PILOT OPERATED PRESSURE REDUCING VALVE (16 kg/cm2 TO 4.0 kg/cm2) CAPACITY : TO BE DECIDED BY THE FO VENDOR

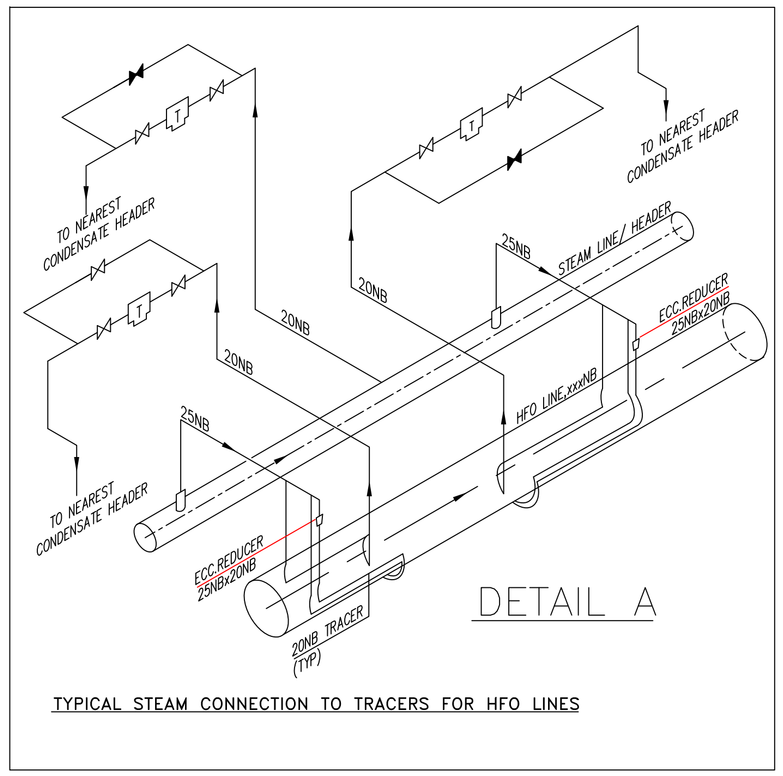
BHEL-PEM BHEL-IA SUPPLIER

REFER BHEL DRG No. XX-XX-XXX-XXX-XXX

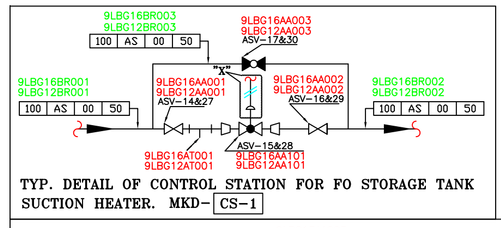
HFO STORAGE TANK
CAP. 3000 KL
9ENB10BB001

HFO STORAGE TANK
CAP. 3000 KL
9ENB11BB001

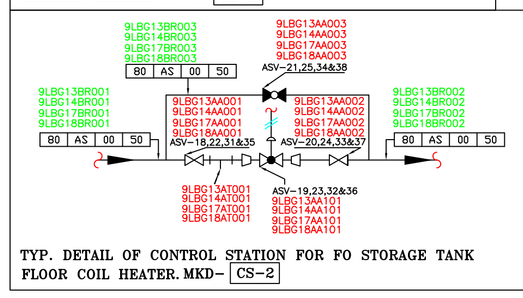
OIL WATER SEPARATOR PIT 9ENR10BB001



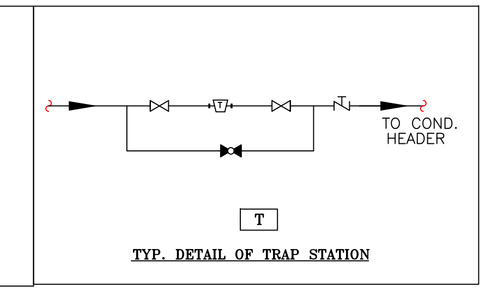
TYPICAL STEAM CONNECTION TO TRACERS FOR HFO LINES



TYP. DETAIL OF CONTROL STATION FOR FO STORAGE TANK SUCTION HEATER. MKD- CS-1



TYP. DETAIL OF CONTROL STATION FOR FO STORAGE TANK FLOOR COIL HEATER. MKD- CS-2



TYP. DETAIL OF TRAP STATION

TENDER DRAWING

NTPC DRG No.	9585-001-130-PVM-L-001
CUSTOMER	NTPC Limited (A GOVT. OF INDIA ENTERPRISE)
PACKAGE:	FUEL OIL UNLOADING AND STORAGE SYSTEM.

PROJECT: – **3x800 MW Patratu Super Thermal Power Station Expansion Phase-I**

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	APPD	SKB	Sd/-	23.06.2018

TITLE

PROCESS & INSTRUMENTATION DIAGRAM FOR STEAM AND CONDENSATE SYSTEM

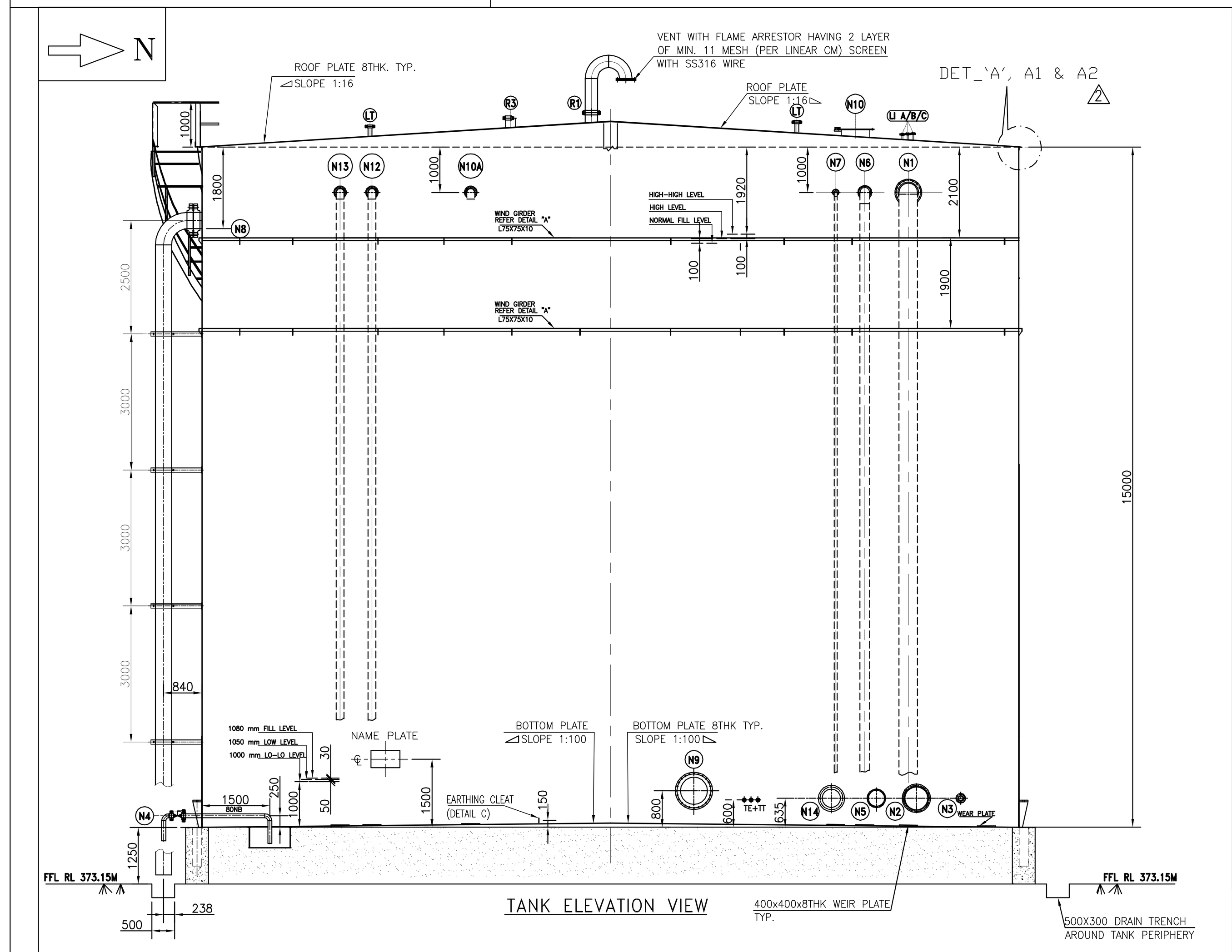
DEPT. | SCALE | SIGN | DATE

DRAWING No. PE-DG-434-166-A001

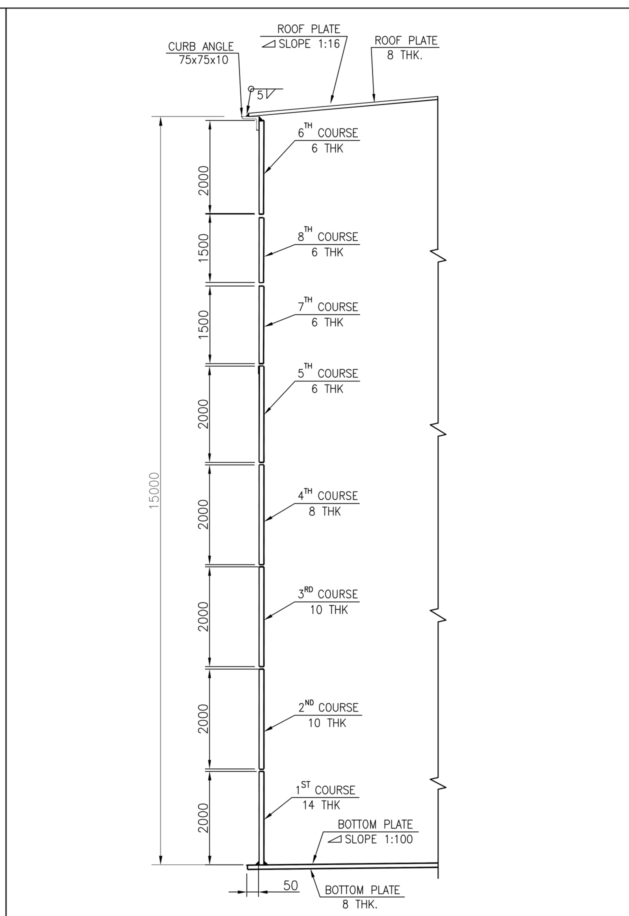
SHEET 06 OF 06 | REV 00

SIZE-A1

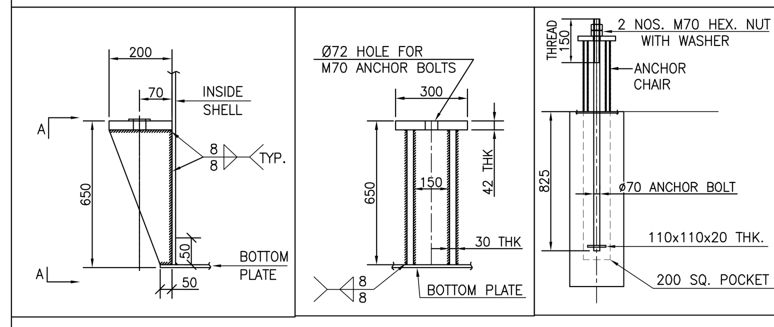
COMPUTER FILE NAME PE-DG-L07-166-A103



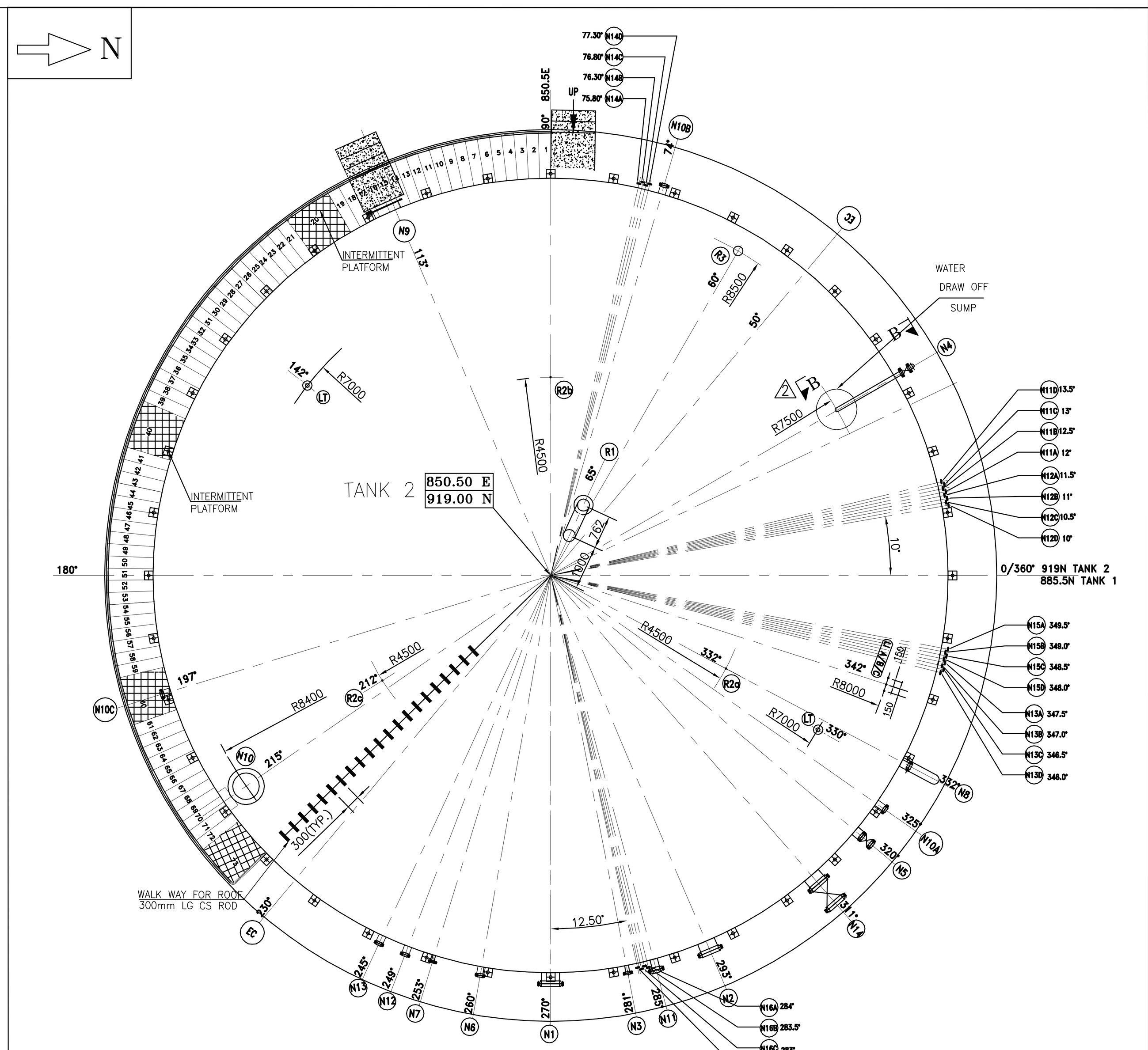
TANK ELEVATION VIEW



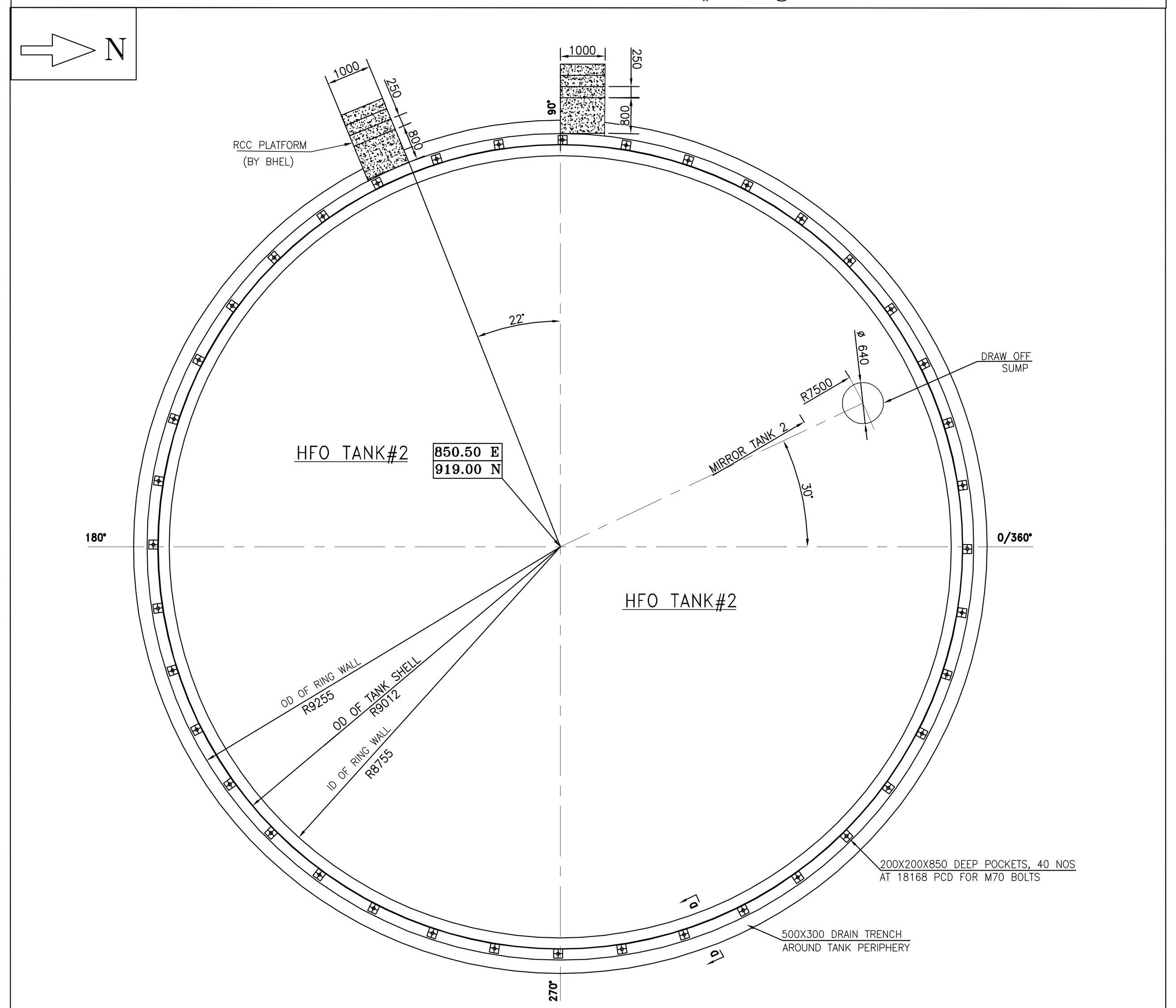
SHELL ARRANGEMENT FOR 1ST TO 08TH COURSE



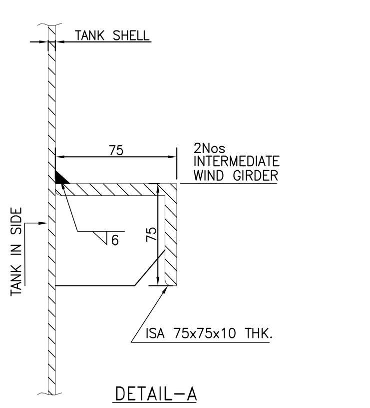
DETAIL OF ANCHOR CHAIR AND ANCHOR BOLT



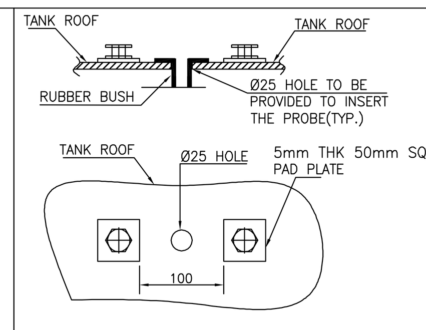
NOZZLE ORIENTATION OF HFO TANK#2



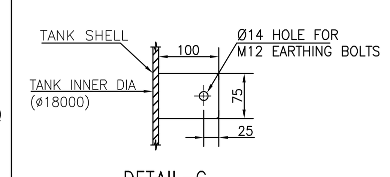
RINGWALL FOUNDATION PLAN FOR HFO TANKS #2



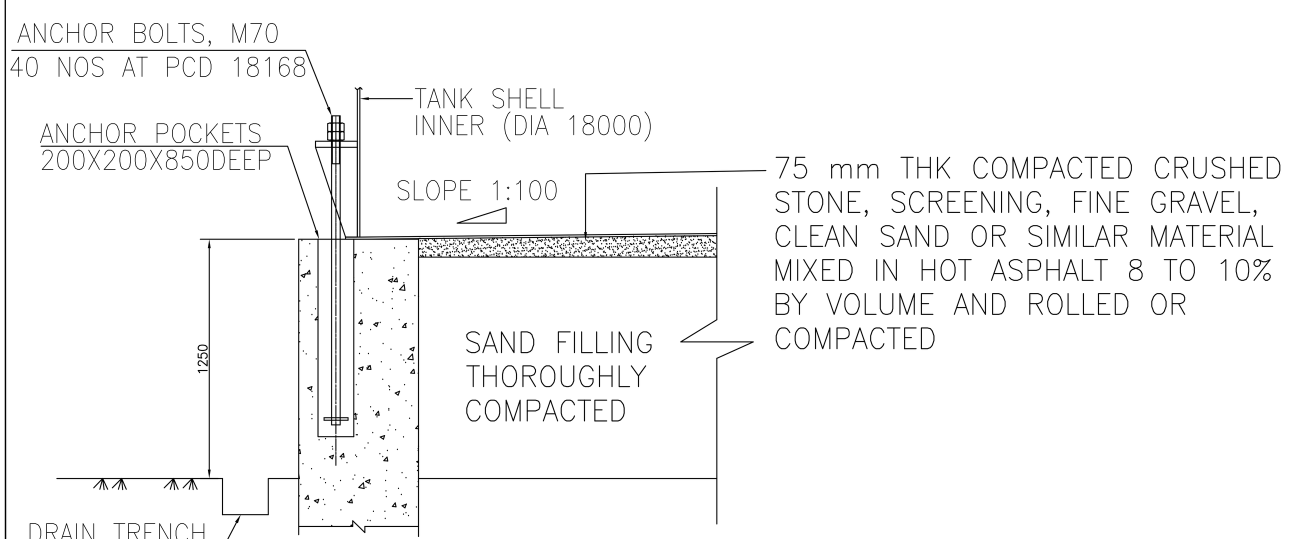
DETAIL-A



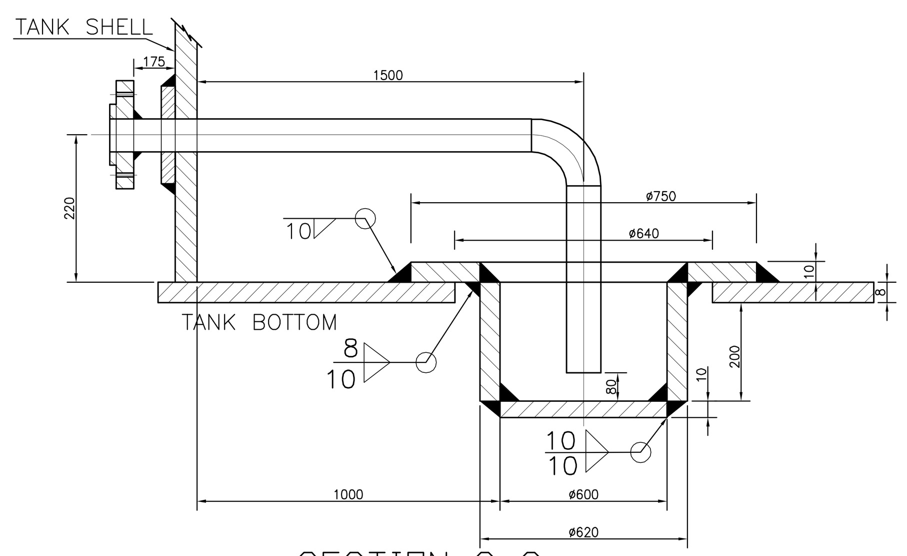
MOUNTING DETAILS OF PROBE TYPE HEAT DETECTOR



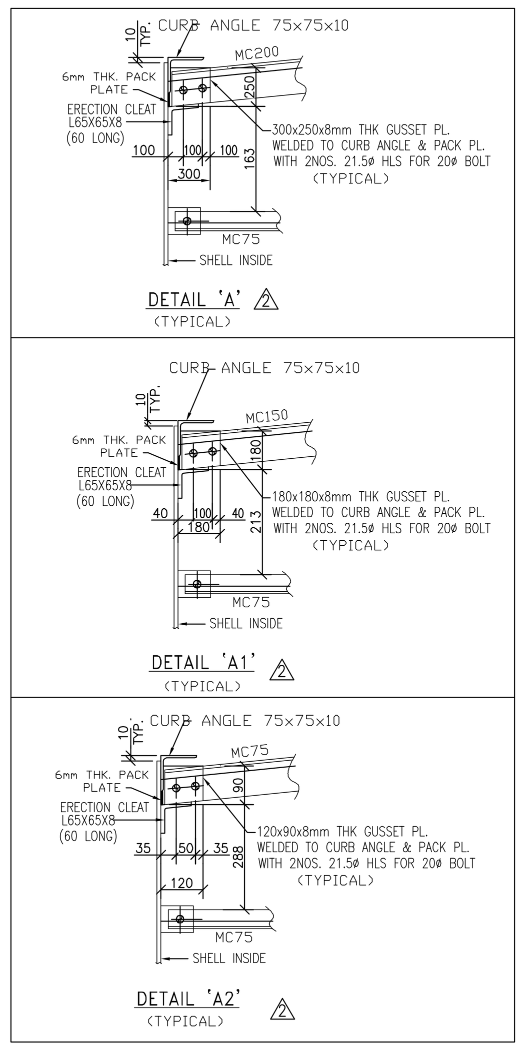
DETAIL-C
EARTHING CLEAT
AS PER FIG 5.23 OF API650



SECTION D-D



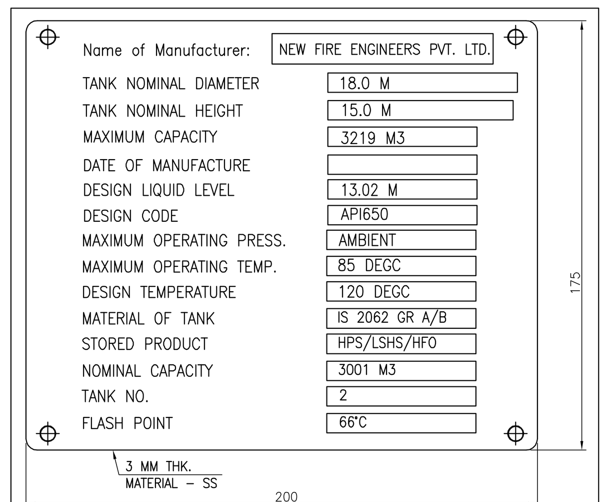
SECTION C-C
TYPICAL DETAIL OF DRAW OFF SUMP AS PER IS:803



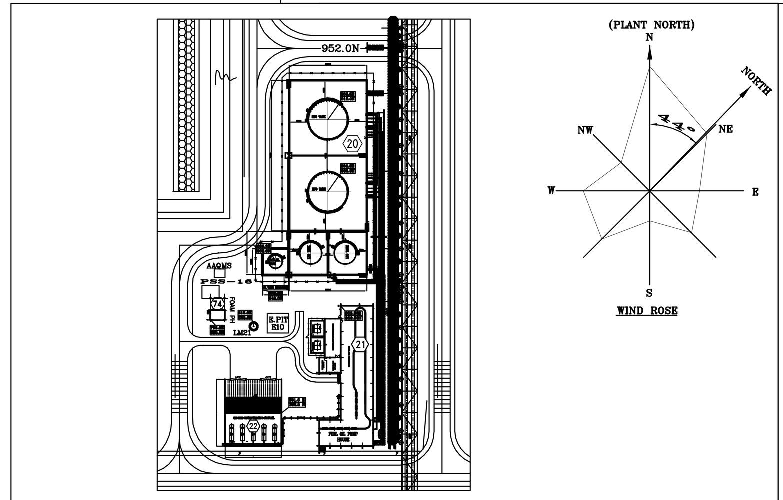
Note: THE REQUIREMENTS SHOWN UNDER GA DRAWING ARE BARE MINIMUM, ANY OTHER ITEM FOUND APPLICABLE DURING DETAILED ENGINEERING AS PER TECHNICAL SPECIFICATION/ FUNCTIONAL REQUIREMENT SHALL BE SUPPLIED BY BIDDER WITHOUT ANY COMMERCIAL IMPLICATION TO BHEL

DESIGN DATA

DESCRIPTION	UNIT	DETAIL
DESIGN CODE	-	API 650/IS:803
STORED PRODUCT	-	HFO
SPECIFIC GRAVITY OF PRODUCT STORED	kg/m3	890 to 950
TYPE OF TANK	-	VERTICAL CYLINDRICAL, FIXED ROOF
NUMBER OF TANKS	no	TWO (2)
DIAMETER OF TANK (ID)	mm	18000
HEIGHT OF TANK	mm	15000
TANK EMPTY WEIGHT	kg	101700
TANK FILLED WEIGHT	kg	3918785 DESIGN
NET WORKING CAPACITY	m3	3001 (AS PER FIG 5.4 OF API650)
MAXIMUM TANK CAPCITY	m3	3327 (AS PER FIG 5.4 OF API650)
BASIC WIND SPEED	m/s	39
DESIGN TEMPERATURE	°C	120
INTERNAL DESIGN PRESSURE	KPa	0.065
OPERATING PRESSURE	-	ATMOSPHERIC
CORROSION ALLOWANCE	mm	2.0
PEAK GROUND ACCELERATION (SP)	-	0.41
SEISMIC MOMENTS	KNM	RING WALL MOMENT - 121822.40, SLAB MOMENT - 182015.36
WIND LOAD & WIND MOMENT	KN & KNM	VERTICAL WIND 241.8/ HORIZONTAL WIND 162.0 KN & 3841
ROOF LOAD (UNIFORM LIVE)	kg/m2	150
TESTING	-	AS PER CL7.3 AND SECTION 8 OF API650
RATE OF FILLING OF TANK (MAX) DESIGN	m3/hr	600
RATE OF EMPTYING OF TANK (MAX) DESIGN	m3/hr	250



NAME PLATE DETAIL



KEY PLAN

SHELL NOZZLES & APPURTENANCES FOR TANK#2

MARK	SIZE NB	QTY. (NO.)	FLANGE TYPE, RATING	NOZZLE CENTRE ELE FROM TOP OF BOTTOM PLATE AS PER TABLE 5.6a OF API650	PROJ. DIST. FROM SHELL PLATE AS PER TABLE 5.6a OF API650	NOZZLE THK IN MM AS PER TABLE 5.6a OF API650	SERVICE
N1	350	1	SORF,150#	14000.0	250	12.70	INLET
N2	500	1	SORF,150#	635.00	250	12.70	OUTLET (SUCTION HEATER)
N3	50	1	SORF,150#	635.00	175	5.54	TANK DRAIN TO DOT
N4	80	1	SORF,150#	250.00	200	10.97	DRAW-OFF SUMP
N5	350	1	SORF,150#	635.00	250	12.7	INTER TANK TRANSFER
N6	250	1	SORF,150#	14000.0	200	12.70	HFO RETURN FROM BOILER
N7	80	1	SORF,150#	14000.0	150	7.62	OIL FROM DOT PUMPS
N8	350	1	SORF,150#	13378.0	250	12.70	OVERFLOW
N11	250	1	SORF,150#	14000.0	250	12.70	SPARE (BLIND FLANGE)
N12	200	1	SORF,150#	14000.0	200	12.70	SPARE INLET (BLIND FLANGE)
N13	200	1	SORF,150#	14000.0	200	12.70	SPARE INLET (BLIND FLANGE)
N14	500	1	SORF,150#	635.0	200	12.70	SPARE OUTLET (WITH VALVE)
N10A/B/C	150	3	SORF,150#	14000.00	200	10.97	FOAM POURER
N11 A/B/C/D	40	4	SORF,150#	475.0	150	5.08	STEAM INLET TO FLOOR COIL HEATER
N12 A/B/C/D	40	4	SORF,150#	475.0	150	5.08	STEAM INLET TO FLOOR COIL HEATER
N13 A/B/C/D	40	4	SORF,150#	475.0	150	5.08	STEAM INLET TO FLOOR COIL HEATER
N14 A/B/C/D	40	4	SORF,150#	255.0	150	5.08	CONDENSATE OUT OF FLOOR COIL HEATER
N15 A/B/C/D	40	4	SORF,150#	255.0	150	5.08	CONDENSATE OUT OF FLOOR COIL HEATER
N16 A/B/C/D	40	4	SORF,150#	255.0	150	5.08	CONDENSATE OUT OF FLOOR COIL HEATER
TE+TT	M33X2 - SOCKET	3	-	600	-	-	TEMPERATURE ELEMENT+TRANSMITER
N9	600	1	AS PER FIG 5.16 OFAPI650	800.0	150	6.0	SHELL MANHOLE WITH BLIND FLANGE
EC	-	2	AS PER DETAIL C	-	-	-	EARTHING CLIT

ROOF NOZZLES & APPURTENANCES FOR TANK#2

MARK	SIZE NB	QTY. (NO.)	FLANGE TYPE, RATING	NOZZLE CENTER DISTANCE FROM ROOF CENTER	PROJ. DIST. FROM SHELL PLATE AS TABLE 5.6a OF API650	NOZZLE THK IN MM AS PER TABLE 5.6a OF API650	SERVICE
R1	250	1	SORF, #150	1000	200	12.7	VENT
R2 a/b/c	25	3	-	4500	-	-	25 DIA HOLES FOR HEAT DETECTION
R3	200	1	SORF, #150	8500	200	12.7	GAUGE WELL FOR GAUGE HATCH
LT	40	2	SORF, #150	7000	175	5.08	LEVEL TRANSMITTERS (ULTRA SONIC)
LI A/B/C	40	3	SORF, #150	8000	150	5.08	LEVEL INDICATOR (FLOAT & ARROW TYPE)
N10	600	1	AS PER FIG 5.16 OFAPI650	8400	150	6.0	ROOF MANHOLE WITH COVER

MATERIAL SPECIFICATION

ITEM	MATERIAL
SHELL, BOTTOM, ROOF, RF PL	IS:2062 GR. B
NOZZLES	API 5L GR. B ERW (PLAIN ENDS FOR PIPE SIZES 50NB & BELOW AND BW ENDS FOR PIPE SIZES ABOVE 50 NB)
MANWAYS NECK	IS:2062 GR. B
NOZZLE FLNAGES	ASTM A105 AS PER ANSI 16.5
HAND RAILING (40ø)	IS:1239 MS (MEDIUM CLASS)
GASKETS	CAF FOR OIL AND METALLIC GASKET FOR STEAM & CONDENSATE
BOLTING (NUTS & BOLTS)	ASTM A194 GR. 2H / ASTM A193 GR. B7/ IS 1363
STRUCTURALS	IS:2062 GR A/B
FITTINGS OF 50 NB & BELOW (SW END)	ASTM A105, SW TO ANSI B16.11
FITTINGS ABOVE 50 NB (BW END)	ASTM A234 GR. WPB, BW TO ANSI B16.9
NAME PLATE AND EARTHING CLIT	SS 304

REFERENCE DRAWINGS

S.N	TITLE	NTPC DRG No	BHEL DRG No.
1.	DESIGNCALCULATION OF TANKS FOR FOHS (HFO, LDO & LDO DAY TANK)	9585-001-130-PVM-U-003	PE-DC-434-166-A003
2.	P&IDs OF FOHS (HFO, LDO, STEAM, CONDENSATE & DAY TANK SYSTEM)	9585-001-130-PVM-L-001	PE-DG-434-166-A001
3.	PLOT PLAN	9585-001-999-POC-F-001	PE-DG-434-100-M001

NOTES:-

1. ALL DIMENSIONS ARE IN MM., ELEVATIONS ARE IN METRE UNLESS OTHER WISE SPECIFIED.
2. ELEVATION (+)0.00M CORRESPONDS TO FINISH FLOOR OF STG BUILDING I.E. RL(+)375.50M. FGL IN TANK FARM AREA IS RL (+)373.0M.
3. TANK SURFACE SHOULD BE CLEANED THOUGHLY AFTER FABRICATION FROM LOOSE SUBSTANCES AND FOREIGN MATERIALS SUCH AS DIRT, RUST, SCALE, OIL, GREASE AND WELDING FLUX ETC.
4. VERTICAL SHELL JOINTS SHALL BE OFFSET FROM EACH OTHER WITH A MINIMUM DISTANCE OF 5 TIMES THE THICKNESS OF SHELL COURSE UNDER CONSIDERATION.
5. BOTTOM PLATE SHALL UNIFORMLY REST ON THE FOUNDATION. THREE PLATE JOINTS IN BOTTOM PLATE SHALL NOT BE CLOSER THAN 300mm FROM EACH OTHER AND ALSO FROM THE TANK SHELL.
6. EARTHING LUG AND NAME PLATE SHALL BE WELDED TO THE TANK AS PER SITE REQUIREMENT.
7. ALL THE INLET PIPING SHALL BE EXTENDED UPTO BOTTOM OF TANK AND CLEARANCE BETWEEN THE BOTTOM OF TANK AND THE THE EDGES OF INLET PIPING SHALL BE 500 MM MAXIMUM.
8. WEIR PLATE SHALL BE PROVIDED AT THE BOTTOM OF ALL THE INLET PIPES INSIDE TANK TO AVOID EROSION OF BOTTOM PLATE.
9. TREAD AND RISE FOR STAIRCASE OF THE TANK SHALL BE 250 AND 200 MM RESPECTIVELY.
10. LEVEL INDICATOR SUPPORTS SHALL BE PROVIDED ON THE SHELL & ROOF.
11. NOZZLE FOR FOAM POURER, HOLES FOR HEAT DETECTOR ON TANK ROOF, PAD PLATES ON TANK FOR SUPPORTING FOAM POURER PIPE AND MVW SPRAY SYSTEM SHALL BE PROVIDED BY VENDOR AS PER FIRE PROTECTION SYSTEM DRAWING.
12. FINAL PAINTING SHALL BE CARRIED OUT AS PER APPROVED PAINTING SCHEDULE AFTER HYDRO TEST OF TANK.
13. TANK NOZZLE FLANGES SHALL BE PROVIDED WITH COUNTER FLANGES ALONG WITH NUTS & BOLTS BY NEW FIRE ENGINEERS PVT. LTD.
14. OPERATING PLATFORMS SHALL BE PROVIDED BY NEW FIRE ENGINEERS PVT. LTD. FOR ALL THE INACCESSIBLE VALVES OF TANK
15. FABRICATION, ERECTION AND TESTING SHALL BE AS PER API650/IS 803.
16. FOR MANUAL WELDING PROCESSES, FILLET WELD LEGS OR GROOVE WELD DEPTHS GREATER THAN 6MM SHALL BE MULTIPASS.
17. ALL TANK SHELL WELD INTERSECTIONS WHERE VERTICAL JOINTS MEET THE HORIZONTAL JOINTS SHALL BE RADIOGRAPHED, REGARDLESS OF THICKNESS.
18. ALL RADIOGRAPHY OR OTHER NDE AND ANY WELDING SHALL BE COMPLETED PRIOR TO HYDROSTATIC TESTING.
19. THE TANK HYDROSTATIC TEST SHALL BE CONDUCTED BEFORE PERMANENT EXTERNAL PIPING IS CONNECTED TO THE TANK EXCEPT FOR PIPING THAT IS NECESSARY TO FILL AND EMPTY THE TANK, WHICH SHOULD HAVE A FLEXIBLE COMPONENT TO ALLOW FOR SETTLEMENT.
20. ALL INLET PIPING INCLUDING SPARE NOZZLES TO THE TANK SHALL BE PROVIDED WITH SUITABLE SIPHON BREAKER. ALL SPARE NOZZLES SHALL BE PROVIDED WITH PIPING UPTO BOTTOM OF TANK.
21. MANHOLE FOR ROOF AND SHELL OF TANK SHALL BE HINGED TYPE.
22. NOZZLE ORIENTATION OF TANK#1 IS MIRROR IMAGE TO Y AXIS OF TANK#2.
23. INSULATION SHALL BE PROVIDED ON COMPLETE SHELL OF THE HFO TANKS.
24. PAINTING SHALL BE AS PER APPROVED DATA SHEET.

REV.	DATE	DESCRIPTION	PREPARED	CHKD	APPD
02	28.02.2020	REVISED AS PER COMMENTS	GAJRAJ	JD	AG
01	06.01.2020	REVISED AS PER COMMENTS	GAJRAJ	JD	AG

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PATRATU VIDYUT UTPADAN NIGAM LIMITED

Project: 3X800MW PVUNL PATRATU TPP PHASE-1 (EPC)

NTPC DWG. NO:- 9585-001-130-PVM-P-035

EPC CONTRACTOR: BHARAT HEAVY ELECTRICALS LIMITED
PROJECTS ENGINEERING MANAGEMENT, NEW DELHI

CONTRACTOR: NEW FIRE ENGINEERS PVT. LTD.

DEPT.	CODE	SCALE	WEIGHT(KG)	REF TO ASSY DRG.	ITEM
MUAX	-	1:175	-	-	-

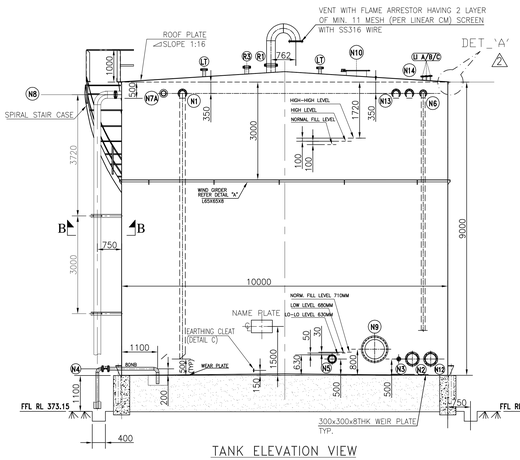
Title:- GA/NOZZLE ORIENTATION OF HFO STORAGE TANK

	NAME	SIGN	DATE
PREP.	GAJRAJ		03.01.2020
CHECKED	JD		03.01.2020
APPD.	AG		03.01.2020

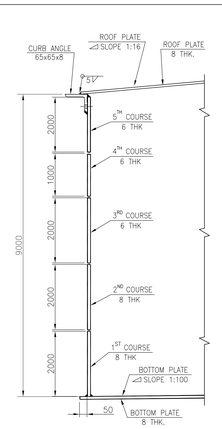
CONTRACTOR DWG No. FOH-1422-SSC-004 | REV: 02 | SHEETS : 1 OF 5 | BHEL DWG. No. PE-V0-434-166-A004

CONTRACTOR JOB NO: FOH-1422 | BHEL JOB NO: 434

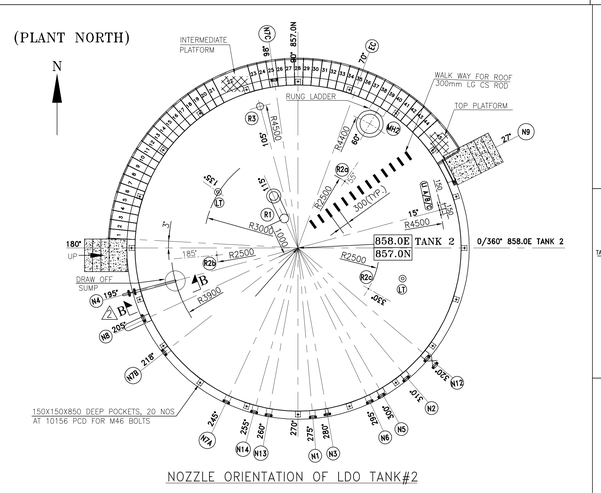
SIZE-A1



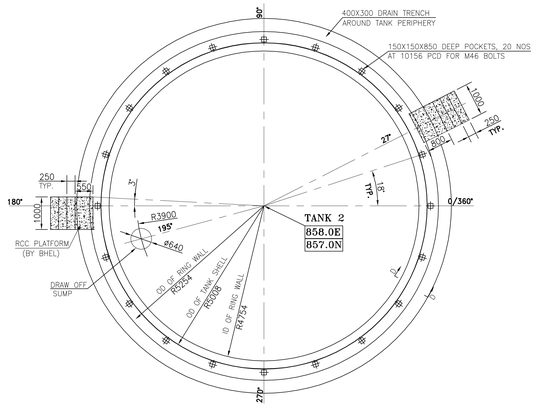
TANK ELEVATION VIEW



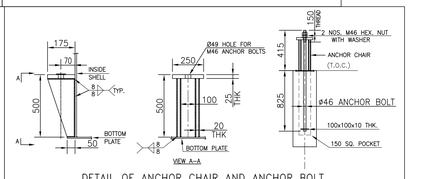
SHELL ARRANGEMENT FOR 1ST TO 05TH COURSE



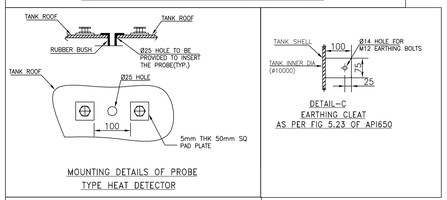
NOZZLE ORIENTATION OF LDO TANK#2



RINGWALL FOUNDATION PLAN FOR LDO TANK # 2

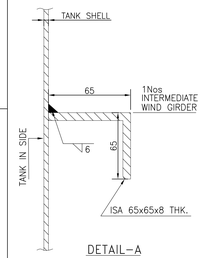


DETAIL OF ANCHOR CHAIR AND ANCHOR BOLT

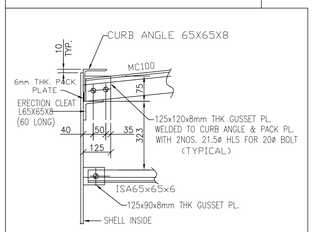


MOUNTING DETAILS OF PROBE TYPE HEAT DETECTOR

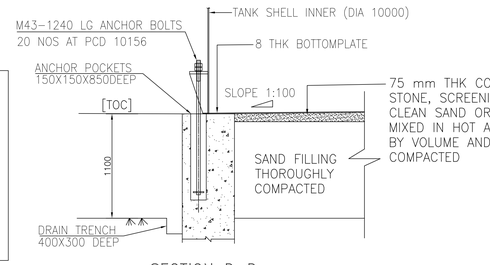
DETAIL–C EARTHING CLEAT AS PER FIG 5.23 OF API650



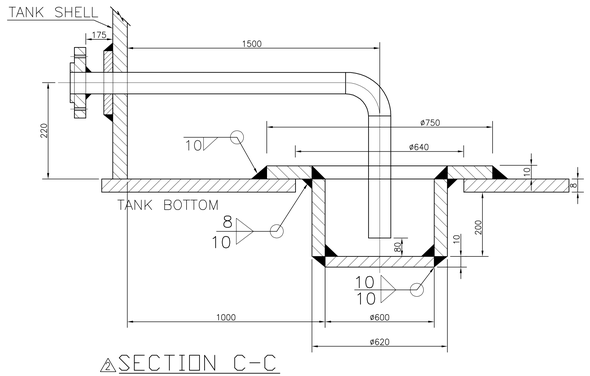
DETAIL–A



DETAIL 'A' TRUSS CONNECTION TO SHELL



SECTION D–D



⚠SECTION C–C TYPICAL DETAIL OF DRAW OFF SUMP AS PER IS:803

SHELL NOZZLES & APPURTENANCES FOR TANK#2							
MARK	SIZE NB	QTY. (NO.)	FLANGE TYPE, RATING	NOZZLE CENTRE ELE FROM TOP OF BOTTOM PLATE AS PER TABLE 5.6a OF API650	PROJ. DIST. FROM SHELL PLATE AS PER TABLE 5.6a OF API650	NOZZLE THK IN MM AS PER TABLE 5.6a OF API650	SERVICE
N1	150	1	SORF,150#	8650	200	10.97	INLET
N2	300	1	SORF,150#	500.00	225	12.70	OUTLET
N3	50	1	SORF,150#	500.00	150	5.54	DRAIN TO DOT
N4	80	1	SORF,150#	200.00	175	7.62	DRAIN–OFF SUMP
N5	200	1	SORF,150#	500.00	200	12.7	INTER TANK TRANSFER LINE
N6	150	1	SORF,150#	8650	200	10.97	LDO RETURN FROM BOILER
N7 A/B/C	100	1	SORF,150#	8650	175	8.56	FOAM POURER
N8	200	1	SORF,150#	8609	200	12.70	OVERFLOW
N9	600	1	AS PER FIG 5.16 OFAPI650	800.0	150	6.0	SHELL MANHOLE WITH BLIND FLANGE
N12	300	1	SORF,150#	500.00	225	12.70	SPARE OUTLET WITH VALVE
N13	100	1	SORF,150#	8650	200	10.97	SPARE INLET (BLIND FLANGE)
N14	100	1	SORF,150#	8650	200	10.97	SPARE INLET (BLIND FLANGE)
EC	–	2	AS PER DETAIL C	–	–	–	EARTHING CUT

ROOF NOZZLES & APPURTENANCES FOR TANK#2							
MARK	SIZE NB	QTY. (NO.)	FLANGE TYPE, RATING	NOZZLE CENTRE DISTANCE FROM ROOF CENTRE	PROJ. DIST. FROM SHELL PLATE AS TABLE 5.6a OF API650	NOZZLE THK IN MM AS PER TABLE 5.6a OF API650	SERVICE
R1	200	1	SORF, #150	1000	200	12.7	VENT
R2 A/B/C	25	3	–	2500	–	–	25 DIA HOLES FOR HEAT DETECTION
R3	200	1	SORF, #150	4500	200	12.7	GAUGE WELL FOR GAUGE HATCH
LT	40	2	SORF, #150	3500	150	5.08	LEVEL TRANSMITTERS (ULTRA SONIC)
LI A/B/C	40	3	SORF, #150	4500	150	5.08	LEVEL INDICATOR
N10	600	1	AS PER FIG 5.16 OFAPI650	4400	150	6.0	ROOF MANHOLE WITH COVER

MATERIAL SPECIFICATION	
ITEM	MATERIAL
SHELL, BOTTOM, ROOF, RF PL	IS:2062 GR. B
NOZZLES	API 5L GR. B ERW (PLAIN ENDS FOR PIPE SIZES 50NB & BELOW AND BW ENDS FOR PIPE SIZES ABOVE 50 NB)
MANWAYS NECK	IS:2062 GR. B
NOZZLE FLANGES	ASTM A105 AS PER ANSI 16.5
HAND RAILING (40NB)	IS:1239 MS (MEDIUM CLASS)
GASKETS	CAF
BOLTING (NUTS & BOLTS)	IS 1363
STRUCTURALS	IS:2062 GR A/B
FITTINGS OF 50 NB & BELOW (SW END)	ASTM A105, SW TO ANSI B16.11
FITTINGS ABOVE 50 NB (BW END)	ASTM A234 GR. WPB, BW TO ANSI B16.9
NAME PLATE AND EARTHING CLIT	SS 304

Name of Manufacturer: NEW FIRE ENGINEERS PVT. LTD.

TANK NOMINAL DIAMETER	10.0 M
TANK NOMINAL HEIGHT	9.0 M
MAXIMUM CAPACITY	555 M3
DATE OF MANUFACTURE	
DESIGN LIQUID LEVEL	7.07 M
DESIGN CODE	API650
MAXIMUM OPERATING PRESS.	AMBIENT
MAXIMUM OPERATING TEMP.	AMBIENT
DESIGN TEMPERATURE	50 DEGC
MATERIAL OF TANK	IS 2062 GR A/B
PRODUCT	LDO
NOMINAL CAPACITY	500 M3
TANK NO	2
FLASH POINT	66°C

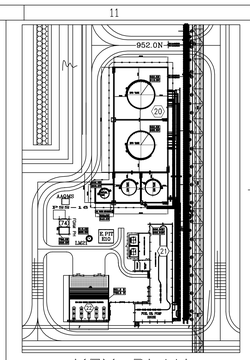
175

3 MM THK. MATERIAL – SS

200

NAME PLATE DETAIL

DESIGN DATA		
DESCRIPTION	UNIT	DETAIL
DESIGN CODE	–	API 650/IS:803
STORED PRODUCT	–	LDO
SPECIFIC GRAVITY OF PRODUCT STORED	kg/m3	820 to 870
TYPE OF TANK	–	VERTICAL CYLINDRICAL, FIXED ROOF
NUMBER OF TANKS	no	TWO (2)
DIAMETER OF TANK (ID)	mm	10000
HEIGHT OF TANK	mm	9000
TANK EMPTY WEIGHT	kg	30793
TANK FILLED WEIGHT	kg	737293
NET WORKING CAPACITY	m3	500 (AS PER FIG 5.4 OF API650)
MAXIMUM TANK CAPCITY	m3	571 (AS PER FIG 5.4 OF API650)
BASIC WIND SPEED/ LOADING	m/s	39/ HORIZONTAL WIND FORCE 54 KN/ VERTICAL WIND FORCE SHALL BE 77.72KN ⚠2
DESIGN TEMPERATURE	°C	50
INTERNAL DESIGN PRESSURE	KPa	18 AS PER API650
OPERATING PRESSURE	–	ATMOSPHERIC
CORROSION ALLOWANCE	mm	2
PEAK GROUND ACCELERATION (SP)/ SEISMIC LOADING	–	0.41/ RING WALL MOMENT MRW – 11897.41KNM/ SLAB MOMENT 6616KNM ⚠2
ROOF LOAD (UNIFORM LIVE)	kg/m2	150
TESTING	–	AS PER CL7.3 AND SECTION 8 OF API650



KEY PLAN

NOTES:–

1. ALL DIMENSIONS ARE IN MM., ELEVATIONS ARE IN METRE UNLESS OTHER WISE SPECIFIED.
2. ELEVATION (+)0.00M CORRESPONDS TO FINISH FLOOR OF STG BUILDING I.E. RL(+)375.50M. FGL IN TANK FARM AREA IS RL (+)373.0M.
3. TANK SURFACE SHOULD BE CLEANED THOUGHLY AFTER FABRICATION FROM LOOSE SUBSTANCES AND FOREIGN MATERIALS SUCH AS DIRT, RUST, SCALE, OIL, GREASE AND WELDING FLUX ETC.
4. VERTICAL SHELL JOINTS SHALL BE OFFSET FROM EACH OTHER WITH A MINIMUM DISTANCE OF 5 TIMES THE THICKNESS OF SHELL COURSE UNDER CONSIDERATION.
5. BOTTOM PLATE SHALL UNIFORMLY REST ON THE FOUNDATION. THREE PLATE JOINTS IN BOTTOM PLATE SHALL NOT BE CLOSER THAN 300mm FROM EACH OTHER AND ALSO FROM THE TANK SHELL.
6. EARTHING LUG AND NAME PLATE SHALL BE WELDED TO THE TANK AS PER SITE REQUIREMENT.
7. ALL THE INLET PIPING SHALL BE EXTENDED UPTO BOTTOM OF TANK AND CLEARANCE BETWEEN THE BOTTOM OF TANK AND THE THE EDGES OF INLET PIPING SHALL BE 500 MM MAXIMUM.
8. WEIR PLATE SHALL BE PROVIDED AT THE BOTTOM OF ALL THE INLET PIPES INSIDE TANK TO AVOID EROSION OF BOTTOM PLATE.
9. TREAD AND RISE FOR STAIRCASE OF THE TANK SHALL BE 250 AND 200 MM RESPECTIVELY.
10. LEVEL INDICATOR SUPPORTS SHALL BE PROVIDED ON THE SHELL & ROOF.
11. NOZZLE FOR FOAM POURER, HOLES FOR HEAT DETECTOR ON TANK ROOF, PAD PLATES ON TANK FOR SUPPORTING FOAM POURER PIPE AND MVW SPRAY SYSTEM SHALL BE PROVIDED BY FO VENDOR AS PER FIRE PROTECTION SYSTEM DRAWING.
12. FINAL PAINTING SHALL BE CARRIED OUT AS PER APPROVED PAINTING SCHEDULE AFTER HYDRO TEST OF TANK.
13. TANK NOZZLE FLANGES SHALL BE PROVIDED WITH COUNTER FLANGES ALONG WITH NUTS & BOLTS BY TANK VENDOR.
14. OPERATING PLATFORMS SHALL BE PROVIDED BY TANK VENDOR FOR ALL THE INACCESSIBLE VALVES AND FOAM POURER OF TANK
15. FABRICATION, ERECTION AND TESTING SHALL BE AS PER API650/IS 803.
16. FOR MANUAL WELDING PROCESSES, FILLET WELD LEGS OR GROOVE WELD DEPTHS GREATER THAN 6MM SHALL BE MULTIPASS.
17. ALL TANK SHELL WELD INTERSECTIONS WHERE VERTICAL JOINTS MEET THE HORIZONTAL JOINTS SHALL BE RADIOGRAPHED, REGARDLESS OF THICKNESS.
18. ALL RADIOGRAPHY OR OTHER NDE AND ANY WELDING SHALL BE COMPLETED PRIOR TO HYDROSTATIC TESTING.
19. THE TANK HYDROSTATIC TEST SHALL BE CONDUCTED BEFORE PERMANENT EXTERNAL PIPING IS CONNECTED TO THE TANK EXCEPT FOR PIPING THAT IS NECESSARY TO FILL AND EMPTY THE TANK, WHICH SHOULD HAVE A FLEXIBLE COMPONENT TO ALLOW FOR SETTLEMENT.
20. ALL INLET PIPING TO THE TANK SHALL BE PROVIDED WITH SUITABLE SIPHON BREAKER.
21. MANHOLE FOR ROOF AND SHELL OF TANK SHALL BE HINGED TYPE.
22. NOZZLE ORIENTATION OF TANK#1 SHALL BE MIRROR IMAGE, PLEASE REFER SHEET 5 OF 5.

REFERENCE DRAWINGS			
S.N	TITLE	NTPC DRG No	BHEL DRG No.
1.	DESIGNCALCULATION OF TANKS FOR FOHS (HFO, LDO & LDO DAY TANK)	9585-001-130-PVM-U-003	PE-DC-434-166-A003
2.	P&IDs OF FOHS (HFO, LDO, STEAM, CONDENSATE & DAY TANK SYSTEM)	9585-001-130-PVM-L-001	PE-DG-434-166-A001
3.	PLOT PLAN	9585-001-999-PDC-F-001	PE-DG-434-100-M001

Note: THE REQUIREMENTS SHOWN UNDER GA DRAWING ARE BARE MINIMUM, ANY OTHER ITEM FOUND APPLICABLE DURING DETAILED ENGINEERING AS PER TECHNICAL SPECIFICATION/ FUNCTIONAL REQUIREMENT SHALL BE SUPPLIED BY BIDDER WITHOUT ANY COMMERCIAL IMPLICATION TO BHEL

REV.	DATE	DESCRIPTION	PREPARED	CHKD	APPD
02	28.02.2020	REVISED AS PER COMMENTS	GAJRAJ	JD	AG
01	06.01.2020	REVISED AS PER COMMENTS	GAJRAJ	JD	AG

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PATRATU VIDYUT UTPADAN NIGAM LIMITED

Project:

3X800MW PVUNL PATRATU TPP PHASE-1 (EPC)

NTPC DWG. NO: –

9585–001–130–PVM–B–004

EPC CONTRACTOR: BHARAT HEAVY ELECTRICALS LIMITED
PROJECTS ENGINEERING MANAGEMENT, NEW DELHI

CONTRACTOR: NEW FIRE ENGINEERS PVT. LTD.

DEPT.	CODE	SCALE	WEIGHT(KG)	REF TO ASSY DRG.	ITEM
MUAX	–	1:175	–	–	–

Title: –

GA/NOZZLE ORIENTATION OF LDO STORAGE TANK

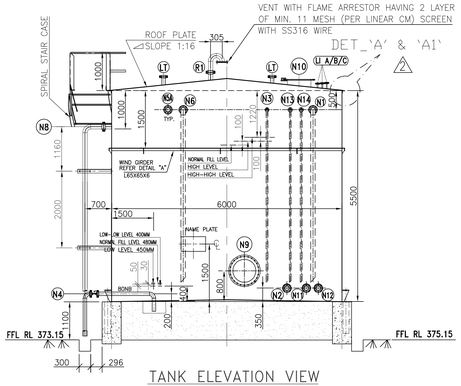
	NAME	SIGN	DATE
PREP.	GAJRAJ		26.12.2019
CHECKED	JD		26.12.2019
APPD.	AG		26.12.2019

CONTRACTOR DWG No. FOH–1422–SSC–004 REV: 02 SHEETS : 2 OF 5

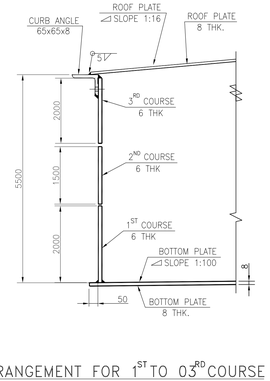
BHEL DWG. No. PE–V0–434–166–A004

CONTRACTOR JOB NO: FOH–1422 BHEL JOB NO: 434

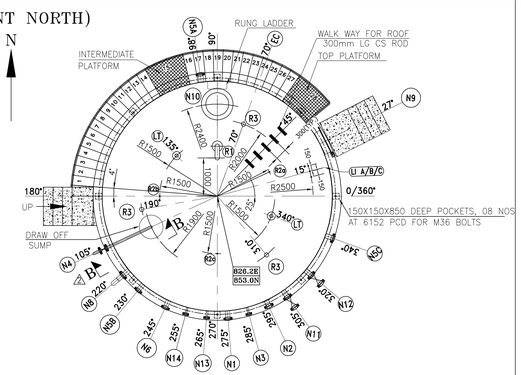
SIZE–A0



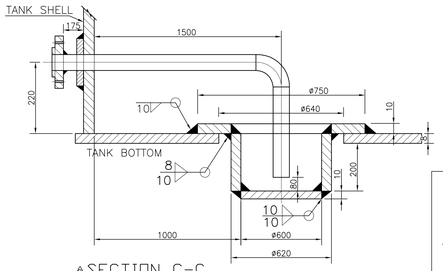
TANK ELEVATION VIEW



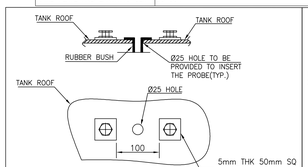
SHELL ARRANGEMENT FOR 1ST TO 03RD COURSE



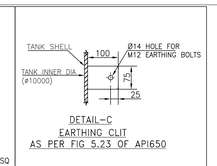
NOZZLE ORIENTATION OF LDO DAY TANK



⚠SECTION C-C
TYPICAL DETAIL OF DRAW OFF SUMP AS PER IS:803



MOUNTING DETAILS OF PROBE TYPE HEAT DETECTOR



DETAIL-C
EARTHING CLIT
AS PER FIG 5.23 OF API650

SHELL NOZZLES & APPURTENANCES

MARK	SIZE NB	QTY. (NO.)	FLANGE TYPE, RATING	NOZZLE CENTRE ELE FROM TOP OF BOTTOM PLATE AS PER TABLE 5.6a OF API650	PROJ. DIST. FROM SHELL PLATE AS PER TABLE 5.6a OF API650	NOZZLE THK IN MM AS PER TABLE 5.6a OF API650	SERVICE
N1	100	1	SORF,150#	5000	175	8.56	INLET
N2	100	1	SORF,150#	350	175	8.56	OUTLET
N3	40	1	SORF,150#	5000	150	5.08	LDO RETURN FROM BOILER
N4	80	1	SORF,150#	200	175	7.62	DRAW OF SUMP
N5 A/B/C	100	1	SORF,150#	5000.0	175	8.56	FOAM POURER
N6	100	1	SORF,150#	5000	175	8.56	SPARE INLET (BLIND FLANGE)
N8	200	1	SORF,150#	4557	175	8.56	OVERFLOW
N9	600	1	AS PER FIG 5.16 OFAPI650	800.0	150	6.0	SHELL MANHOLE WITH BLIND FLANGE
N11/12	100	1	SORF,150#	350	175	8.56	SPARE OUTLET WITH VALVE
N13/14	40	1	SORF,150#	5000	150	5.08	SPARE INLET (BLIND FLANGE)
EC	–	2	AS PER DETAIL C	–	–	–	EARTHING CLIT

ROOF NOZZLES & APPURTENANCES

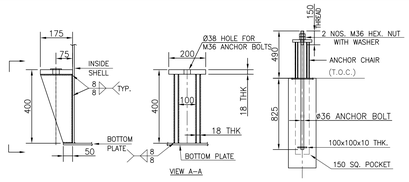
MARK	SIZE NB	QTY. (NO.)	FLANGE TYPE, RATING	NOZZLE CENTRE DISTANCE FROM ROOF CENTRE	PROJ. DIST. FROM SHELL PLATE AS TABLE 5.6a OF API650	NOZZLE THK IN MM AS PER TABLE 5.6a OF API650	SERVICE
R1	100	1	SORF, #150	1000	175	8.56	VENT
R2 a/b/c	25	3	–	1500	–	–	25 DIA HOLES FOR HEAT DETECTION
R3	100	1	SORF, #150	2000	175	8.56	GAUGE WELL FOR GAUGE HATCH
LT	40	2	SORF, #150	1500	150	5.08	LEVEL TRANSMITTERS (ULTRA SONIC)
LI A/B/C	40	3	SORF, #150	2500	150	5.08	LEVEL INDICATOR
N10	600	1	AS PER FIG 5.16 OFAPI650	2400	150	6	ROOF MANHOLE WITH COVER

MATERIAL SPECIFICATION

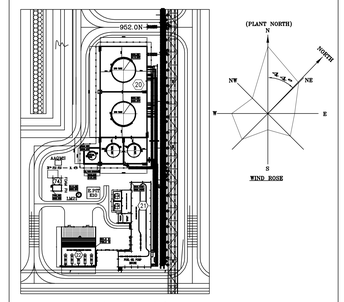
ITEM	MATERIAL
SHELL, BOTTOM, ROOF, RF PL	IS:2062 GR. B
NOZZLES	API 5L GR. B ERW (PLAIN ENDS FOR PIPE SIZES 50NB & BELOW AND BW ENDS FOR PIPE SIZES ABOVE 50 NB)
MANWAYS NECK	IS:2062 GR. B
NOZZLE FLNAGES	ASTM A105 AS PER ANSI 16.5
HAND RAILING (40 MM OD)	IS:1239 MS (MEDIUM CLASS)
GASKETS	CAF
BOLTING (NUTS & BOLTS)	ASTM A194 GR. 2H / ASTM A193 GR. B7/ IS 1363
STRUCTURALS	IS:2062 GR A/B
FITTINGS OF 50 NB & BELOW (SW END)	ASTM A105, SW TO ANSI B16.11
FITTINGS ABOVE 50 NB (BW END)	ASTM A234 GR. WPB, BW TO ANSI B16.9
NAME PLATE AND EARTHING CLIT	SS 304

DESIGN DATA

DESCRIPTION	UNIT	DETAIL
DESIGN CODE	–	API 650/IS:803
STORED PRODUCT	–	LDO
SPECIFIC GRAVITY OF PRODUCT STORED	kg/m3	820 to 870
TYPE OF TANK	–	VERTICAL CYLINDRICAL, FIXED ROOF
NUMBER OF TANKS	no	ONE (1)
DIAMETER OF TANK (ID)	mm	6000
HEIGHT OF TANK	mm	5500
TANK EMPTY WEIGHT	kg	10365
TANK FILLED WEIGHT	kg	166000
NET WORKING CAPACITY	m3	102 (AS PER FIG 5.4 OF API650)
MAXIMUM TANK CAPCITY	m3	121 (AS PER FIG 5.4 OF API650)
BASIC WIND SPEED	m/s	39/ 19.8KN DUE TO HORIZONTAL WIND FORCE/ VERTICAL WIND FORCE 27.98KN
DESIGN TEMPERATURE	°C	50
INTERNAL DESIGN PRESSURE	KPa	0.65
OPERATING PRESSURE	–	ATMOSPHERIC
CORROSION ALLOWANCE	mm	2.0
PEAK GROUND ACCELERATION (SP)/ SEISMIC LOADS	–	0.41/ RING WALL MOMENT (MRW) - 1601.25KNM & SLAB MOMENT MS - 2342.45 KNM.
ROOF LOAD (UNIFORM LIVE)	kg/m2	150
TESTING	–	AS PER CL7.3 AND SECTION 8 OF API650



DETAIL OF ANCHOR CHAIR AND ANCHOR BOLT



Name of Manufacturer:	NEW FIRE ENGINEERS PVT. LTD.
TANK NOMINAL DIAMETER	6.0 M
TANK NOMINAL HEIGHT	5.5
MAXIMUM CAPACITY	119 M3
DATE OF MANUFACTURE	
DESIGN LIQUID LEVEL	4.28 M
DESIGN CODE	API650
MAXIMUM OPERATING PRESS.	AMBIENT
MAXIMUM OPERATING TEMP.	AMBIENT
DESIGN TEMPERATURE	50 DEGC
MATERIAL OF TANK	IS 2062 GR A/B
PRODUCT	LDO
NOMINAL CAPACITY	100 M3
TANK NO	1
FLASH POINT	66°C

3 MM THK. MATERIAL – SS

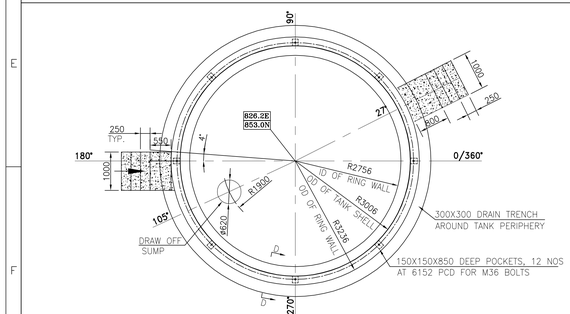
150

200

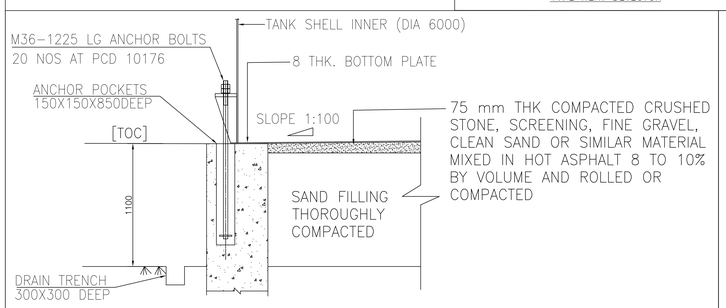
NAME PLATE DETAIL

REFERENCE DRAWINGS

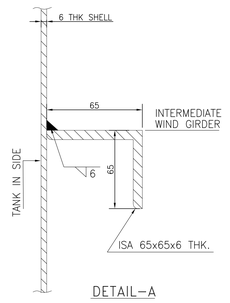
S.N	TITLE	NTPC DRG No	BHEL DRG No.
1.	DESIGN CALCULATION OF TANKS FOR FOHS (HFO, LDO & LDO DAY TANK)	9585-001-130-PVM-U-003	PE-DC-434-166-A003
2.	P&IDs OF FOHS (HFO, LDO, STEAM, CONDENSATE & DAY TANK SYSTEM)	9585-001-130-PVM-L-001	PE-DG-434-166-A001
3.	PLOT PLAN	9585-001-999-POC-F-001	PE-DG-434-100-M001



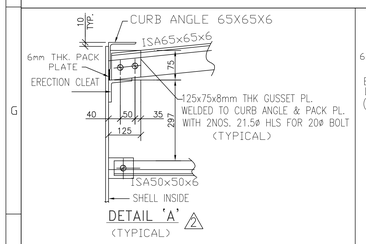
RINGWALL FOUNDATION PLAN FOR LDO DAY TANK



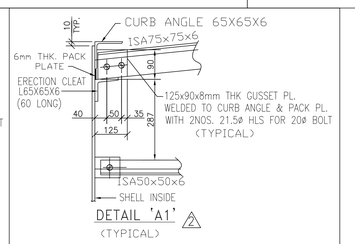
SECTION D-D



DETAIL-A



DETAIL 'A' (TYPICAL) ⚠2



DETAIL 'A1' (TYPICAL) ⚠2

Note: THE REQUIREMENTS SHOWN UNDER GA DRAWING ARE BARE MINIMUM, ANY OTHER ITEM FOUND APPLICABLE DURING DETAILED ENGINEERING AS PER TECHNICAL SPECIFICATION/ FUNCTIONAL REQUIREMENT SHALL BE SUPPLIED BY BIDDER WITHOUT ANY COMMERCIAL IMPLICATION TO BHEL

NOTES:-

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3. TANK SURFACE SHOULD BE CLEANED THOUGHLY AFTER FABRICATION FROM LOOSE SUBSTANCES AND FOREIGN MATERIALS SUCH AS DIRT, RUST, SCALE, OIL, GREASE AND WELDING FLUX ETC.
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5. BOTTOM PLATE SHALL UNIFORMLY REST ON THE FOUNDATION. THREE PLATE JOINTS IN BOTTOM PLATE SHALL NOT BE CLOSER THAN 300mm FROM EACH OTHER AND ALSO FROM THE TANK SHELL.
6. EARTHING LUG AND NAME PLATE SHALL BE WELDED TO THE TANK AS PER SITE REQUIREMENT.
7. ALL THE INLET PIPING SHALL BE EXTENDED UPTO BOTTOM OF TANK AND CLEARANCE BETWEEN THE BOTTOM OF TANK AND THE THE EDGES OF INLET PIPING SHALL BE 500 MM MAXIMUM.
8. WEIR PLATE SHALL BE PROVIDED AT THE BOTTOM OF ALL THE INLET PIPES INSIDE TANK TO AVOID EROSION OF BOTTOM PLATE.
9. TREAD AND RISE FOR STAIRCASE OF THE TANK SHALL BE 250 AND 200 MM RESPECTIVELY.
10. LEVEL INDICATOR SUPPORTS SHALL BE PROVIDED ON THE SHELL & ROOF.
11. NOZZLE FOR FOAM POURER, HOLES FOR HEAT DETECTOR ON TANK ROOF, PAD PLATES ON TANK FOR SUPPORTING FOAM POURER PIPE AND MW SPRAY SYSTEM SHALL BE PROVIDED BY FO VENDOR AS PER FIRE PROTECTION SYSTEM DRAWING.
12. FINAL PAINTING SHALL BE CARRIED OUT AS PER APPROVED PAINTING SCHEDULE AFTER HYDRO TEST OF TANK.
13. TANK NOZZLE FLANGES SHALL BE PROVIDED WITH COUNTER FLANGES ALONG WITH NUTS & BOLTS BY TANK VENDOR.
14. OPERATING PLATFORMS SHALL BE PROVIDED BY TANK VENDOR FOR ALL THE INACCESSIBLE VALVES POURER OF TANK
15. FABRICATION, ERECTION AND TESTING SHALL BE AS PER API 650/IS 803.
16. FOR MANUAL WELDING PROCESSES, FILLET WELD LEGS OR GROOVE WELD DEPTHS GREATER THAN 6MM SHALL BE MULTIPASS.
17. ALL TANK SHELL WELD INTERSECTIONS WHERE VERTICAL JOINTS MEET THE HORIZONTAL JOINTS SHALL BE RADIOGRAPHED, REGARDLESS OF THICKNESS.
18. ALL RADIOGRAPHY OR OTHER NDE AND ANY WELDING SHALL BE COMPLETED PRIOR TO HYDROSTATIC TESTING.
19. THE TANK HYDROSTATIC TEST SHALL BE CONDUCTED BEFORE PERMANENT EXTERNAL PIPING IS CONNECTED TO THE TANK EXCEPT FOR PIPING THAT IS NECESSARY TO FILL AND EMPTY THE TANK, WHICH SHOULD HAVE A FLEXIBLE COMPONENT TO ALLOW FOR SETTLEMENT.
20. ALL INLET PIPING TO THE TANK SHALL BE PROVIDED WITH SUITABLE SIPHON BREAKER NIPPLE TO PREVENT RETURN FLOW.
21. MANHOLE FOR ROOF AND SHELL OF TANK SHALL BE HINGED TYPE.

REV.	DATE	DESCRIPTION	PREPARED	CHKD	APPD
02	28.02.2020	REVISED AS PER COMMENTS	GAJRAJ	JD	AG
01	06.01.2020	REVISED AS PER COMMENTS	GAJRAJ	JD	AG

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PATRATU VIDYUT UTPADAN NIGAM LIMITED

Project:
3X800MW PVUNL PATRATU TPP PHASE-1 (EPC)

NTPC DWG. NO:-
9585-001-130-PVM-B-004

EPC CONTRACTOR:
BHARAT HEAVY ELECTRICALS LIMITED
PROJECTS ENGINEERING MANAGEMENT, NEW DELHI

CONTRACTOR:
NEW FIRE ENGINEERS PVT. LTD.

DEPT.	CODE	SCALE	WEIGHT(KG)	REF TO ASSY DRG.	ITEM
MUAX	–	1:175	–	–	–

Title:-
GA/NOZZLE ORIENTATION OF LDO DAY OIL TANK

	NAME	SIGN	DATE
PREP.	GAJRAJ		26.12.2019
CHECKED	JD		26.12.2019
APPD.	AG		26.12.2019

CONTRACTOR DWG No.: FOH-1422-SSC-004
REV: 02
SHEETS : 3 OF 5
BHEL DWG. No.: PE-V0-434-166-A004
CONTRACTOR JOB NO: FOH-1422
BHEL JOB NO: 434
SIZE-A1

COMPUTER FILE NAME: PE-V0-434-166-A008

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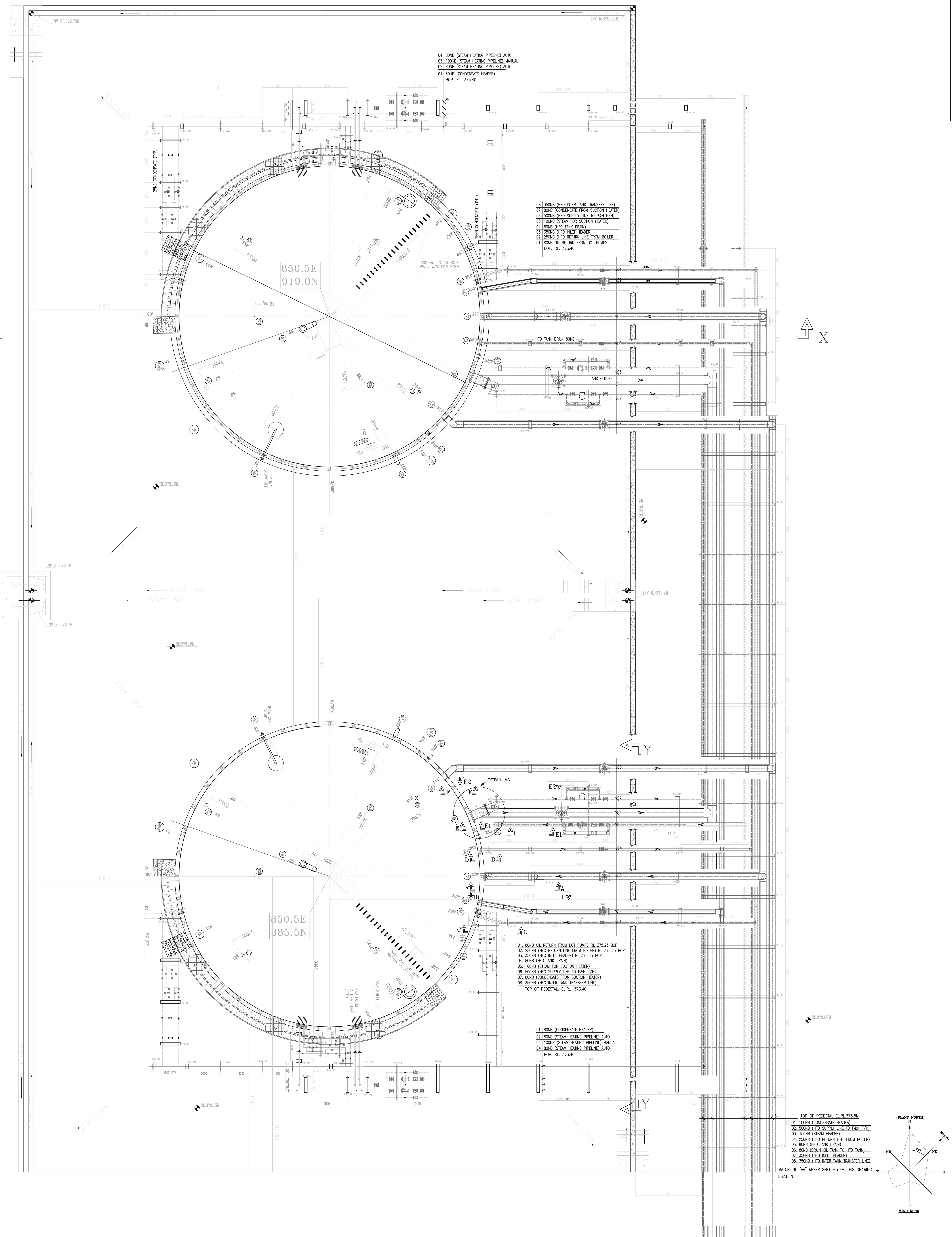
it must not be used directly or indirectly in any way deterimental to the interest of the company.

DRAWING No. PE-V0-434-166-A008

FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN MM



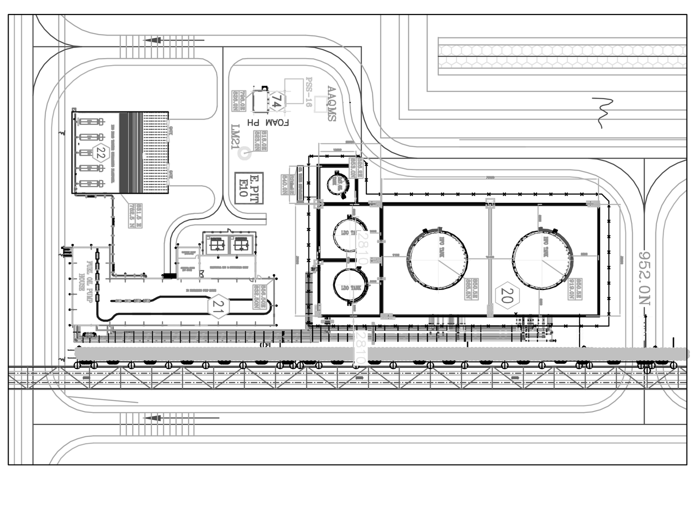
NOTES:-

1. ALL DIMENSIONS ARE IN MM., ELEVATIONS ARE IN METRE UNLESS OTHER WISE SPECIFIED.
2. ALL ELEVATIONS ARE REFERRED TO THE FINISHED FLOOR LEVEL OF POWER HOUSE BUILDING AS EL.(+/-)0.0M WHICH CORRESPONDS TO RL.(+)375.50M. FGL IN FOPH AREA IS RL.(+)373.00M AS EL.(-)2.50M.
3. FINISHED GRADE LEVEL (FGL) FOR FUEL OIL STORAGE TANK FARM AREA SHALL BE RL.(+)373.10M AS EL.(-)2.40M.
4. ALL GUIDES ANCHOR BRACES, DAMPERS, EXPANSION JOINT AND STRUCTURAL STEEL TO BE ATTACHED TO THE BUILDING/STRUCTURE/TRENCHES ETC. SHALL BE PROVIDED BY BHEL.
5. PEDESTAL/FOUNDATION/INSERT PLATE SHALL BE PROVIDE BY BHEL.
6. PIPE CENTER LINE ELEVATION / BOP ELEVATION FOR PUMPS/ STRAINERS SUCTION/DISCHARGE LINES ELEVATION MAY REQUIRED TO BE REVISED LATER AS PER APPROVED EQUIPMENT GA DRAWINGS.

REF. DRAWINGS

01. Composite Layout of Fuel Oil Area-(NTPC DRG. NO.-9585-001-130-PVM-P-035) (BHEL DRG. NO. PE-V0-434-166-A006)
02. Civil Input Drawing in Tank Farm Area for FOHS-(BHEL DRG. NO. PE-V0-434-166-A072)
03. GA/Nozzle Orientation of HFO, LDO & DOT Storage Tank-(NTPC DRG. NO.-9585-001-130-PVM-B-004) (BHEL DRG. NO. PE-DG-434-166-A004)
04. HFO & LDO TANK GA & RC DETAILS OF FOUNDATION-(NTPC DRG. NO.-9585-001-315-PVC-C-1267) (BHEL DRG. NO. PE-DG-434-134-C007)
05. PROCESS & INSTRUMENTATION DIAGRAM FOR HFO SYSTEM-(NTPC DRG. NO.-9585-001-130-PVM-L-001) (BHEL DRG. NO. PE-DG-434-166-A001)

KEY PLAN



REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED
00	22.11.19	SUBMISSION FOR APPROVAL	UN	DK	RGS

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PATRATU VIDYUT UTPADAN NIGAM LIMITED

Project:
3X800MW PVUNL PATRATU TPP PHASE-1 (EPC)

NTPC DWG. NO:- 9585-001-130-PVM-B-001

EPC CONTRACTOR: BHARAT HEAVY ELECTRICALS LIMITED
PROJECTS ENGINEERING MANAGEMENT, NEW DELHI

CONTRACTOR: NEW FIRE ENGINEERS PVT. LTD.

DEPT.	CODE			SCALE	WEIGHT(KG)	REF TO ASSY DRG.	ITEM
MUAX	-			1:125	-	-	-

Title:- Piping Layout in & Around Storage Tank Farm Area

	NAME	SIGN	DATE
PREP.	UN		28.02.20
CHECKED	DK		28.02.20
APPD.	RGS		28.02.20

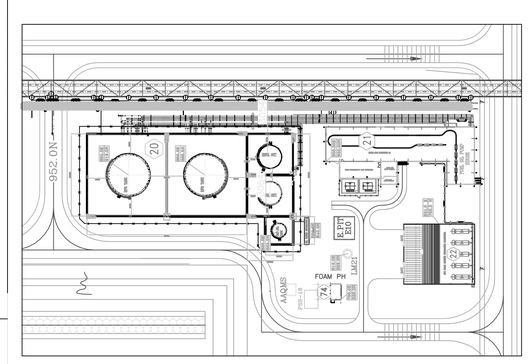
CONTRACTOR DWG No. FOH-1422- SSC-004
REV. : 01
SHEETS : 1 OF 4
BHEL DWG. No. PE-DG-434-166-A004
CONTRACTOR JOB NO: FOH-1422
BHEL JOB NO: 434

SIZE-A0

CUSTOMER'S DRAWING No. PE-V0-434-166-A008

CUSTOMER'S DRAWING No.

PE-V0-434-166-A008



KEY PLAN

NOTES:-

1. ALL DIMENSIONS ARE IN MM., ELEVATIONS ARE IN METRE UNLESS OTHER WISE SPECIFIED.
2. ALL ELEVATIONS ARE REFERRED TO THE FINISHED FLOOR LEVEL OF POWER HOUSE BUILDING AS EL(+/-)0.0M WHICH CORRESPONDS TO RL(+)375.50M. FGL IN FOPH AREA IS RL(+)373.00M AS EL(-)2.50M.
3. FINISHED GRADE LEVEL (FGL) FOR FUEL OIL STORAGE TANK FARM AREA SHALL BE RL(+)373.10M AS EL(-)2.40M.
4. ALL GUIDES ANCHOR BRACES, DAMPERS, EXPANSION JOINT AND STRUCTURAL STEEL TO BE ATTACHED TO THE BUILDING/STRUCTURE/TRENCHES ETC. SHALL BE PROVIDED BY BHEL.
5. PEDESTAL/FOUNDATION/INSERT PLATE SHALL BE PROVIDE BY BHEL.
6. PIPE CENTER LINE ELEVATION / BOP ELEVATION FOR PUMPS/ STRAINERS SUCTION/DISCHARGE LINES ELEVATION MAY REQUIRED TO BE REVISED LATER AS PER APPROVED EQUIPMENT GA DRAWINGS.

REF. DRAWINGS

01. Composite Layout of Fuel Oil Area-(NTPC DRG. NO.-9585-001-130-PVM-P-035) (BHEL DRG. NO. PE-V0-434-166-A006)
02. Civil Input Drawing in Tank Farm Area for FOHS-(BHEL DRG. NO. PE-V0-434-166-A072)
03. GA/Nozzle Orientation of HFO, LDO & DOT Storage Tank-(NTPC DRG. NO.-9585-001-130-PVM-B-004) (BHEL DRG. NO. PE-DG-434-166-A004)
04. HFO & LDO TANK GA & RC DETAILS OF FOUNDATION-(NTPC DRG. NO.-9585-001-315-PVC-C-1267) (BHEL DRG. NO. PE-DG-434-134-C007)
05. PROCESS & INSTRUMENTATION DIAGRAM FOR HFO SYSTEM-(NTPC DRG. NO.-9585-001-130-PVM-I-001) (BHEL DRG. NO. PE-DG-434-166-A001)

REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED
00	22.11.19	SUBMISSION FOR APPROVAL	UN	DK	RGS

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Project:

PATRATU VIDYUT UTPADAN NIGAM LIMITED

3X800MW PVUNL PATRATU TPP PHASE-1 (EPC)

NTPC DWG. NO:-

9585-001-130-PVM-B-001

EPC CONTRACTOR: BHARAT HEAVY ELECTRICALS LIMITED
PROJECTS ENGINEERING MANAGEMENT, NEW DELHI

CONTRACTOR: NEW FIRE ENGINEERS PVT. LTD.

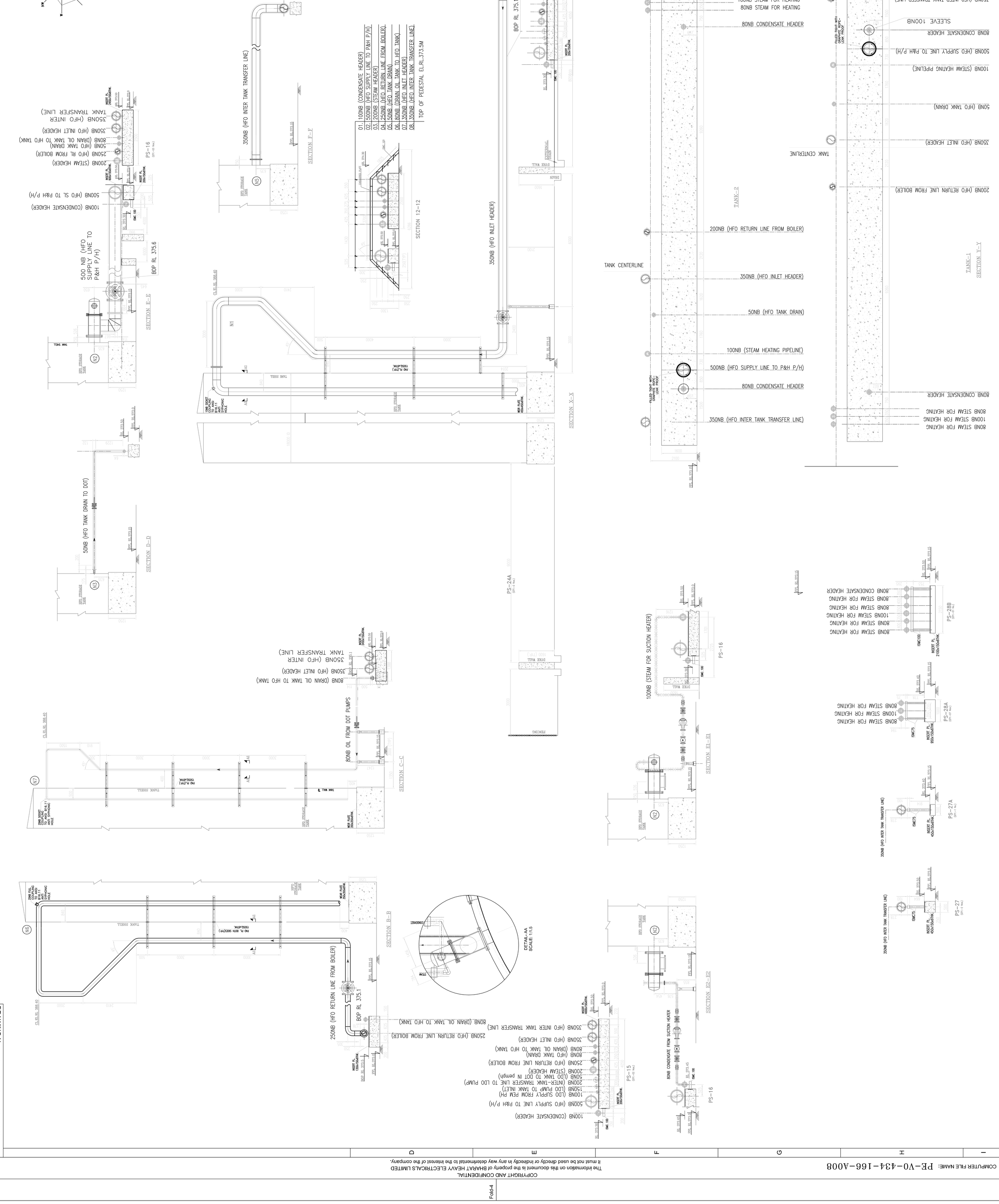
DEPT.	CODE	SCALE	WEIGHT(KG)	REF TO ASSY DRG.	ITEM
MUAX	-	1:125	-	-	-

Title:-
Piping Layout in & Around Storage Tank Farm Area

	NAME	SIGN	DATE
PREP.	UN		28.02.20
CHECKED	DK		28.02.20
APPD.	RGS		28.02.20

CONTRACTOR DWG No.: FOH-1422- SSC-004 | REV. : 01 | SHEETS : 2 OF 4 | BHEL DWG. No.: PE-DG-434-166-A004

CONTRACTOR JOB NO.: FOH-1422 | BHEL JOB NO.: 434 | SIZE-A0



DRAWING No. PE-V0-434-166-A008

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COMPUTER FILE NAME: PE-V0-434-166-A008

Fold-4

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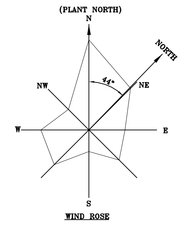
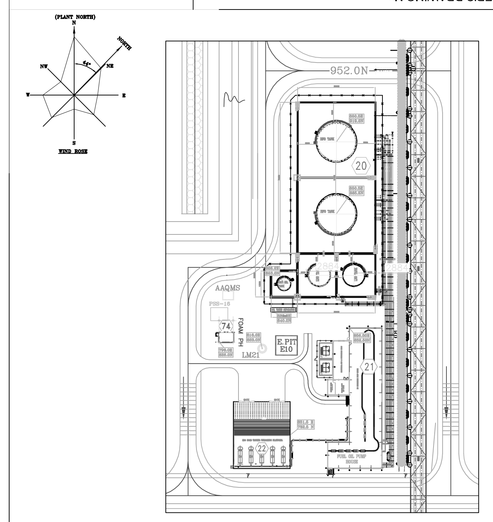
COMPUTER FILE NAME: PE-V0-434-166-A008





KEY PLAN

NOTES:--

1. ALL DIMENSIONS ARE IN MM., ELEVATIONS ARE IN METRE UNLESS OTHER WISE SPECIFIED.
2. ALL ELEVATIONS ARE REFERRED TO THE FINISHED FLOOR LEVEL OF POWER HOUSE BUILDING AS EL.(+/-)0.0M WHICH CORRESPONDS TO RL.(+)375.50M. FGL IN FOPH AREA IS RL.(+)373.00M AS EL.(-)2.50M.
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03. GA/Nozzle Orientation of HFO, LDO & DOT Storage Tank-(NTPC DRG. NO.-9585-001-130-PVM-B-004) (BHEL DRG. NO. PE-DG-434-166-A004)
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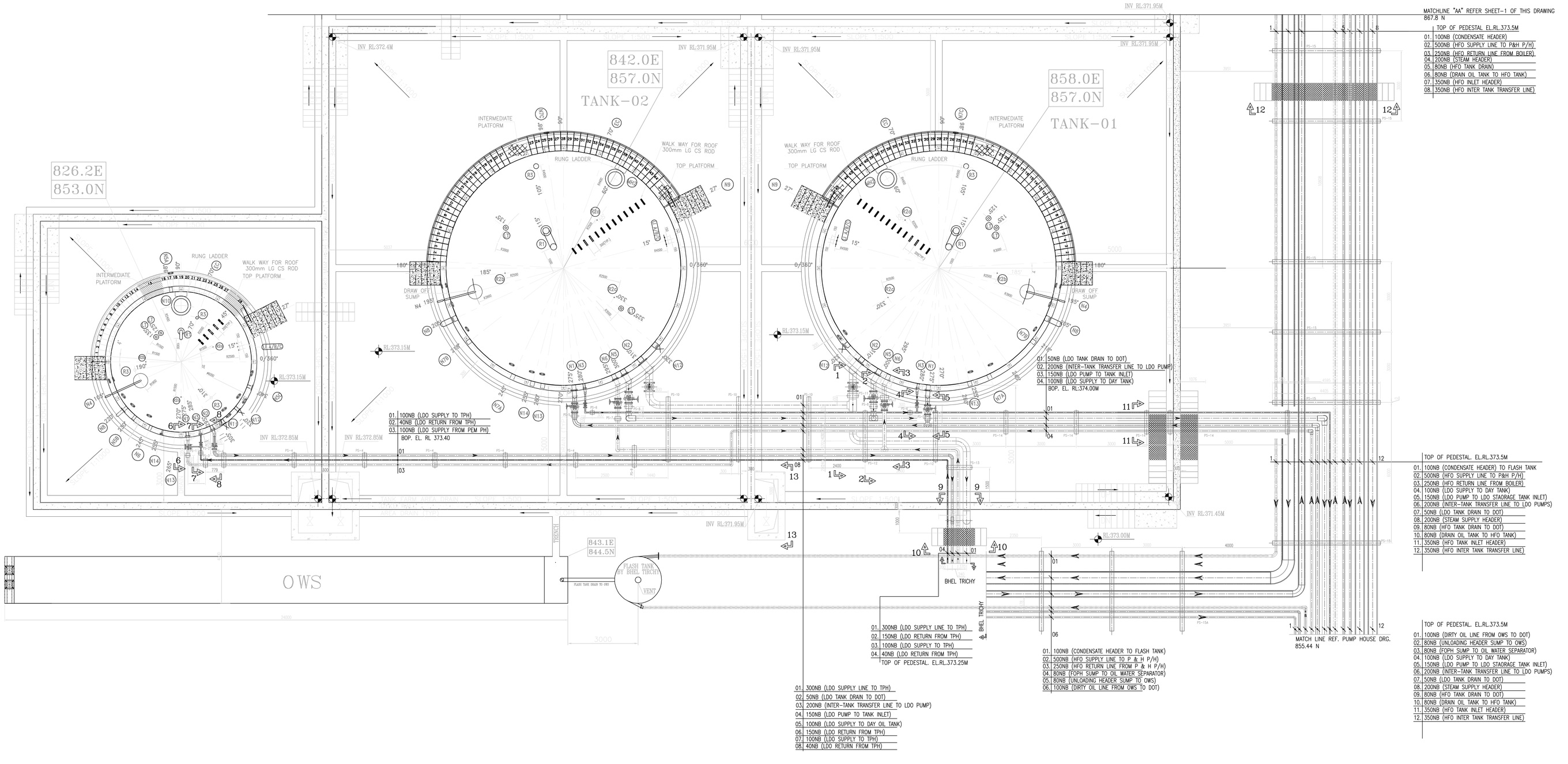
05. PROCESS & INSTRUMENTATION DIAGRAM FOR HFO SYSTEM-(NTPC DRG. NO.-9585-001-130-PVM-L-001) (BHEL DRG. NO. PE-DG-434-166-A001)



REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED
00	22.11.19	SUBMISSION FOR APPROVAL	UN	DK	RGS

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PATRATU VIDYUT UTPADAN NIGAM LIMITED

Project:
3X800MW PVUNL PATRATU TPP PHASE-1 (EPC)

NTPC DWG. NO:-
9585-001-130-PVM-B-001

EPC CONTRACTOR:
BHARAT HEAVY ELECTRICALS LIMITED
PROJECTS ENGINEERING MANAGEMENT, NEW DELHI

CONTRACTOR:
NEW FIRE ENGINEERS PVT. LTD.

DEPT.	CODE	SCALE	WEIGHT(KG)	REF TO ASSY DRG.	ITEM
MJAX	-	1:125	-	-	-

Title:-
Piping Layout in & Around Storage Tank Farm Area

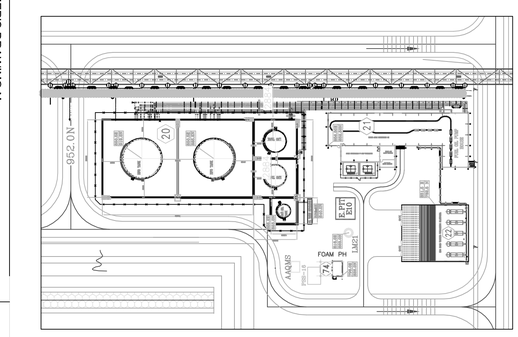
	NAME	SIGN	DATE
PREP.	UN		28.02.20
CHECKED	DK		28.02.20
APPD.	RGS		28.02.20

CONTRACTOR DWG No.: FOH-1422- SSC-004
REV. : 00
SHEETS : 3 OF 4
BHEL DWG. No.: PE-DG-434-166-A004
CONTRACTOR JOB NO.: FOH-1422
BHEL JOB NO: 434

SIZE-A0

CUSTOMER'S DRAWING No.
PE-V0-434-166-A008

KEY PLAN



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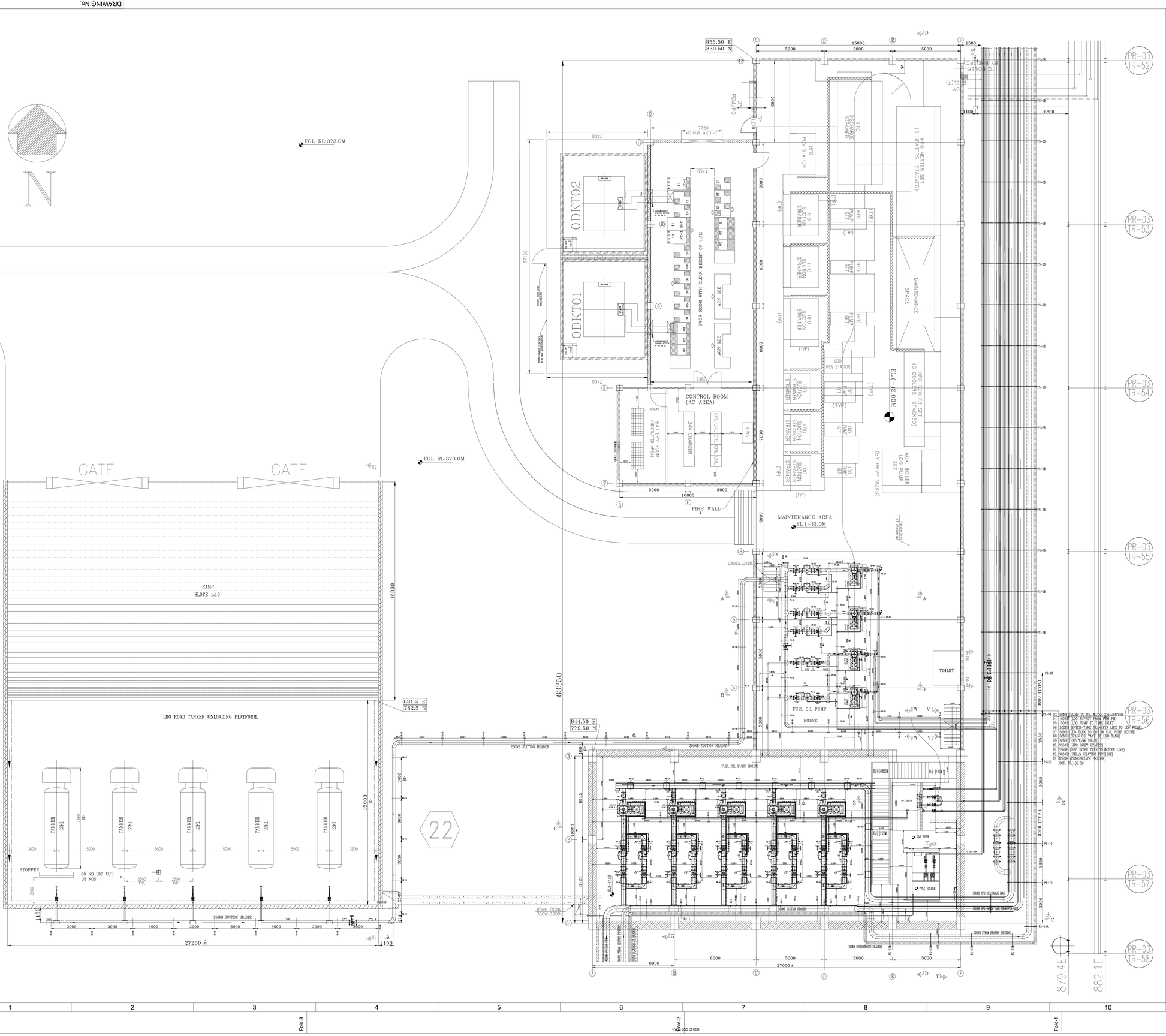
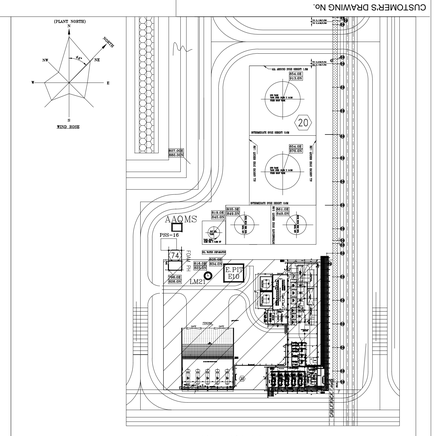
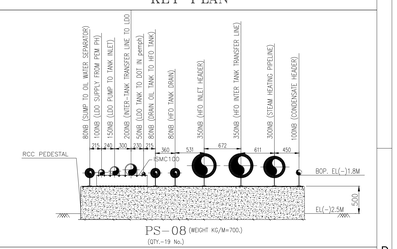
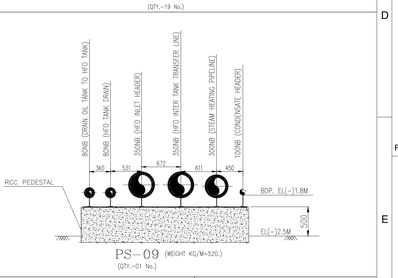
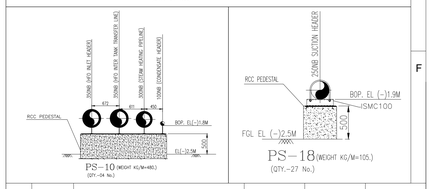
COMPUTER FILE NAME: PE-DG-434-166-A004











REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED

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PVUN — PATRATU VIDYUT UTPADAN NIGAM LIMITED

Project: 3X800MW PVUNL PATRATU TPP PHASE-1 (EPC)

NTPC DWG. NO:- 9585-001-130-PVM-B-004

EPC CONTRACTOR: BHARAT HEAVY ELECTRICALS LIMITED, PROJECTS ENGINEERING MANAGEMENT, NEW DELHI

CONTRACTOR: NEW FIRE ENGINEERS PVT. LTD.

DEPT.	CODE	SCALE	WEIGHT(KG)	REF TO ASSY DRG.	ITEM
MUAX	-	-	-	-	-

Title:- PIPING LAYOUT OF UNLOADING PUMP HOUSE

	NAME	SIGN	DATE
PREP.	YOGESH KUMAR	-SD-	11.12.19
CHECKED	RS	-SD-	11.12.19
APPD.	SR	-SD-	11.12.19

CONTRACTOR DWG No. FOH-1422-SSC-004 | REV:00 | SHEETS : 1 OF 4 | BHEL DWG. No. PE-DG-434-166-A004

CONTRACTOR JOB NO: FOH-1422 | BHEL JOB NO: 434

SIZE-A1

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COMPUTER FILE NAME: PE-DG-434-166-A004

844.50 E
779.50 N

CROSS OVER

FUEL OIL PUMP HOUSE

TOILET

250NB SUCTION HEADER

450NB SUCTION HEADER

P-11

HFO U/L PUMP # 1

HFO U/L PUMP # 2

LDO U/L PUMP#2

LDO U/L PUMP#1

LDO TTR PUMP#2

LDO TTR PUMP#1

EL:(-)7.1M

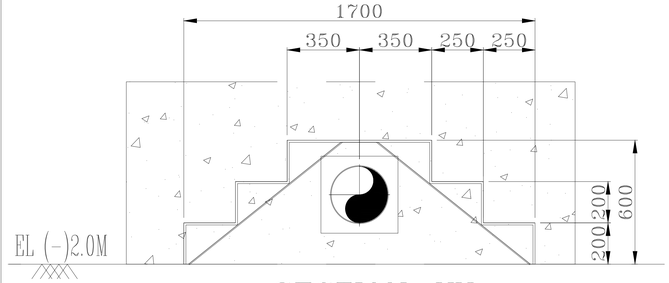
EL:(-)4.625M

EL:(-)2.00M

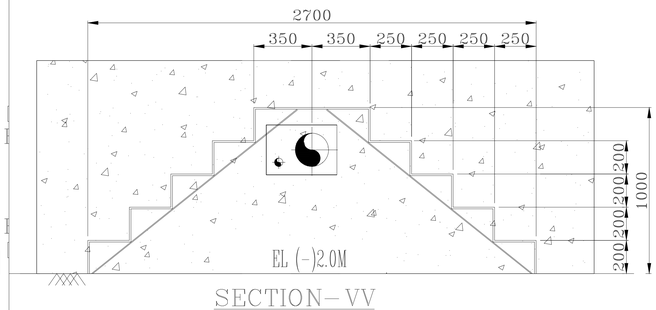
EL:(-)7.25M

EL:(-)9.6M

FFL(-)10.85M



SECTION–XX



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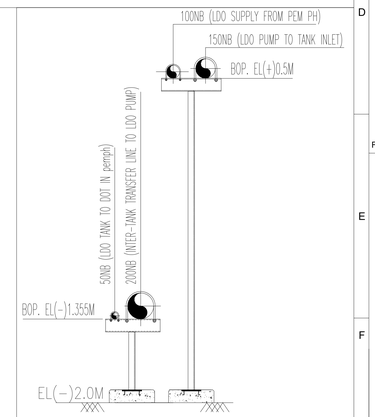

SECTION–WW

REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED

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PATRATU VIDYUT UTPADAN NIGAM LIMITED

Project: 3X800MW PVUNL PATRATU TPP PHASE-1 (EPC)

NTPC DWG. NO:– 9585–001–130–PVM–B–004

EPC CONTRACTOR: BHARAT HEAVY ELECTRICALS LIMITED
PROJECTS ENGINEERING MANAGEMENT, NEW DELHI

CONTRACTOR: NEW FIRE ENGINEERS PVT. LTD.

DEPT.	CODE	SCALE	WEIGHT(KG)	REF TO ASSY DRG.	ITEM
MUAX	-	-	-	-	-

Title:– PIPING LAYOUT OF UNLOADING PUMP HOUSE

	NAME	SIGN	DATE
PREP.	YOGESH KUMAR	-SD-	11.12.19
CHECKED	RS	-SD-	11.12.19
APPD.	SR	-SD-	11.12.19

CONTRACTOR DWG No.	REV:00	BHEL DWG. No.
FOH-1422-SSC-004	SHEETS : 2 OF 4	PE-DG-434-166-A004

CONTRACTOR JOB NO: FOH-1422 | BHEL JOB NO: 434

SIZE-A1

FIRST ANGLE PROJECTION | ALL DIMENSIONS ARE IN MM

DRAWING No. PE-DG-434-166-A004

CUSTOMER'S DRAWING No.

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COMPUTER FILE NAME: PE-DG-434-166-A004

MAINTENANCE AREA
EL:(-)2.0M

FUEL OIL PUMP HOUSE

844.50 E
779.50 N

63250

TOILET

CROSS OVER

250NB SUCTION HEADER

FUEL OIL PUMP HOUSE

EL.(-)4.625M

EL.(-)2.00M

EL.(-)7.25M

EL.(-)9.6M

EL.(-)7.1M

FFL(-)10.85M

350NB HFO DISCHARGE LINE

350NB HFO INTER TANK TRANSFER LINE

400NB SUCTION HEADER

300NB STEAM HEATING PIPELINE

100NB (CONDENSATE HEADER)

PS-08 03. 80NBFT(SUMP TO OIL WATER SEPARATOR)
04. 100NB (LDO SUPPLY FROM PCM PH)
05. 150NB (LDO PUMP TO TANK INLET)
06. 200NB (INTER-TANK TRANSFER LINE TO LDO SUMP)
07. 50NB (LDO TANK TO DOT IN U/L PUMP HOUSE)
08. 80NB (DRAIN OIL TANK TO HFO TANK)
09. 80NB (HFO TANK DRAIN)
10. 350NB (HFO INLET HEADER)
11. 350NB (HFO INTER TANK TRANSFER LINE)
12. 300NB (STEAM HEATING PIPELINE)
13. 100NB (CONDENSATE HEADER)
BOP. EL(-)2.2M

PR-0 TR-5

679.4E

682.1E

SECTION-HH

SECTION-GG

SECTION-CC

SECTION-DD

REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED

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PATRATU VIDYUT UTPADAN NIGAM LIMITED

Project: 3X800MW PVUNL PATRATU TPP PHASE-1 (EPC)

NTPC DWG. NO:- 9585-001-130-PVM-B-004

EPC CONTRACTOR: BHARAT HEAVY ELECTRICALS LIMITED
PROJECTS ENGINEERING MANAGEMENT, NEW DELHI

CONTRACTOR: NEW FIRE ENGINEERS PVT. LTD.

DEPT.	CODE	SCALE	WEIGHT(KG)	REF TO ASSY DRG.	ITEM
MUAX	-	-	-	-	-

Title:- PIPING LAYOUT OF UNLOADING PUMP HOUSE

	NAME	SIGN	DATE
PREP.	YOGESH KUMAR	-SD-	11.12.19
CHECKED	RS	-SD-	11.12.19
APPD.	SR	-SD-	11.12.19

CONTRACTOR DWG No. FOH-1422-SSC-004 | REV:00 | SHEETS : 3 OF 4

BHEL DWG. No. PE-DG-434-166-A004

CONTRACTOR JOB NO: FOH-1422 | BHEL JOB NO: 434

SIZE-A1

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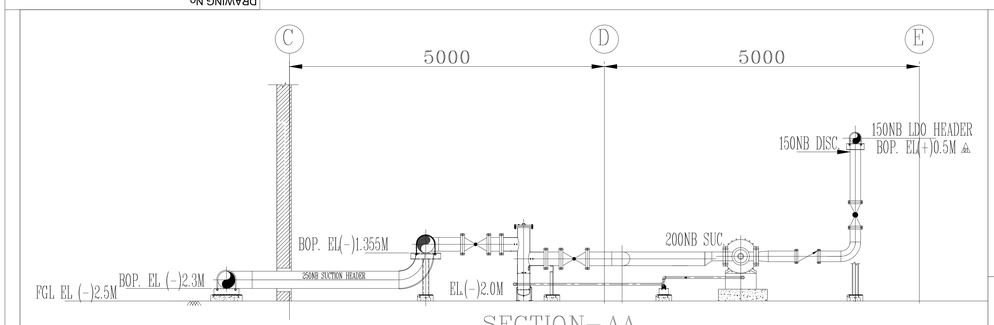

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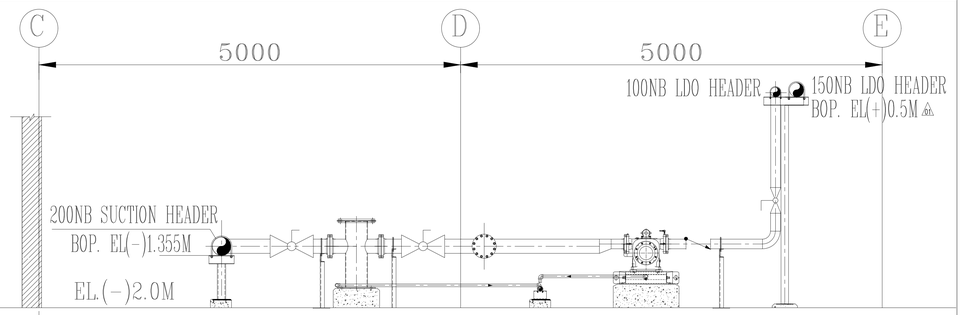

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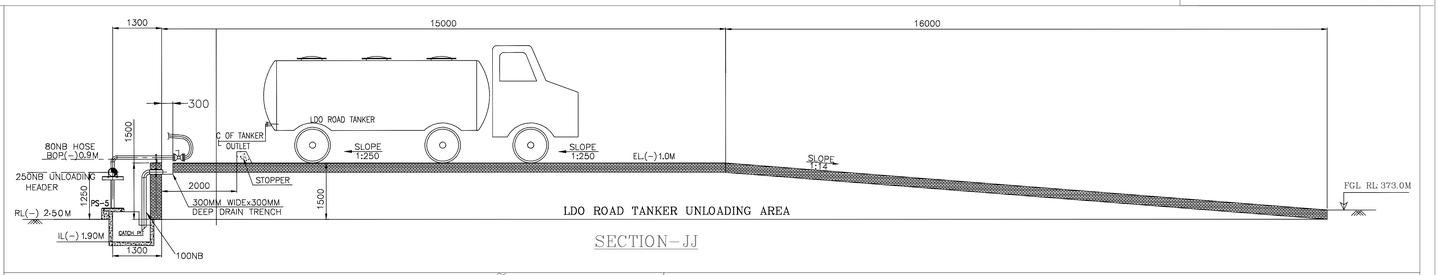

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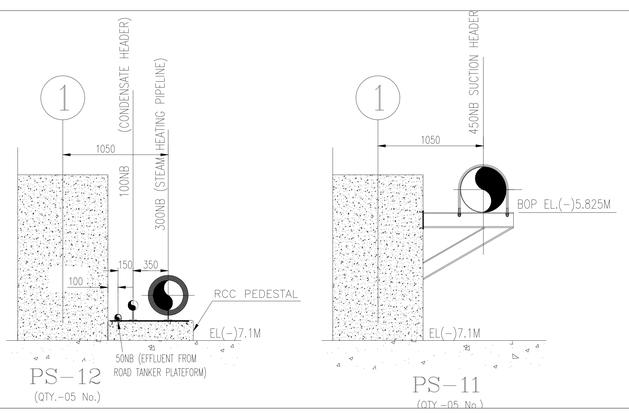


PS–12
(QTY.–05 No.)

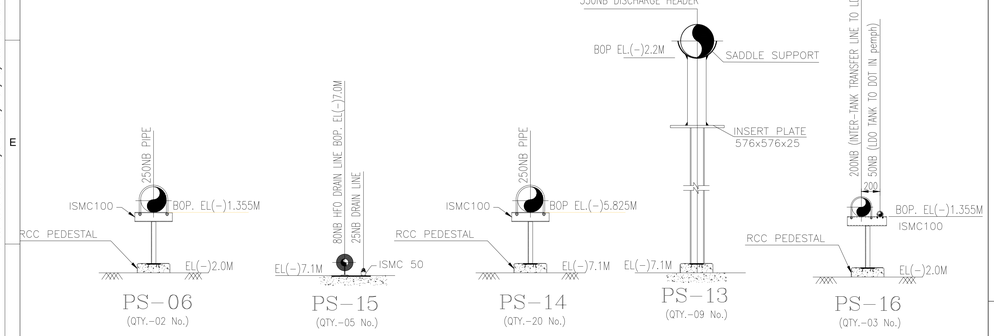
PS–11
(QTY.–05 No.)

NOTES:

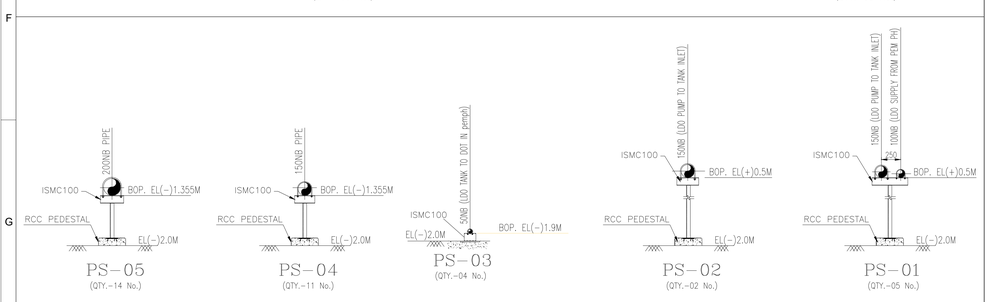
1. FINISH FLOOR LEVEL = RL (+)375.50 M,CORRESPONDS TO PLANT EL 0.0M (GROUND FLOOR OF STG BUILDING) P/H IS EL(–) 2.0M
2. ALL DIMENSIONS ARE IN MM AND ELEVATIONS ARE IN METER.
3. FOR STEAM LINES & TRACER LINES,TRAPS WILL BE PROVIDED AT EVERY 40 MTR.
4. HANDRAIL TO BE PROVIDED BY PEM–CIVIL, WHEREVER APPLICABLE.

REFERENCE DRAWINGS:–

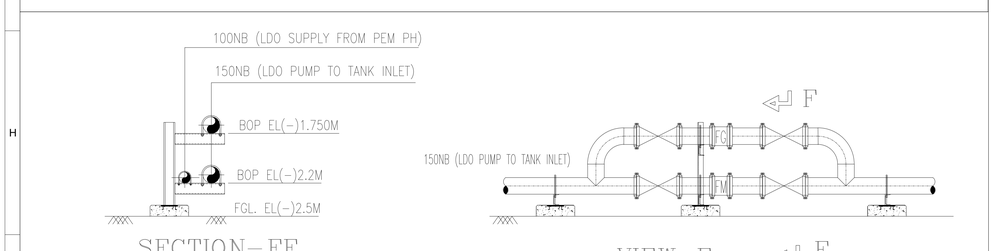
1). P & I DIAGRAM FOR FOHS SYSTEM	: 9585–001–130–PVM–L–001
2). PLOT PLAN	: 9585–001–999–POC–F–001
3). PIPING LAYOUT IN & AROUND STORAGE TANK FARM AREA	: 9585–001–130–PVM–P–034
4). LAYOUT OF FUEL OIL PRESSURING PUMP HOUSE WITH FOUNDATION	: 9585–001–102–PVM–B–077
▲5). ELECTRICAL EQUIPMENT AND CABLING LAYOUT IN FOPH AREA	: 9585–001–200–PVE–F–010



PS–06 (QTY.–02 No.)
PS–15 (QTY.–05 No.)
PS–14 (QTY.–20 No.)
PS–13 (QTY.–09 No.)
PS–16 (QTY.–03 No.)

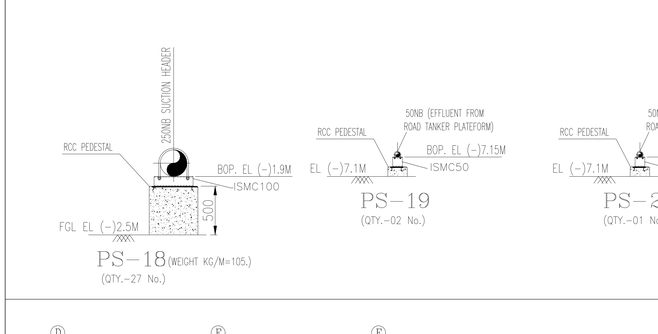


PS–05 (QTY.–14 No.)
PS–04 (QTY.–11 No.)
PS–03 (QTY.–04 No.)
PS–02 (QTY.–02 No.)
PS–01 (QTY.–05 No.)



SECTION–FF

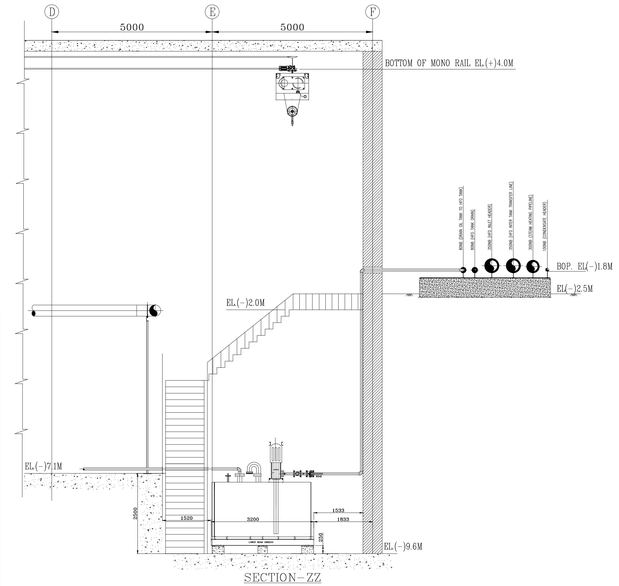
VIEW–E



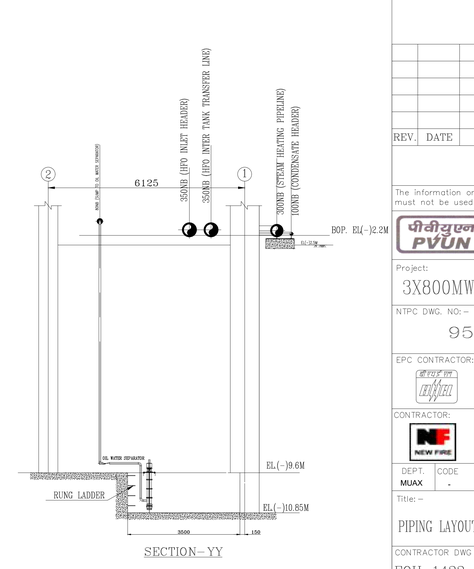
PS–18 (WEIGHT KG/M=105.)
(QTY.–27 No.)
PS–19 (QTY.–02 No.)
PS–20 (QTY.–01 No.)
PS–10A (QTY.–05 No.)

LEGEND:–

EL	ELEVATION
FFL	FINISHED FLOOR LEVEL
FGL	FINISHED GROUND LEVEL
BOP	BOTTOM OF PIPE



SECTION–ZZ



SECTION–YY

REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED

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PATRATU VIDYUT UTPADAN NIGAM LIMITED

Project: 3X800MW PVUNL PATRATU TPP PHASE-1 (EPC)

NTPC DWG. NO:– 9585–001–130–PVM–B–004

EPC CONTRACTOR: BHARAT HEAVY ELECTRICALS LIMITED
PROJECTS ENGINEERING MANAGEMENT, NEW DELHI

CONTRACTOR: NEW FIRE ENGINEERS PVT. LTD.

DEPT.	CODE	SCALE	WEIGHT(KG)	REF TO ASSY DRG.	ITEM
MUAX	-	-	-	-	-

Title:– PIPING LAYOUT OF UNLOADING PUMP HOUSE

	NAME	SIGN	DATE
PREP.	YOGESH KUMAR	–SD–	11.12.19
CHECKED	RS	–SD–	11.12.19
APPD.	SR	–SD–	11.12.19

CONTRACTOR DWG No. FOH–1422–SSC–004 | REV:00 | SHEETS : 4 OF 4 | BHEL DWG. No. PE–DG–434–166–A004

CONTRACTOR JOB NO: FOH–1422 | BHEL JOB NO: 434

SIZE-A1

COMPUTER FILE NAME: PE–DG–434–166–A004

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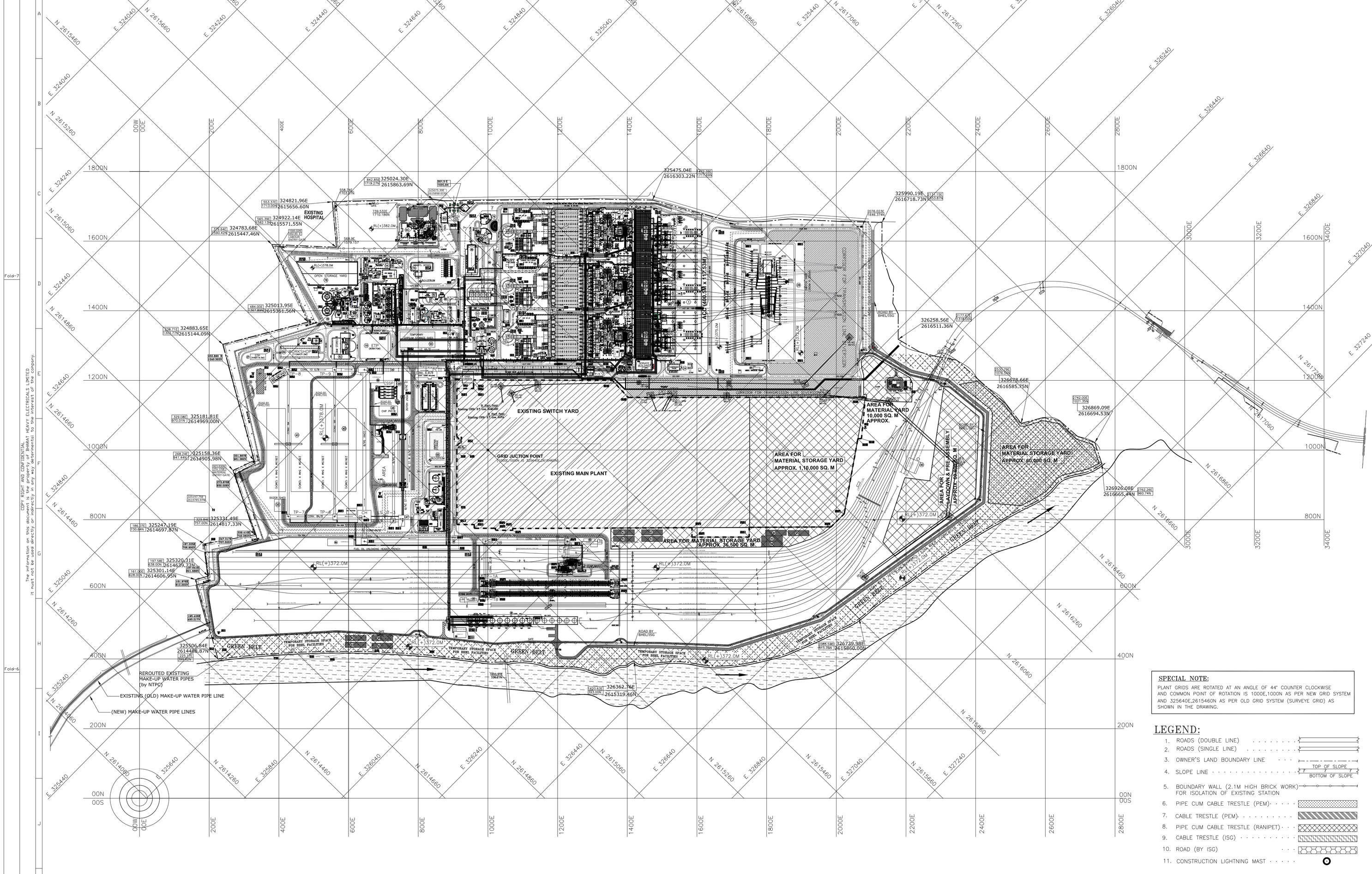

LIST OF BUILDING/EQUIPMENT SHOWN

S.No.	ZONE	DESCRIPTION
1	D-8	ACC
2	C-8, D-8 & E-8	ACC CONDENSATE STORAGE TANK
3	C-8, D-8 & D-8	ACC MCC ROOM
4	C-8, D-8 & D-8	ACC VACUUM HOGGING PUMP HOUSE
5	D-4	ACW CHLORINE DICOXIDE DOSING SYSTEM
6	D-5	ACW COOLING TOWER
7	D-9	ACW PUMPS AREA
8	D-4	ACW TREATMENT SYSTEM
9	D-5	AUX. BOILER
10	C-7, D-7 & E-7	BOILER
11	D-4	CHEMICAL LAB
12.	D-6, D-6 & E-6	CHIMNEY
13	-	CMB
14.	E-7	CONDENSATE STORAGE TANKS
15.	E-7	CONDENSATE TRANSFER PUMP HOUSE
16.	D-4	CPU REGEN. BUILDING
17.	C-7, D-7 & E-7	ESP
18.	C-6, D-6 & D-6	ESP CONTROL ROOM
19.	E-4	ETP
20.	F-5	FO - FARM AREA (HFO, LDO, BOT)
21.	G-5	FO - FUEL OIL PUMP HOUSE
22.	G-5	FO - OIL TANKER UNLOADING
23.	E-10	H2 GEN. PLANT
24.	E-8	MAIN PLANT & MRS COMPRESSOR HOUSE
25.	C-7, D-7 & D-7	MRS
26.	D-4	PLANT WATER PUMPS AREA
27.	E-3	STP
28.	D-9	SWITCHYARD
29.	D-7, D-7 & E-7	TG BUILDING
30.	D-8, D-8 & E-8	TRANSFORMER YARD
31.	E-3	WEIGH BRIDGE
32.	H-6	AHP BA & FA SILO MCC
33.	D-7, D-7 & E-7	AHP BOTTOM ASH CONVYER
34.	D-7, D-7 & E-7	AHP BOTTOM ASH SILO
35.	D-6	AHP COMPRESSOR HOUSE-1
36.	E-6	AHP COMPRESSOR HOUSE-2
37.	D-6	AHP FLY ASH INTERMEDIATE SILO
38.	H-6	AHP FLY ASH SILO
39.	F-9	MISC. SWITCH GEAR BLDG.
40.	F-11	CHP- LDCO SHED
41.	H-5	SILO UTILITY BLDG.
42.	F-5	CHP-COAL CONVYER
43.	F-4, F-4	CHP-COAL STOCK PILE A,B,C,D
44.	G-4	CHP-CRUSHER HOUSE
45.	D-7, D-7, D-7	SURGE HOPPERS
46.	-	-
47.	G-5	CHP-PUMP HOUSE-A (ON GROUND FLR OF LS CRYO
48.	E-5	CHP-PUMP HOUSE-B
49.	E-5	CSSP
50.	F-3	DOZER SHED
51.	D-6	LHP - GYPSUM, DEWATERING BUILDING
52.	E-6	LHP - LIMESTONE CRUSHER HOUSE
53.	E-5	LHP - TEMPORARY GYPSUM STORAGE SHED
54.	D-4	IM PLANT
55.	D-5	IM PLANT - ACID ALKALIE STORAGE
56.	D-5	IM PLANT N-PIT & BACKWASH
57.	D-6, D-6 & E-6	FGD - ABSORBER
58.	-	-
59.	D-6, D-6	COMMON FGD C ROOM & ESP CONTROL ROOM UNIT-2
60.	D-4	PT CHEMICAL HOUSE
61.	D-4	PT CLARIFIER
62.	D-4	PT PLANT
63.	D-4	DM TANKS
64.	C-5	ADMIN BUILDING
65.	F-5	AMMONIA STORAGE
66.	C-5	AUDITORIUM
67.	C-6	CANTEEN
68.	D-8	DG SETS
69.	D-8 & D-8	FIRE FIGHTING - DRILL TOWER
70.	D-5	FIRE FIGHTING - FIRE STATION
71.	D-7	FIRE FIGHTING - FIRE WATER BOOSTER PUMP HOUSE
72.	D-5	FIRE FIGHTING - FIREWATER PUMP HOUSE
73.	D-5	FIRE FIGHTING - FIREWATER TANKS
74.	G-5	FIRE FIGHTING - FOAMING PUMP HOUSE
75.	E-4	FOA BUILDING
76.	D-5	IT BUILDING
77.	C-5	GATE COMPLEX
78.	D-4	OPEN STORAGE YARD
79.	D-5	OWNERS OFFICE
80.	C-5	SAFETY PARK
81.	E-5	OWNER'S STORES (CONSTRUCTION)
82.	E-4	STORES (O&M)
83.	C-5	TIME OFFICE
84.	E-3	WORKSHOP
85.	-	BHEL OFFICE
86.	E-7	AHP MCC-1 (SWITCHGEAR CUM DCS ROOM)
87.	D-7	AHP MCC-2 (SWITCHGEAR CUM DCS ROOM)
88.	D-7	AHP MCC-3 (SWITCHGEAR CUM DCS ROOM)
89.	D-6	AHP MCC-4 (SWITCHGEAR CUM CONTROL ROOM)
90.	H-5	AHP MCC-5 (SWITCHGEAR CUM DCS ROOM)
91.	H-6	CHP MCC-1 (SWITCHGEAR CUM DCS ROOM)
92.	G-7	CHP MCC-2 (SWITCHGEAR CUM DCS ROOM)
93.	G-8, G-9, H-4	BHEL CLOSED STORAGE SHEDS (TEMPORARY-SITE SCOPE)
94.	G-4	CHP MCC-3 (SWITCHGEAR CUM CONTROL ROOM)
95.	E-4	CHP MCC-4 (SWITCHGEAR CUM DCS ROOM)
96.	E-6	CHP MCC-5 (SWITCHGEAR CUM DCS ROOM)

SPECIAL NOTE:

PLANT GRIDS ARE ROTATED AT AN ANGLE OF 44° COUNTER CLOCKWISE AND COMMON POINT OF ROTATION IS 1000E,1000N AS PER NEW GRID SYSTEM AND 325640E,2615460N AS PER OLD GRID SYSTEM (SURVEYE GRID) AS SHOWN IN THE DRAWING.

LEGEND:

1. ROADS (DOUBLE LINE)
2. ROADS (SINGLE LINE)
3. OWNER'S LAND BOUNDARY LINE
4. SLOPE LINE (TOP OF SLOPE / BOTTOM OF SLOPE)
5. BOUNDARY WALL (2.1M HIGH BRICK WORK) FOR ISOLATION OF EXISTING STATION
6. PIPE CUM CABLE TRESTLE (PEM)
7. CABLE TRESTLE (PEM)
8. PIPE CUM CABLE TRESTLE (RANIPET)
9. CABLE TRESTLE (ISG)
10. ROAD (BY ISG)
11. CONSTRUCTION LIGHTNING MAST

REFERENCE DRGS:

SL. No.	TITLE	DRG. NUMBER	SCOPE
1	REFERENCE PLOT PLAN	9585-999-POC-F-001	NTPC
2	YARD PIPING & TRESTLE LAYOUT	9585-001-999-PGM-F-010	PEM

NOTES:-

1. ALL DIMENSIONS ARE IN MM & ELEVATIONS IN METERS UNLESS STATED OTHERWISE.
2. FINISH FLOOR LEVEL = RL (+)375.50 M,CORRESPONDS TO PLANT EL 0.0M (GROUND FLOOR OF STG BUILDING) FINISHED GROUND LEVEL OF BOP AREAS AS MARKED.
3. LOCATION/SIZE OF BOP FACILITIES IS TENTATIVE ONLY

SCALE 40 0 40 80 120 160M

PROGRESSIVE REVISION

REV.	DATE	ALTD	CHD	APPD
3	23.03.2019	RC	BKA	JJ
1	DRAWING REVISED AS PER LATEST GAs OF DIFFERENT FACILITIES & NTPC COMMENTS ON REV. 2.			
2	27.09.2018	RC	BKA	JJ
1	DRAWING REVISED AS PER LATEST GAs OF DIFFERENT FACILITIES & NTPC COMMENTS ON REV. 1			
1	16.07.2018	RC	BKA	JJ
	DRAWING REVISED AS PER LATEST GAs OF DIFFERENT FACILITIES & NTPC COMMENTS ON REV. 0			

JOB NO. 434
STATUS CONTRACT
DISTRIBUTION

NTPC DRG NO.: 9585-001-999-POC-F-001

CUSTOMER: NTPC LIMITED

3x800MW PATRATU SUPER THERMAL POWER PROJECT

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

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DEPT CODE	NAME	SIGN	DATE
M	DRN. VKS		26.03.2018
	DES. DEEPAK/RC		26.03.2018
	CHD BKA		26.03.2018
	APPD JJ		26.03.2018

TITLE: PLOT PLAN

DEPT. SCALE 1:425
SIGN
DRAWING NO. PE-DG-434-100-M001
SHEET 1 OF 1 REV. 4P-C
SIZE-A0

PATRATU VIDYUT UTPADAN NIGAM LIMITED

3X800MW PVUNL PATRATU TPP PHASE-1

TECHNICAL SPECIFICATION

FOR

FUEL OIL HANDLING SYSTEM

ANNEXURE - V

(MANDATORY SPARES LIST)

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
PPEI, NOIDA-INDIA

LIST OF MANDATORY SPARES FOR

FUEL OIL HANDLING SYSTEM

1.00.00 **SPARES**

The Bidder shall include in his scope of supply all the necessary Mandatory spares, start up and commissioning spares and recommended spares and indicate these in the relevant schedules of the Bid Form and Price Schedules. The general requirements pertaining to the supply of these spares is given below:-

1.01.00 **MANDATORY SPARES**

(a) The list of mandatory spares considered essential by the Employer is indicated in Section VI, Part-F chapter. The bidder shall indicate the prices for each and every item (except for items not applicable to the bidders design) in the 'Schedule of mandatory Spares' whether or not he considers it necessary for the Employer to have such spares. If the bidder fails to comply with the above or fails to quote the price of any spare item, the cost of such spares shall be deemed to be included in the contract price. The bidder shall furnish the population per unit of each item in the Bid Forms and Price Schedules. Whenever the quantity is mentioned in "sets" the bidder has to give the item details and prices of each item.

(b) The Employer reserves the right to buy any or all the mandatory spares parts.

(c) The prices of mandatory spares indicated by the Bidder in the Bid Proposal sheets shall be used for bid evaluation purposes.

(d) All mandatory spares shall be delivered at site at least two months before scheduled date of initial operation of the first unit. However, spares shall not be dispatched before dispatch of corresponding main equipments.

(e) Wherever quantity is specified both as a percentage and a value, the Bidder has to supply the higher quantity until and unless specified otherwise.

(f) In case specified spares are not applicable to a particular design offered by the bidder, functionally equivalent applicable spares pertaining to the offered design shall be provided in quantities as per specified spares.

1.02.00 **RECOMMENDED SPARES**

(a) In addition to the spare parts mentioned above, the contractor shall also provide a list of recommended spares for 3 years of normal operation of the plant and indicate the list and total prices in relevant schedule of the Bid Form and Price Schedules. This list shall take into consideration the mandatory spares specified in this Section-VI, part-F and should be independent of the list of the mandatory spares. The Employer reserves the right to buy any or all of the recommended spares. The recommended spares shall be delivered at project site at least two months before the scheduled

date of initial operation of first unit. However, the spares shall not be dispatched before the dispatch of the main equipment.

(b) Price of recommended spars will not be used for evaluation of the bids. The price of these spares will remain valid upto 6 months after placement of Notification of Award for the main equipment. However, the Contractor shall be liable to provide necessary justification for the quoted prices for these spares as desired by the Employer.

1.03.00 **START-UP & COMMISSIONING SPARES**

Start-up and commissioning spares are those spares which may be required during the start-up and commissioning of the equipment/system. All spares used till the plant is handed over to the employer shall come under this category. The Contractor shall provide for an adequate stock of such start up and commissioning spares to be brought by him to the site for the plant erection and commissioning. They must be available at site before the equipments are energized. The unused spares, if any, should be removed from there only after the issue of Taking Over certificate. All start up spares which remain unused at the time shall remain the property of the Contractor.

1.04.00 The Bidder shall include in his scope of supply all the necessary Mandatory spares, start up and commissioning spares and recommended spares and indicate these in the relevant schedules of the Bid Form and Price Schedules. The general requirements pertaining to the supply of these spars is given below.

2.00.00 The Contractor shall indicate the service expectancy period for the spares parts (both mandatory and recommended) under normal operating conditions before replacement is necessary.

3.00.00 All spares supplied under this contract shall be strictly inter changeable with the parts for which they are intended for replacements. The spares shall be treated and packed for long storage under the climatic conditions prevailing at the site e.g. small items shall be packed in sealed transparent plastic with desecrator packs as necessary.

4.00.00 All the spares (both recommended and mandatory) shall be manufactured along with the main equipment components as a continuous operation as per same specification and quality plan.

5.00.00 The contractor will provide Employer with cross-sectional drawings, catalogues, assembly drawings and other relevant documents so as to enable the Employer to identify and finalise order for recommended spares.

6.00.00 Each spares part shall be clearly marked or labelled on the outside of the packing with its description. When more than one spares part is packed in a single case, a general description of the content shall be shown on the outside of such case and a detailed list

	enclosed. All cases, containers and other packages must be suitably marked and numbered for the purposes of identification.
7.00.00	All cases, containers or other packages are to be opened for such examination as may be considered necessary by the Employer.
8.00.00	The contractor will provide the Employer with all the addresses and particulars of his sub suppliers while placing the order on vendors for items/components/equipments covered under the contract and will further ensure with his vendors that the Employer, if so desires, will have the right to place order for spares directly on them on mutually agreed terms based on offers of such vendors.
9.00.00	The Contractor shall warrant that all spares supplied will be new and in accordance with the contract Documents and will be free from defects in design, material and workmanship.
10.00.00	In addition to the recommended spares listed by the contractor, if the employer further identifies certain particular items of spares, the contractor shall submit the prices and delivery quotation for such spares within 30 days of receipt of such request with a validity period of 6 months for consideration by the Employer and placement of order for additional spares if the Employer so desires.
11.00.00	The Contractor shall guarantee the long term availability of spares to the Employer for the full life of the equipment covered under the contract. The Contractor shall guarantee that before going out of production of spares parts of the equipment covered under the Contract, he shall give the Employer at least 2 years advance notice so that the latter may order his bulk requirement of spares, if he so desires. The same provision will also be applicable to sub-contractors. Further, in case of discontinuance of manufacture of any spares by the Contractor and/or his sub contractors, Contractor will provide the Employers, two years in advance, with full manufacturing drawings, material specifications and technical information including information on alternative equivalent makes required by the Employer for the purpose of manufacture/procurement of such items.
12.00.00	The bidder to provide datasheets/assembly drawings of the manufacturer/ any other relevant document showing Bill of Material(s), Make, Model Number, Part Number etc. through which the mandatory spares to be supplied can be uniquely identified. This would facilitate the Employer to assign a unique code to each of the mandatory spare as brought out in GCC. The bidder shall extend all necessary assistance in this regard.

	ITEM	QUANTITY
1.00.00	**MECHANICAL ITEMS**	
1.01.00	Strainer elements	
	a. F.O. Drain pumps	1 no.
	b. HFO/ LSHS/HPS/ LDO unloading & transfer pumps	1 no.
1.02.00	Floor Coil Heater	
	a. Oil water separator pit	15% of total length of coil
1.03.00	Relief valve complete assembly	
	a. HFO/ LSHS/HPS/ LDO unloading pumps	1 no.
	b. Pressure reducing station	1 no.
1.04.00	Bearings of	
	a. HFO/ LSHS/HPS/ LDO unloading pumps	1 set
	b. F. O. Drain pumps	1 set
	c. Sump pumps	1 set
	d. Dirty Oil pumps	1 set
1.05.00	Rotor Assembly (Complete cartridge assembly)	
	a. HFO/ LSHS/HPS/ LDO unloading pumps	1 no.
	b. F. O. Drain pumps	1 no.
	c. Sump pumps	1 no.
	d. Dirty Oil pumps	1 no.
1.06.00	Coupling Bolts with nuts, washer and bushes for HFO/ LSHS/HPS/ LDO LDO unloading pumps	1 set for each size of coupling
1.07.00	Wearing Rings	1 set for each type of pump
1.08.00	Gland Packing (if applicable)	1 set for each type of pump
1.09.00	Mechanical seal Assembly (if applicable)	2 sets each for Fuel Oil unloading cum transfer pump

1.10.00	Shaft Sleeve	1 set for each type of pump
	ITEM	**QUANTITY**
1.11.00	Valves (Each type and size)	a) 1 number, where the total quantity of a particular type and size of valve is less than or equal to 10. b) 2 numbers, where the total quantity of a particular type and size of valve is less than 40 but more than 10. c) 10% of total quantity (to nearest whole number) of a particu-lar type and size of valve, where the total quantity of a particular type and size of valve is more than 40
1.12.00	Steam Trap	2 numbers for each type and size
1.13.00	Control valves (complete assy)	one (1) no. complete for floor coil heaters one (1) no. complete for suction heaters
1.14.00	Pressure reducing valve	One (1) no.
1.15.00	Neoprene rubber unloading hoses with end connections complete hose)	Ten (10) Nos.

	ITEM	QUANTITY
2.00.00	**CONTROL AND INSTRUMENTATION ITEMS**	
2.01.00	**MEASURING INSTRUMENTS**	
	1 Electronic Transmitters	
	Transmitters of all types and model no. (for the measurement of Pressure, differential pressure flow, level, etc.)	10% or 1 no. of each type and model whichever is more.
	2 Temperature elements	
	(i) RTD's*, Thermocouples	10% or 2 no. of each type , make and model
	(ii) Thermowell**	10% or 2 no. of each type , make and model
	* (With head assembly, terminal block and nipple) **(to be divided into various insertion lengths in proportion to main population)	
	3 Local Indicators like temperature gauges, pressure gauges, differential pressure gauges, flow gauges etc.	5% or 1 no. of each type, make and model
	4 Process Actuated Switch Devices Includes all types of Pressure, differential pressure, flow, temperature, level switch Devices	5% or 1 no. of each type, make and model
2.02.00	**PROCESS CONNECTION PIPING (FOR IMPULSE PIPING/TUBING, SAMPLING PIPING/TUBING AND AIR SUPPLY PIPING AS APPLICABLE)**	
	1 Valves	10% or 1 no. of each type, make and model
	2 2 way, 3way, 5way valve manifolds	10% or 1 no. of each type, make and model
	3 Fittings	10% or 1 no. of each type, make and model
	4 Purge Meters	5% or 1 no. of each type, make and model whichever is more

	ITEM	QUANTITY
	5 Filter Regulator	20% or 2 nos. of each type, make and model whichever is more
2.03.00	**ELECTRICAL ACTUATORS**	
	1 Actuators	10% (or) 1 no. of each type, model and rating, whichever is more.

Note :

One (1) set means total numbers as required for one complete replacement for one equipment.

MANDATORY SPARES FOR FUEL HANDLING PUMP HOUSE

Part C		
S.no.	**Item Description**	**Quantity**
1	HFO pressurizing pump motor	1 no.
2	LDO pressurizing pump motor	1 no.
3	Drain oil pump motor	1 no.

MANDATORY SPARES FOR AIR CONDITIONING SYSTEM

Part C		
S.no.	**Item Description**	**Quantity**
1	SCREEW COMPRESSOR CHILLING UNIT motor	1 no.

MANDATORY SPARES FOR VFD for CEP

S.no.	**Item Description**	**Quantity**
1	HV Bushing with metal parts and gaskets for VFD Transformer	-1 No. of each rating
2	LV Bushing with metal parts and gaskets for VFD Transformer (if applicable)	-1 No. of each rating
3	WTI with contacts for VFD transformer	-1 No. of each rating
4	Electronic cards (a) Control modules (b) I/O module (c) Power supply modules (d)Gate module including gate transformer	1 nos. of each type & rating
5	Power device (Thyristor, IGBT etc.)	No. of devices in one bridge leg
6	Over voltage limiter and surge suppressor network	1 Set
7	Semi conductor fuses for Power device (Thyristor, IGBT etc.)	1 Set
8	Power & Control fuse	25% of installed quantity
9	Control Transformer	1 nos. of each type & rating
10	Contactor/Breaker	1 no.
11	CT/VT	1 nos. of each type & rating
12	Indicating lamps	100% of each type & rating
13	Auxiliary contactors & relays	1 no. of each type & rating
14	Panel mounted meters	1 no.
15	Indicating lamp holder full set	15% of each type and colour

3X800MW PVUNL PATRATU TPP PHASE-1

ANNEXURE - VI
(TERMS & CONDITION FOR MS PLATE FREE ISSUE)

1.0 SCOPE OF SUPPLY

Bidder's Scope of work shall be as per technical specification no PE-TS-434-166-A001. MS Plates required for Shell, roof and bottom of fuel oil tanks (HFO,LDO,LDO DAY TANK) shall only be free issued by BHEL as specified in this Annexure. Any other plates required for RF pad plates, manholes, wind girder (plate fabricated), anchor chairs, gusset plates, stiffener plates, weir plates, interconnecting platform, etc shall be supplied by bidder.

The bidder shall furnish quantities of MS plate, required from BHEL (free issue), along with his offer as per "Format for MS Plate" attached with this Annexure I. In case the quantities of MS plate quoted by the bidder, exceeds the base quantities as specified, the bidder's bid shall be loaded for the excess quantity at the specified evaluation rate.

During detailed engineering while furnishing the fabrication drawing for BHEL's & Customer Review/approval, Bidder shall furnish the theoretical quantities of MS Plate in Drawing/Documents.

If the total quantity of MS Plate during contract execution is found to be more than the quantities quoted at tender stage or base values, whichever is higher, the additional cost for excess quantity of MS Plate shall be deducted from the bidder's payments at penal rate. No Benefit will be given to bidders, in case of reduction in actual quantity of MS Plate with respect to the quantities considered in bid evaluation.

2.0 FREE ISSUE OF MS PLATE CONDITIONS:

A) GENERAL NOTES:

1) MS Plate shall be issued free of cost by BHEL as per approved fabrication drawings. The contractor shall collect these materials from BHEL stores/store yard at specified places at his own cost and store the same at the work site or in his stores as per standard norms. Materials issued will be used only for construction of fuel oil Tanks as per contract requirement.

2) BHEL reserves the right to recover from the contractor any loss arising out of damage/ theft or any other causes or during verification/stacking or at any time under the custody of the contractor.

3) The contractor shall take care of material issued by BHEL and shall protect the same from damage and weathering.

4) The contractor shall in no case be entitled for any compensation on account of any delay in supply or non-supply thereof for all or any such materials. However, in case of non-availability of any specific section(s) which delays the completion of work, such cases shall be recorded separately in monthly planning format) and shall be considered for time extension of contract.

5) Contractor will have to make his own arrangement at his own cost for procurement of any other materials except as mentioned above, as required for the works and of such quality as acceptable to BHEL.

6) Contractor shall also carryout in complete association with BHEL, the material management functions and execution like day-to-day update of materials, issued to contractor.
7) The contractor shall solely be responsible for the safety & security of material after it is handed over and issued to contractor by the BHEL.

8) BHEL issued materials, shall not be under any circumstances whatsoever, and shall be taken out of the project site unless otherwise permitted by BHEL for outside job.

B) HANDLING OF MATERIALS ISSUED BY BHEL:

1) Materials shall be issued by BHEL based on the weighment basis/linear measurements & sectional weight. However, on specific request of the contractor "as a special case to expedite the job" the consignment received at BHEL stores can directly be diverted to the work site following issuance procedure of BHEL. Such direct issues

shall be as per the Challan/dispatch document/LR received with the consignment. In such cases, Contractor shall do unloading of materials from trucks/lorry at their own cost.

2) All materials issued by BHEL shall be stacked, stored above ground level by use of concrete or wooden sleepers. No materials shall remain on ground at any time. All concrete or wooden sleepers required for stacking the materials shall be arranged by contractor (successful bidder of this package) at his own cost within the quoted rates. All other equipments like winches, D-Shackles, slings of various sizes, max puller, pulley blocks, jacks, trucks, trailors etc. Required for such handling of MS plates from BHEL stores/storage yard etc. Shall be arranged by contractor within quoted/accepted rates.

3) The contractor shall take delivery of the materials from the designated place within the project premises at his own cost and store the same at his stores as per standard norms. Open land for such purposes shall be provided by BHEL on free of cost basis. Temporary barbed wire fencing of the open storage yard is to be done by the contractor and is included under the scope of his work. Contractor shall also remove grass, bushes, trees etc wherever required off the land provided to him and shall make proper continuous up keeping of the open yard /land by removing grass, bushes trees etc and same is included under the scope of his work & No extra payment shall be made to the contractor in this regard. The bidder shall make complete arrangement of necessary security personnel's to safeguard all such materials in his custody. Materials issued will be used only for construction of Misc Tanks as per the scope specified in this specification. The contractor shall take care of material issued by BHEL and shall protect the same from theft, damage and weathering. Excessive rusting of steel in custody of agency/contractor must be avoided. In case, due to any cause attributable to the contractor, such rusting of steel occur rendering the same unusable, then such quantity of steel shall be recovered from the interim payment as per the contract conditions specified.i.e.as per the bid evaluation Price.

C) <u>ISSUE OF MS PLATES FREE OF COST:</u>

1) The MS Plates shall be issued to the contractor on the following basis:

   i. MS Plate: Weighment basis (Unit-MT)

2) All the MS Plate issued by BHEL shall be properly accounted for. The total quantity of MS Plate required for the work will be calculated from the approved fabrication drawings as per contract.

   In case any such sectional weights are not available in the applicable drawing/documents, the manufacturer recommendation shall be binding.

3) The MS Plate issued to the contractor shall be mainly in standard length as received from the supplier. However, the contractor shall be bound to accept the MS Plate in length / width as available in the project stores, no claims for extra payment because of issue of non-standard length will be entertained.

4) The contractor shall satisfy himself of the quality and quantity of the materials at the time of taking delivery from BHEL stores. No claims whatsoever will be entertained by BHEL because of quality or quantity after the materials are taken by the contractor from BHEL stores.

5) The contractor shall submit to BHEL, a statement indicating estimated quantity MS Plate required during a quarter. In addition, the contractor shall also furnish the estimated requirement of MS Plate during a month by the third week of the previous month indicating his requirement.

6) Following shall be limit for the maximum quantity of BHEL issue materials that would be with the contractor at any point of time when work is in progress (excluding what has already been incorporated in the works).

SL No.	ISSUE OF MATERIALS	MAX QUANTITY IN CONTRACTORS STORE
01	MS Plate	ONE MONTH

7) Bidders shall ensure that no lamination material is taken over by them from BHEL.

8) The contractor must note that MS Plate required for other parts shall be arranged by the contractor at his own cost.

9) Bidder to give requirement of Material in BHEL Scope well in advance of before Three month from requirement. Any delay in raising the requirement of these item leading to delay in placement of order, will be Contractor responsibility and its attributable delay in erection will be responsibility of Bidder only.

D) RETURN OF MATERIAL:

1) All surplus MS steel and wastage materials will be taken back on weightment basis.
2) Surplus, unused and untampered MS steel shall be sorted section-wise and returned separately for a place directed by BHEL within the project area. Return of such material will not be entitled to any handling and incidental charges.
3) All wastages / scrap shall be promptly returned to the BHEL store and a receipt obtained for material accounting purposes. Return of such material will not be entitled to any transportation and incidental charge.

E) CONSUMPTION AND WASTAGE:

1) The theoretical consumption of various thickness / sections of MS plate shall be based on approved fabrication drawings. Weight shall be calculated considering the sectional weights as per Indian standards.
2) Actual consumption = Issue – Surplus.
3) Surplus = Untampered and unused quantity of MS plate returned by the contractor to BHEL store along with relevant documents.
4) Wastage = Actual consumption – Theoretical consumption.
5) Allowable wastage: Ten percent (10%) of the theoretical consumption shall be considered. Wastage shall be considered as cut pieces and scrap material, measured as per actual weighment basis. Invisible wastage, if any, shall be considered to be included in the specified 10 % allowable wastage.
6)

S.No.	MS Plate	Basis of issue & penal recovery
S-1	Theoretical consumption (without considering any wastage, scrap or loss) as per approved fabrication drawing or Quantity mentioned in “FORMAT FOR REQUIRED MS PLATE” whichever is less.	Free
S-2	Wastage limited to plus ten percent (+10%) of the aforesaid theoretical consumption (S-1) towards allowable wastage.	Free
S-3	Wastage beyond Ten percent (10%) of the aforesaid theoretical consumption (S-1)	Penal rate.

F) RECOVERY OF MATERIAL:

If wastage exceeds the specified limit, the recovery of excess wastage shall be at the Penal rate. Penal rate of MS plate shall be Rs 50,000/- per MT (Ex-works).

PATRATU VIDYUT UTPADAN NIGAM LIMITED

3X800MW PVUNL PATRATU TPP PHASE-1

TECHNICAL SPECIFICATION

FOR

FUEL OIL HANDLING SYSTEM

SECTION – IB

SPECIFIC TECHNICAL SPECIFICATION
ELECTRICAL PORTION

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
PPEI, NOIDA-INDIA

`

TECHNICAL SPECIFICATION

FOR

FUEL OIL HANDLING SYSTEM (ELECTRICAL PORTION)

1.0 **EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:**

a) Services and equipment as per "Electrical Scope between BHEL and Vendor".

b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.

c) Supply of mandatory spares as specified in the specifications of mechanical equipments.

d) Electrical load requirement for FUEL OIL HANDLING SYSTEM **.**

e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.

f) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer/BHEL approval without any commercial and delivery implications to BHEL

g) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.

h) Motor shall meet minimum requirement of motor specification.

i) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.

j) Cable BOQ worked out based on routing of cable listing provided by the vendor for " both end equipment in vendor's scope"shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.

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

Refer "Electrical Scope between BHEL and Vendor".

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

3.1 The electrical specification without any deviation from the technical/quality assurance requirements stipulated shall be deemed to be complied by the bidder in case bidder furnishes the overall compliance of package technical specification in the form of

compliance certificate/No deviation certificate.

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

4.0 List of enclosures :

a) Electrical scope between BHEL & vendor

b) Customer (NTPC) specification for Motors

c) Customer (NTPC) cabling spec (to be referred by vendor for their scope of work (as per Electrical scope between BHEL & vendor)).

d) Quality plan for motors & NTPC quality assurance

e) Datasheet A & C (Annexure- I)

f) List of Mandatory Spares (refer mechanical specification)

g) Sub vendor List for Motors & other Electrical items (Annexure-III)

h) Electrical Load data format (Annexure –IV)

i) BHEL cable listing format (Annexure –V)

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGE : FUEL OIL SYSTEM

SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT

PROJECT: 3X800 MW PATRATU STPS EXPANSION PH-I

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	BHEL	BHEL	240 V AC (supply feeder)/415 V AC (3 PHASE 4 WIRE) supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motor.
3	Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	 BHEL BHEL BHEL	 BHEL Vendor BHEL	1. For 3.b) & c): Sizes of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL) in the form of cable listing. Finalisation of cable sizes shall be done by BHEL. Vendor shall provide lugs & glands accordingly. 2. Termination at BHEL equipment terminals by BHEL. 3. Termination at Vendor equipment terminals by Vendor.
4	Junction box for control & instrumentation cable	Vendor	Vendor	Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 10-12 mtrs) and trunk cable.
5	Any special type of cable like compensating, co-axial, prefab, MICC, optical fibre etc.	Vendor	Vendor	Refer C&I portion of specification for scope of fibre Optical cables if used between PLC/ microprocessor & DCS.
6	Cable trays, accessories & cable trays supporting system 100/ 50 mm cable trays/ Conduits/ Galvanised steel cable troughs for local cabling	BHEL Vendor	BHEL Vendor	Local cabling from nearby main route cable tray (BHEL scope) to equipment terminal (vendor's scope) shall be through 100/ 50 mm. cable trays/ conduits/ Galvanised steel cable troughs, as per approved layout drawing during contract stage.
7	Cable glands ,lugs and bimetallic strip for equipment supplied by Vendor	Vendor	Vendor	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power and control cables.
8	Conduit and conduit accessories for cabling between equipment supplied by vendor	Vendor	Vendor	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537.
9	Lighting	BHEL	BHEL	
10	Equipment grounding (including electronic earthing) & lightning protection	BHEL	BHEL	Refer note no. 4 for electronic earthing

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGE : FUEL OIL SYSTEM

SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT

PROJECT: 3X800 MW PATRATU STPS EXPANSION PH-I

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
11	Below grade grounding	BHEL	BHEL	
12	LT Motors with base plate and foundation hardware	Vendor	Vendor	Makes shall be subject to customer/ BHEL approval at contract stage.
13	Mandatory spares	Vendor	-	Vendor to quote as per specification.
14	Recommended O & M spares	Vendor	-	As specified elsewhere in specification
15	Any other equipment/ material/ service required for completeness of system based on system offered by the vendor (to ensure trouble free and efficient operation of the system).	Vendor	Vendor	
16	a) Input cable schedules (Control & Screened Control Cables) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable and electronic earthing cable in enclosed excel format shall be submitted by vendor during detailed engineering stage.
17	Electrical Equipment & cable tray layout drawings	Vendor	-	a. In case, vendor's Fuel oil pump house building is located as combined with Heating & Pumping building (BHEL-TRICHY), cable tray/trench layout inside combined building shall be prepared by BHEL-PEM. Vendor to furnish drawing (both in print form as well as in AUTOCAD) of Fuel oil pump house layout clearly indicating all pumps, panels, JB's etc. which require cabling along with their terminal box/location/ Foundation etc. b. In case, vendor's Fuel oil pump house building is separate from Heating & Pumping building (BHEL-TRICHY), vendor shall prepare & submit cable tray/trench & equipment layout (both in print form as well as in AUTOCAD) of the complete Fuel oil pump house building indicating location and identification of all equipment requiring cabling for BHEL review & approval. Vendor to ensure the cable tray lay out shall confirm to NFPA (National fire prevention act)/TAC (Tariff advisory committee) applicable for hazardous area classification.

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGE : FUEL OIL SYSTEM

SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT

PROJECT: 3X800 MW PATRATU STPS EXPANSION PH-I

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
18	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

NOTES:

1. Make of all electrical equipment/ items supplied shall be reputed make & shall be subject to approval of BHEL/customer after award of contract.
2. All QPs shall be subject to approval of BHEL/customer after award of contract without any commercial implication.
3. In case the requirement of Junction Box arises on account of Power Cable size mis-match due to vendor engineering at later stage, vendor shall supply the Junction Box for suitable termination.
4. Vendor shall indicate location of Electronic Earth pit in their Civil assignment drawing.

SUB–SECTION – B-07

MOTORS

MOTORS

1.00.00 GENERAL REQUIREMENTS

1.01.00 For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and relative humidity of 95% (at 40 deg C) shall be considered. The equipment shall operate in a highly polluted environment.

1.02.00 All equipment shall be suitable for rated frequency of 50 Hz with a variation of +3% & -5%, and 10% combined variation of voltage and frequency unless specifically brought out in the specification.

1.03.00 Contractor shall provide fully compatible electrical system, equipment, accessories and services.

1.04.00 All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and international Codes & Standards, especially the Indian Statutory Regulations.

1.05.00 Paint shade shall be as per RAL 5012 (Blue) for indoor and outdoor equipment.

1.06.00 The responsibility of coordination with electrical agencies and obtaining all necessary clearances for contractors equipment and systems shall be under the contractor scope.

1.07.00 Degree of Protection

Degree of protection for various enclosures as per IEC60034-05 shall be as follows:-

i)	Indoor motors	-	IP 54
ii)	Outdoor motors	-	IP 55
iii)	Cable box-indoor area	-	IP 54
iv)	Cable box-Outdoor area	-	IP 55

2.00.00 CODES AND STANDARDS

1)	Three phase induction motors	:	IS/IEC:60034
2)	Single phase AC motors	:	IS/IEC:60034
3)	Crane duty motors	:	IS:3177, IS/IEC:60034
4)	DC motors/generators	:	IS/IEC:60034
5)	Energy Efficient motors	:	IS 12615, IEC: 60034-30

CLAUSE NO.	TECHNICAL REQUIREMENTS
3.00.00	**TYPE**
3.01.00	**AC Motors:** a) Squirrel cage induction motor suitable for direct-on-line starting. b) Continuous duty LT motors upto 200 KW Output rating (at 50 deg.C ambient temperature), shall be Premium Efficiency class-IE3, conforming to IS 12615, or IEC:60034-30. c) Crane duty motors shall be squirrel cage Induction motor as per the requirement. d) Motor operating through variable frequency drives shall be suitable for inverter duty. Also these motors shall comply the requirements stipulated in IEC: 60034-18-41 and IEC: 60034-18-42 as applicable.
3.02.00	DC Motors Shunt wound
4.00.00	**RATING** (a) Continuously rated (S1). However, crane motors shall be rated for S4 duty, 40% cyclic duration factor. (b) Whenever the basis for motor or driven equipment ratings are not specified in the corresponding mechanical specification sub-sections, maximum continuous motor ratings shall be at least 10% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations. (c) For BFP motors, starting MVA shall be restricted to meet requirements indicated in B-0.
5.00.00	**TEMPERATURE RISE** **Air cooled motors** 70 deg. C by resistance method for both thermal class 130(B) & 155(F) insulation. **Water cooled** 80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method for both thermal class 130(B) & 155(F) insulation.

	41 deg.C over inlet cooling water maximum temperature of 39 deg.C for thermal class 90 (Y) wet wound Boiler circulation pump motor.
6.00.00	**OPERATIONAL REQUIREMENTS**
6.01.00	**Starting Time**
6.01.01	For motors with starting time upto 20 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 secs. more than starting time.
6.01.02	For motors with starting time more than 20 secs. and upto 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 secs. more than starting time.
6.01.03	For motors with starting time more than 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time.
6.01.04	Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.
6.02.00	**Torque Requirements**
6.02.01	Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.
6.02.02	Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.
6.03.00	**Starting voltage requirement** (a) Up to 85% of rated voltage for ratings below 110 KW (b) Up to 80% of rated voltage for ratings from 110 KW to 200 KW (c) Up to 85% of rated voltage for ratings from 201 KW to 1000 KW (d) Up to 80% of rated voltage for ratings from 1001 KW to 4000 KW (e) Up to 75 % of rated voltage for ratings above 4000KW Except AOP & JOP motors running on D.G emergency supply, starting voltage shall be 80%.

CLAUSE NO.	TECHNICAL REQUIREMENTS
7.00.00	**DESIGN AND CONSTRUCTIONAL FEATURES**
7.01.00	Suitable single phase space heaters shall be provided on motors rated 30KW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters & RTDs shall be provided. However for flame proof motors, space heater terminals inside the main terminal box may be acceptable.
7.02.00	All motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACA) type. However, motors rated 3000KW or above can be Closed air circuit water cooled (CACW). The method of movement of primary and secondary coolant shall be self-circulated by fan or pump directly mounted on the rotor of the main motor as per IEC 60034-6. However VFD driven motors can be offered with forced cooling type with machine mounted fan or pump driven by separate electric motor. Motors and EPB located in hazardous areas shall have flame proof enclosures conforming to IS: 2148 as detailed below (a) Fuel oil area : Group – IIB (b) Hydrogen generation : Group - IIC or (Group-I, Div-II as per plant area NEC) or (Class-1, Group-B, Div-II as per NEMA / IEC60034)
7.03.00	Winding and Insulation (a) Type : Non-hygroscopic, oil resistant, flame resistant (b) Starting duty : Two hot starts in succession, with motor initially at normal running temperature. (c) 11kV & 3.3 kV AC motors : Thermal class 155 (F) insulation. The winding insulation process shall be total Vacuum Pressure Impregnated i.e. resin poor method. The lightning Impulse & intertern insulation surge withstand level shall be as per IEC-60034 part-15. However winding insulation for wet wound Boiler circulation pump motor shall be thermal class 90 (Y) or better. (d) 240VAC, 415V AC & 220V DC motors : Thermal Class (B) or better
7.04.00	Motors rated above 1000KW shall have insulated bearings to prevent flow of shaft currents.

CLAUSE NO.	TECHNICAL REQUIREMENTS
7.05.00	Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature.
7.06.00	Noise level for all the motors shall be limited to 85dB (A) except for BFP motor for which the maximum limit shall be 90 dB(A). Vibration shall be limited within the limits prescribed in IS/IEC 60034-14. Motors shall withstand vibrations produced by driven equipment. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads.
7.07.00	In HT motors, at least four numbers simplex / two numbers duplex platinum resistance type temperature detectors shall be provided in each phase stator winding. Each bearing of HT motor shall be provided with dial type thermometer with adjustable alarm contact and preferably 2 numbers duplex platinum resistance type temperature detectors.
7.08.00	Motor body shall have two earthing points on opposite sides.
7.09.00	11 KV motors shall be offered with Separable Insulated Connector (SIC) as per IEEE 386. The offered SIC terminations shall be provided with protective cover and trifurcating sleeves. SIC termination kit shall be suitable for fault level of 25 KA for 0.17 seconds.
7.10.00	3.3 KV motors shall be offered with dust tight phase separated double walled (metallic as well as insulated barrier) Terminal box. Suitable termination kit shall be provided for the offered Terminal box. The offered Terminal Box shall be suitable for fault level of 250 MVA for 0.12 sec. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non-magnetic material for single core cables) shall be provided.
7.11.00	The spacing between gland plate & center of terminal stud shall be as per Table-I.
7.12.00	All motors shall be so designed that maximum inrush currents and locked rotor and pullout torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.
7.13.00	The motors shall be suitable for bus transfer schemes provided on the 11kV, 3.3 kV /415V systems without any injurious effect on its life.
7.14.00	For motors rated 2000 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box.
7.15.00	The size and number of cables (for HT and LT motors) to be intimated to the successful bidder during detailed engineering and the contractor shall provide terminal box suitable for the same.

CLAUSE NO.	TECHNICAL REQUIREMENTS
8.00.00	The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance) except for BFP motor. (a) 50 kW to 110 kW : 11.0 (b) From 110 KW & upto 200 KW : 9.0 (c) Above 200 KW & upto 1000KW : 10.0 (d) From 1001KW & upto 4000KW : 9.0 (e) Above 4000KW : 6 to 6.5
9.00.00	CW motor shall be designed with minimum power factor of 0.8 at design duty point.
10.00.00	**TYPE TEST**
10.01.00	**HT MOTORS**
10.01.01	The contractor shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The bidder shall indicate the charges for each of these type tests separately in the relevant schedule of Section - VII-(BPS) and the same shall be considered for the evaluation of the bids. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the employer's engineer.
10.01.02	The type tests shall be carried out in presence of the employer's representative, for which minimum 15 days notice shall be given by the contractor. The contractor shall obtain the employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set–up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.
10.01.03	In case the contractor has conducted such specified type test(s) within last ten years as on the date of bid opening, he may submit during detailed engineering the type test reports to the employer for waival of conductance of such test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The employer reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the contractor.
10.01.04	Further the Contractor shall only submit the reports of the type tests as listed in "LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED "and carried out within last ten years from the date of bid opening. These reports should be for

the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the employer either at third party lab or in presence of client/ employer's representative and submit the reports for approval.

10.01.05 **LIST OF TYPE TESTS TO BE CONDUCTED**

The following type tests shall be conducted on each type and rating of HT motor

(a) No load saturation and loss curves upto approximately 115% of rated voltage

(b) Measurement of noise at no load.

(c) Momentary excess torque test (subject to test bed constraint).

(d) Full load test (subject to test bed constraint)

(e) Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp., coolant flow and its temp. shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose.

10.01.06 **LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED**

The following type test reports shall be submitted for each type and rating of HT motor

(a) Degree of protection test for the enclosure followed by IR, HV and no load run test.

(b) Terminal box-fault level withstand test for each type of terminal box of HT motors only.

(c) Lightning Impulse withstand test on the sample coil shall be as per clause no. 4.3 IEC-60034, part-15

(d) Surge-withstand test on interturn insulation shall be as per clause no. 4.2 of IEC 60034, part-15

10.02.00 **LT Motors**

10.02.01 LT Motors supplied shall be of type tested design. During detailed engineering, the contractor shall submit for employer's approval the reports of all the type tests as listed in this specification and carried out within last *ten* years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

10.02.02 However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the employer either at third party lab or in presence of client/ employer's representative and submit the reports for approval.

10.02.03 **LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED**

The following type test reports shall be submitted for each type and rating of LT motor of above 50 KW only

1. Measurement of resistance of windings of stator and wound rotor.
2. No load test at rated voltage to determine input current power and speed
3. Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors)
4. Full load test to determine efficiency power factor and slip.
5. Temperature rise test.
6. Momentary excess torque test.
7. High voltage test.
8. Test for vibration severity of motor.
9. Test for noise levels of motor(Shall be limited as per clause no 7.06.00 of this section)
10. Test for degree of protection and
11. Over speed test.

12. Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1

10.03.00 All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

10.04.00 The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.

TABLE - I

DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS

Motor MCR in KW	**Minimum distance between centre of stud and gland plate in mm**
UP to 3 KW	**As per manufacturer's practice.**
Above 3 KW - upto 7 KW	85
Above 7 KW - upto 13 KW	115
Above 13 KW - upto 24 KW	167
Above 24 KW - upto 37 KW	196
Above 37 KW - upto 55 KW	249
Above 55 KW - upto 90 KW	277
Above 90 KW - upto 125 KW	331
Above 125 KW-upto 200 KW	203

For HT motors the distance between gland plate and the terminal studs shall not be less than 500 mm.

PHASE TO PHASE/ PHASE TO EARTH AIR CLEARANCE:

NOTE: Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows:

Motor MCR in KW	Clearance
UP to 110 KW	10mm
Above 110 KW and upto 150 KW	12.5mm
Above 150 KW	19mm

SUB–SECTION – B-09

CABLING

1.00.00 **CODES AND STANDARDS**

1.01.00 All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS codes, standards, etc.) referred to herein, the former shall prevail. All work shall be carried out as per the following standards/ codes as applicable .

IS:513	Cold rolled low carbon steel sheets and strips.
IS:802	Code of practice for the use of Structural Steel in Overhead Transmission Line Towers.
IS:1079	Hot Rolled carbon steel sheet & strips
IS:1239	Mild steel tubes, tubulars and other wrought steel fIttings
IS:1255	Code of practice for installation and maintenance of power cables upto and including 33 KV rating
IS:1367 Part-13	Technical supply conditions for threaded Steel fasteners. (Hot dip galvanized coatings on threaded fasteners).
IS:2147	Degree of protection provided by enclosures for low voltage switchgear and control gear
IS:2309	Code of Practice for the protection of building and allied structures against lightning.
IS:2629	Recommended practice for hot dip galvanising of iron & steel
IS:2633	Method for testing uniformity of coating on zinc coated articles.
IS:3043	Code of practice for Earthing
IS:3063	Fasteners single coil rectangular section spring washers.
IS:6745	Methods for determination of mass of zinc coating on zinc coated iron & steel articles.
IS:8308	Compression type tubular in- line connectors for aluminium conductors of insulated cables
IS:8309	Compression type tubular terminal ends for aluminium conductors of insulated cables.
IS:9537	Conduits for electrical installation.
IS:9595	Metal - arc welding of carbon and carbon manganese steels - recommendations.
IS:13573	Joints and terminations for polymeric cables.
BS:476	Fire tests on building materials and structures
IEEE:80	IEEE guide for safety in AC substation grounding
IEEE:142	Grounding of Industrial & commercial power systems

	DIN 46267 (Part-II)	Non tension proof compression joints for Aluminium conductors.
	DIN 46329	Cable lugs for compression connections, ring type ,for Aluminium conductors
	BS:6121	Specification for mechanical Cable glands for elastomers and plastic insulated cables.
		Indian Electricity Act.
		Indian Electricity Rules.

1.02.00 Equipment complying with other internationally accepted standards such as IEC, BS, DIN, USA, VDE, NEMA etc. will also be considered if they ensure performance and constructional features equivalent or superior to standards listed above. In such a case, the Bidder shall clearly indicate the standard(s) adopted, furnish a copy in English of the latest revision of the standards alongwith copies of all official amendments and revisions in force as on date of opening of bid and shall clearly bring out the salient features for comparison.

2.00.00 DESIGN AND CONSTRUCTIONAL FEATURE

2.01.00 **Inter Plant Cabling**

2.01.01 Interplant cabling for main routes shall be laid along overhead trestles/duct banks. Cables from main plant to switchyard control room shall be laid in overhead trestles or duct bank. In case of Duct banks, pull-pits shall be filled with sand and provided with a PCC covering. Directly burried cables, if essential ,shall not have concentration of more than 4 cables in one route. All buried cables, Cables for switchyard and CHP shall be armoured

2.01.02 **Transformer yard**

In transformer yard cables shall be laid in overhead trestle. The main cable routes coming out from Main plant building and crossing the Transformer yard shall be laid in overhead trestles. In transformer yard, trestle height for rail/road crossing shall be suitable for movement of Generator Transformer with bushing.

2.01.03 **Trenches**

PCC flooring of built up trenches shall be sloped for effective drainage with sump pits and sump pumps.

2.01.04 No sub zero level cable vault/trenches shall be provided below control building/switchgear rooms in main plant.

2.01.05 **Cable Vault**

Clear access passage of at least 750mm wide & 2.1 mt clear heights shall be provided at entrances and along the cable trays in cable vault. Wherever the passage is through cable routes & across the cable tray the clear height shall not be less than 1.5 mts.

Cable vaults shall be provided with adequate drainage facilities for drainage of fire water.

Each cable vault should have at least two doors.

Exit signs shall be provided near doors for personnel escape in case of emergency

2.01.06	**Boiler Area** Two separate cable routes one on each side shall be provided for each boiler unit. Cables for on set of auxiliaries such as ID, FD, PA fan & half of the coal mills shall be routed in one route & for other set of auxiliaries through other route. Cable trays in boiler & ESP area shall be supported from the boiler and ESP structures. The same shall be coordinated with SG/ESP contractor. Cable trays in these areas shall be in vertical formation to avoid dust accumulation. No cable trenches shall be provided in boiler/ESP area.
2.01.07	**Turbine Hall Area** a)Two separate cable routes shall be provided for cable routing of working and standby drives or different set/group (say 50% capacity) of auxiliaries.
2.01.08	**OffSite Area** In offsite pumphouses, overhead cable tray arrangement shall be followed. However cable trenches may be considered below switchgear/mcc. Trestle In fuel oil pump house, overhead cable tray arrangement shall be provided. RCC trenches provided in MCC room shall be separated from fuel oil area to avoid oil accumulation.
2.01.09	The cable slits to be used for motor/equipment power/control supply shall be sand filled & covered with PCC after cabling.
2.01.10	Sizing criteria, derating factors for the cables shall be met as per respective chapters. However for the power cables, the minimum conductor size shall be 6 sq.mm. for aluminium conductor and 2.5 sq.mm. for copper conductor cable.
2.01.11	Conscious exceptions to the above guidelines may be accepted under special conditions but suitable measures should be taken at such location to: • Meet all safety requirements • Safeguard against fire hazards, mechanical damage, flooding of water, oil accumulation, electrical faults/interferences, etc
3.00.00	**EQUIPMENT DESCRIPTION**
3.01.00	**Cable trays, Fittings & Accessories**
3.01.01	Cable trays shall be ladder/perforated type as specified complete with matching fittings (like brackets, elbows, bends, reducers, tees, crosses, etc.) accessories (like side coupler plates, etc. and hardware (like bolts, nuts, washers, G.I. strap, hook etc.) as required. Cable tray shall be ladder type for power & control cables and perforated for instrumentation cables.
3.01.02	Cable trays, fittings and accessories shall be fabricated out of rolled mild steel sheets free from flaws such as laminations, rolling marks, pitting etc. These (including hardware) shall be hot dip galvanized as per Clause No. 3.13.00 of this chapter.
3.01.03	Cable trays shall have standard width of 150 mm, 300 mm & 600 mm and standard lengths of 2.5 metre. Thickness of mild steel sheets used for fabrication of cable trays and fittings shall be 2 mm. The thickness of side coupler plates shall be 3 mm.
3.01.04	Cable troughs shall be required for branching out few cables from main cable route. These shall be U-shaped, fabricated of mild steel sheets of thickness 2 mm and shall be hot dip

	galvanised as per Clause No. 3.13.00 of this chapter. Troughs shall be standard width of 50 mm & 75 mm with depth of 25 mm
3.02.00	**Support System for Cable Trays**
3.02.01	Cable tray support system shall be pre-fabricated out of single sheet as per enclosed tender drawings.
3.02.02	Support system for cable trays shall essentially comprise of the two components i.e. main support channel and cantilever arms. The main support channel shall be of two types : (i) C1:- having provision of supporting cable trays on one side and (ii) C2:-having provision of supporting cable trays on both sides. The support system shall be the type described hereunder a. Cable supporting steel work for cable racks/cables shall comprise of various channel sections, cantilever arms, various brackets, clamps, floor plates, all hardwares such as lock washers, hexagon nuts, hexagon head bolt, support hooks, stud nuts, hexagon head screw, channel nut, channel nut with springs, fixing studs, etc. b. The system shall be designed such that it allows easy assembly at site by using bolting. All cable supporting steel work, hardwares fitings and accessories shall be prefabricated factory galvanised. c. The main support and cantilever arms shall be fixed at site using necessary brackets, clamps, fittings, bolts, nuts and other hardware etc. to form various arrangements required to support the cable trays. Welding of the components shall not be allowed. However, welding of the bracket (to which the main support channel is bolted) to the overhead beams, structural steel, insert plates or reinforcement bars will be permitted. Any cutting or welding of the galvansied surface shall be brushed and red lead primer, oil primer & aluminium paint shall be applied d. All steel components, accessories, fittings and hardware shall be hot dip galvanised after completing welding, cutting, drilling and other machining operation. e. The typical arrangement of flexible support system is shown in the enclosed drawings and described briefly below: The main support channel and cantilever arms shall be fabricated out of 2.5 thick rolled steel sheet conforming to IS 1079. f. Cantilever arms of 320 mm, 620mm and 750 mm in length are required, and shall be as shown in the enclosed drawing. The arm portion shall be suitable for assembling the complete arm assembly on to component constructed of standard channel section. The back plate shall allow sufficient clearance for fixing bolt to be tightened with tray in position. g. Support system shall be able to withstand • weight of the cable trays • weight of the cables (75 Kg/Metre run of each cable tray) • Concentrated load of 75 Kg between every support span. • Factor of safety of minimum 1.5 shall be considered.
3.02.03	The size of structural steel members or thickness of sheet steel of main support channel and cantilever arms and other accessories as indicated above or in the enclosed drawings are indicative only. Nevertheless, the support system shall be designed by the bidder to fully meet the requirements of type tests as specified. In case the system fails in the tests, the components design modification shall be done by the Bidder without any additional cost to

	the Employer. The bidder shall submit the detailed drawings of the system offered by him alongwith the bid.
3.03.04	FOR COAL HANDLING PLANT THE FOLLOWING SHALL ALSO BE APPLICABLE**:**
	a) All overhead cable routes shall be along the route of the conveyor gallery on separate supporting structures and cables shall be laid in vertical trays. The bottom of the steel shall be such that the existing facilities, movement of trucks/human beings etc. does not get affected. The cable trestle shall have a minimum 600mm clear walk way and shall have maintenance platforms as required. The bottom of the steel supporting structure shall be generally at 3.0M above the grade level except for rail/road crossings where it shall be at 8.0M above grade level. Tap offs from the overhead cable trestle can be through shallow trenches with prior approval of the Employer. Directly buried cable, if essential, shall not have concentration of more than 4 cables on one route.
	b) Cable trenches shall be provided only in Switchgear/MCC rooms.
	c) Cables shall not be routed through the conveyor galleries except for the equipment located in the conveyor galleries for a particular conveyor i.e. protection switches, receptacles etc.
	d) Cables for PCS and BSS shall be routed along the conveyors through GI conduits.
3.04.00	**Pipes, Fittings & Accessories**
3.03.01	Pipes offered shall be complete with fittings and accessories (like tees, elbows, bends, check nuts, bushings, reducers, enlargers, coupling caps, nipples etc.) The size of the pipe shall be selected on the basis of maximum 40% fill criteria
3.03.02	GI Pipes shall be of medium duty as per IS: 1239
3.03.03	Duct banks shall be High Density PE pipes encased in PCC (10% spare of each size, subject to minimum one) with suitable water-proof manholes.
3.03.04	Hume pipes shall be NP3 type as per IS 458.
3.04.00	**Junction Boxes**
3.04.01	Junction box shall be made of Fire retardant material. Material of JB shall be Thermoplastic or thermosetting or FRP type. The box shall be provided with the terminal blocks, mounting bracket and screws etc. The cable entry shall be through galvanized steel conduits of suitable diameter. The JB shall have suitable for installing glands of suitable size on the bottom of the box. The JB shall be suitable for surface mounting on ceiling/structures. The JB shall be of grey color RAL 7035. All the metal parts shall be corrosion protected. Junction box surface should be such that it is free from crazings, blisterings, wrinkling, colour blots/striations. There should not be any mending or repair of surface. JB's will be provided with captive screws so that screws don't fall off when cover is opened. JB's mounting brackets should be of powder coated MS. Type test reports for the following tests shall be furnished:-
	(a) Impact resistance for impact energy of 2 Joules (IK07)as per BS EN50102
	(b) Thermal ageing at 70deg C for 96 hours as per IEC60068-2-2Bb.
	(c) Class of protection shall be IP 55.

(d) HV test.

3.04.02 Terminal blocks shall be 1100V grade, of suitable current rating, made up of unbreakable polyamide 6.6 grade. The terminals shall be screw type or screw-less (spring loaded) / cage clamp type with lugs. Marking on terminal strips shall correspond to the terminal numbering in wiring diagrams. All metal parts shall be of non-ferrous material. In case of screw type terminals the screw shall be captive, preferably with screw locking design. All terminal blocks shall be suitable for terminating on each side the required cables/wire size. All internal wiring shall be of cu. Conductor PVC wire.

3.05.00 **Terminations & Straight Through Joints**

3.05.01 Termination and jointing kits for 33kV, 11 kV, 6.6 KV and 3.3 kV grade XLPE insulated cables shall be of proven design and make which have already been extensively used and type tested. Termination kits and jointing kits shall be Pre-moulded type or heat shrinkable type. Further Cold shrinkable type termination and jointing kits are also acceptable. The Cold shrinkable type kits shall be type tested as per relevant standards. Calculation to withstand the required fault level shall also be furnished in case of cold shrinkable type kits. 33 kV, 11 kV, 6.6 KV and 3.3kV grade joints and terminations shall be type tested and Type test reports as per IS:13573 Part-II and IEC60502 shall be furnished. Also, heat shrink material shall comply with requirements of ESI 09-13 (external tests). Critical components used in cable accessories shall be of tested and proven quality as per relevant product specification/ESI specification. Cable joints and terminations should be with FRLS properties as per IEC 60754-1&2. Kit contents shall be supplied from the same source as were used for type testing. The kit shall be complete with the tinned copper solderless crimping type cable lugs & ferrule or mechanical connectors (wherein bolts are tightened that shear off at an appropriate torque) as per DIN standard suitable for aluminium compacted conductor cables. (Tender drg. no 0000-211-POE –A-51-RA of cable lug attached at the end of this chapter)..

3.05.02 Straight through joint and termination shall be capable of withstanding the fault level of 21 KA for 0.12 Sec. with dynamic peak of 52 KA for 33 KV system & of 40 kA for 0.12 sec with a dynamic peak of 100 kA for 11 kV, 6.6 KV & 3.3 KV system. Straight through joints shall have provisions for shield connection and earthing wherever required and complete with all accessories and consumables suitable for storage without deterioration at a temperature of 50 deg. C with shelf life of more than five years. 1.1 kV grade straight through joints shall also be of proven design

3.05.03 1.1 KV grade Straight Through Joint shall be of proven design.

3.06.00 **Cable glands**

3.06.01 Cable shall be terminated using double compression type cable glands. Testing requirements of Cable glands shall conform to BS:6121 and gland shall be of robust construction capable of clamping cable and cable armour (for armoured cables) firmly without injury to insulation. Cable glands shall be made of heavy duty brass machine finished and nickel chrome plated. Thickness of plating shall not be less than 10 micron. All washers and hardware shall also be made of brass with nickel chrome plating Rubber components shall be of neoprene or better synthetic material and of tested quality. Cable glands shall be suitable for the sizes of cable supplied/erected.

3.07.00 Cable lugs/ferrules

3.07.01 Cable lugs/ferrules for power cables shall be tinned copper solderless crimping type suitable for aluminium compacted conductor cables. Cable lugs and ferrules for control cables shall be tinned copper type. The cable lugs for control cables shall be provided with insulating

sleeve and shall suit the type of terminals provided on the equipments. Cable lugs and ferrule shall conform to DIN standards.

3.08.00 **Trefoil clamps**

3.08.01 Trefoil clamps for single core cables shall be pressure die cast aluminum or fibre glass or nylon and shall include necessary fixing accessories like G.I. nuts, bolts, washers, etc. Trefoil clamps shall have adequate mechanical strength to withstand the forces generated by the peak value of maximum system short circuit current.

3.09.00 **Cable Clamps & Ties**

3.09.01 The cable clamps/ties required to clamp multicore cables shall be of SS-316 material, 12mm wide, polyster coated ladder lock type. The clamps/ties shall have self locking arrangement & shall have sufficient strength. The cable clamps/ties shall be supplied in finished individual pieces of suitable length to meet the site requirements.

3.10.00 **Receptacles**

3.10.01 Receptacles boxes shall be fabricated out of MS sheet of 2mm thickness and hot dipped gavanised or of die-cast aluminium alloy of thickness not less than 2.5 mm. The boxes shall be provided with two nos. earthing terminals, gasket to achieve IP55 degree of protection, terminal blocks for loop-in loop-out for cable of specified sizes, mounting brackets suitable for surface mounting on wall/column/structure, gland plate etc. The ON-OFF switch shall be rotary type heavy duty, double break,AC23 category, suitable for AC supply. Plug and Socket shall be shrouded Die-cast aluminium. Socket shall be provided with lid safety cover. Robust mechanical interlock shall be provided such that the switch can be put ON only when the plug is fully engaged and plug can be withdrawn only when the switch is in OFF position. Also cover can be opened only when the switch is in OFF position. Wiring shall be carried out with 1100 V grade PVC insulated stranded aluminium/copper wire of adequate size. The Terminal blocks shall be of 1100 V grade. The Terminal blocks shall be of 1100 V grade made up of unbreakable polymide 6.6 grade with adequate current rating and size. The welding receptacles shall be provided with inbuilt ELCB rated for suitable adjustable mA sensitivity ranging from 30-300 mA

3.12.00 **Cable Drum Lifting Jack**

The jack for cable drum lifting shall be of screw type with 10 ton capacity. The cable drum jacks shall be manufactured from fabricated steel. The spindles supplied with the cable drum jack shall be manufactured using BSEN-24 grade steel bar with locking collars. Jack nests shall be of SG cast steel. Cable drum jack supplied shall have undergone load testing and reports for the same shall be submitted. At least Two Nos. of jacks shall be supplied for NTPC use. Contractor has to make arrangements for his own jacks for cable reeling/unreeling under his scope of installation.

3.13.00 **Galvanising**

3.13.01 Galvanising of steel components and accessories shall conform to IS:2629 , IS4759 & IS:2633. Additionally galvanising shall be uniform, clean smooth, continuous and free from acid spots.

3.13.02 The amount of zinc deposit over threaded portion of bolts, nuts, screws and washers shall be as per IS:1367 . The removal of extra zinc on threaded portion of components shall be carefully done to ensure that the threads shall have the required zinc coating on them as specified

3.14.00	**Welding**
3.14.01	The welding shall be carried out in accordance with IS:9595. All welding procedures and welders qualification shall also be followed strictly in line with IS:9595
4.00.00	**INSTALLATION**
4.01.00	**Cable tray and Support System Installation**
4.01.01	Cables shall run in cable trays mounted horizontally or vertically on cable tray support system which in turn shall be supported from floor, ceiling, overhead structures, trestles, pipe racks, trenches or other building structures.
4.01.02	Horizontally running cable trays shall be clamped by bolting to cantilever arms and vertically running cable trays shall be bolted to main support channel by suitable bracket/clamps on both top and bottom side rails at an interval of 2000 mm in general. For vertical cable risers/shafts cable trays shall be supported at an interval of 1000mm in general. Fixing of cable trays to cantilever arms or main support channel by welding shall not be accepted. Cable tray installation shall generally be carried out as per the approved guidelines/ drawings. Vendor shall design the support system along with tray, spacing etc in line with tray loadings/drawings.
4.01.03	The cantilever arms shall be positioned on the main support channel with a minimum vertical spacing of 300 mm unless otherwise indicated.
4.01.04	The contractor shall fix the brackets/ clamps/ insert plates using anchor fasteners. Minimum size of anchor fasteners shall be M 8 X 50 and material shall be stainless steel grade 316 or better. Anchor fastener shall be fixed as recommended by manufacturer and as approved by site engineer. For brick wall suitable anchor fasteners shall be used as per the recommendations of manufacturer. Make of anchor fasteners subject to QA approval and the same shall be finalized at pre-award stage.
4.01.05	All cable way sections shall have identification, designations as per cable way layout drawings and painted/stenciled at each end of cable way and where there is a branch connection to another cable way. Minimum height of letter shall be not less than 75 mm. For long lengths of trays, the identification shall be painted at every 10 meter. Risers shall additionally be painted/stenciled with identification numbers at every floor.
4.01.06	In certain cases it may be necessary to site fabricate portions of trays, supports and other non standard bends where the normal prefabricated trays, supports and accessories may not be suitable. Fabricated sections of trays, supports and accessories to make the installation complete at site shall be neat in appearance and shall match with the prefabricated sections in the dimensions. They shall be applied with one coat of red lead primer, one coat of oil primer followed by two finishing coats of aluminium paint.
4.02.00	**Conduits/Pipes/Ducts Installation**
4.02.01	The Contractor shall ensure for properly embedding conduit pipe sleeves wherever necessary for cabling work. All openings in the floor/roof/wall / cable tunnel/cable trenches made for conduit installation shall be sealed and made water proof by the Contractor.
4.02.02	GI pull wire of adequate size shall be laid in all conduits before installation. Metallic conduit runs at termination shall have two lock nuts wherever required for junction boxes etc.
4.02.03	Conduit runs/sleeves shall be provided with PVC bushings having round edge at each end. All conduits/pipes shall have their ends closed by caps until cables are pulled. After cables are pulled, the ends of conduits/pipes shall be sealed with Glass wool/Cement Mortar/Putty to prevent entrance of moisture and foreign material

4.02.04 Exposed conduit/pipe shall be adequately supported by racks, clamps, straps or by other approved means. Conduits /pipe support shall be installed square and true to line and grade with an average spacing between the supports as given below, unless specified otherwise

Conduit /pipe size (dia).	**Spacing**
Upto 40 mm	1 M
50 mm	2.0 M
65-85 mm	2.5 M
100 mm and above	3.0 M

4.02.05 For bending of conduits, bending machine shall be arranged at site by the contractor to facilitate cold bending. The bends formed shall be smooth.

4.03.00 **Junction Boxes Installation**

4.03.01 Junction boxes shall be mounted at a height of 1200mm above floor level or as specified in the drawings and shall be adequately supported/mounted on masonry wall by means of anchor fasteners/ expandable bolts or shall be mounted on an angle, plate or other structural supports fixed to floor, wall, ceiling or equipment foundations.

4.04.00 **Cable Installation**

4.04.01 Cable installation shall be carried out as per IS:1255 and other applicable standards.

4.04.02 For Cable unloading, pulling etc following guidelines shall be followed in general:

a) Cable drums shall be unloaded, handled and stored in an approved manner on hard and well drained surface so that they may not sink. In no case shall be drum be stored flat i.e. with flange horizontal. Rolling of drums shall be avoided as far as possible. For short distances, the drums may be rolled provided they are rolled slowly and in proper direction as marked on the drum. In absence of any indication, the drums may be rolled in the same direction as it was rolled during taking up the cables. For unreeling the cable, the drum shall be mounted on suitable jacks or on cable wheels and shall be rolled slowly so that cable comes out over the drum and not from below. All possible care shall be taken during unreeling and laying to avoid damage due to twist, kink or sharp bends. Cable ends shall be provided with sealed plastic caps to prevent damage and ingress of moisture.

b) While laying cable, ground rollers shall be used at every 2 meter interval to avoid cable touching ground. The cables shall be pushed over the rollers by a gang of people positioned in between the rollers. Cables shall not be pulled from the end without having intermediate pushing arrangements. Pulling tension shall not exceed the values recommended by cable manufacturer. Selection of cable drums for each run shall be so planned so as to avoid using straight through joints. Care should be taken while laying the cables so as to avoid damage to cables. If any particular cable is damaged, the same shall be repaired or changed to the satisfaction of Project Manager.

4.04.03 Cables shall be laid on cable trays strictly in line with cable schedule . Where specific cable layouts are not shown on drawings, Contractor shall route these as directed by the Project Manager

4.04.04	Power and control cables shall be laid on separate tiers inline with the approved guidelines/drawings. The laying of different voltage grade cables shall be on different tiers according to the voltage grade of the cables. In horizontal tray stacks, H.T. cables shall be laid on top most tier and cables of subsequent lower voltage grades on lower tiers of trays. Single core cable in trefoil formation shall be laid with a distance of four times the diameter of cable between trefoil center lines and clamped at every two metre. All multicore cables shall be laid in touching formation. Power and control cables shall be secured fixed to trays/support with cable clamps/ties with self locking arrangement. For horizontal trays arrangements, multicore power cables and control cables shall be secured at every five meter interval. For vertical tray arrangement, individual multicore power cables and control cables shall be secured at every one meter. After completion of cable laying work in the particular vertical tray, all the control cables shall be binded to trays/supports by cable clamps/ties with self locking arrangement at every five meter interval and at every bend. Fibre Optical cable shall be laid in trenches/trays or as decided by Employer.
4.04.05	Bending radii for cables shall be as per manufacturer's recommendations and IS:1255.
4.04.06	Where cables cross roads/rail tracks, the cables shall be laid in hume pipe/ HDPE pipe.
4.04.07	No joints shall be allowed in trip circuits, protection circuits and CT/PT circuits. Also joints in critical equipment in main plant area shall not be permitted. Vendor shall identify and accordingly procure the cable drum length.
4.04.08	In each cable run some extra length shall be kept at suitable point to enable one LT/two HT straight through joints to made, should the cable develop fault at a later stage. Control cable termination inside equipment enclosure shall have sufficient lengths so that shifting of termination in terminal blocks can be done without requiring any splicing.
4.04.09	Wherever few cables are branching out from main trunk route troughs shall be used.
4.04.10	Wind loading shall be considered for designing support as well Cable trays wherever required.
4.04.11	Where there is a considerable risk of steam, hot oil or mechanical damage cable routes shall be protected by barriers or enclosures.
4.04.12	The installation work shall be carried out in a neat workman like manner & areas of work shall be cleaned of all scraps, water, etc. after the completion of work in each area every day. Contractor shall replace RCC/Steel trench covers after the Installation work in that particular area is completed or when further work is not likely to be taken up for some time.
4.04.13	**Separation** At least 300mm clearance shall be provided between: - HT power & LT power cables, - LT power & LT control/instrumentation cables,
4.04.14	**Segregation** 1) Segregation means physical isolation to prevent fire jumping. 2) All cables associated with the unit shall be segregated from cables of other units. 3) Interplant cables of station auxiliaries and unit critical drives shall be segregated in such a way that not more than half of the drives are lost in case of single incident of fire. Power and control cables for AC drives and corresponding emergency AC or

DC drives shall be laid in segregated routes. Cable routes for one set of auxiliaries of same unit shall be segregated from the other set.

4) In switchyard, control cables of each bay shall be laid on separate racks/trays.

4.04.15 Minimum number of spare cores required to be left for interconnection in control cables shall be as follows:

Minimum number of spare cores required to be left for interconnection in control cables shall be as follows:

No. of cores in cable	No. of spare cores
2C,3C	NIL
5C	1
7C-10C	2
14C and above	3

4.04.16 **Directly Buried Cables**

a) Cable trenches shall be constructed for directly buried cables. Construction of cable trench for cables shall include excavation, preparation of sieved sand bedding, riddled soil cover, supply and installation of brick or concrete protective covers, back filling and compacting, supply and installation of route markers and joint markers. Laying of cables and providing protective covering shall be as per IS:1255 and the enclosed drawings showing cabling details.

b) RCC cable route and RCC joint markers shall be provided wherever required. The voltage grade of the higher voltage cables in route shall be engraved on the marker. Location of underground cable joints shall be indicated with cable marker with an additional inscription "Cable Joint". The marker shall project 150 mm above ground and shall be spaced at an interval of 30 meters and at every change in direction. They shall be located on both sides of road crossings and drain crossings. Top of cable marker/joint marker shall be sloped to avoid accumulation of water/dust on marker.

4.04.17 Cable tags shall be provided on all cables at each end (just before entering the equipment enclosure), on both sides of a wall or floor crossing, on each duct/conduit entry, and at every 20 meters in cable tray/trench runs. Cable tags shall also be provided inside the switchgear, motor control centers, control and relay panels etc. where a number of cables enter together through a gland plate. Cable tag shall be of rectangular shape for power cables and control cables. Cable tag shall be of 2 mm thick aluminum with number punched on it and securely attached to the cable by not less than two turns of 20 SWG GI wire conforming to IS:280. Alternatively, the Contractor may also provide cable tags made of nylon, cable marking ties with cable number heat stamped on the cable tags. The cable tag requirements mentioned above shall prevail over Tag requirements mentioned elsewhere in this document for HT power, LT power & control cables.

4.04.18 While crossing the floors, unarmoured cables shall be protected in conduits upto a height of 500 mm from floor level if not laid in tray.

4.05.00 **Cable Terminations & Connections**

4.05.01 The termination and connection of cables shall be done strictly in accordance with cable termination kit manufacturer" instructions, drawings and/or as directed by Project Manager. Cable jointer shall be qualified to carryout satisfactory cable jointing/termination. Contractor

	shall furnish for review documentary evidence/experience reports of the jointers to be deployed at site.
4.05.02	Work shall include all clamps, fittings etc. and clamping, fitting, fixing, plumbing, soldering, drilling, cutting, taping, preparation of cable end, crimping of lug, insulated sleeving over control cable lugs, heat shrinking (where applicable), connecting to cable terminal, shorting and grounding as required to complete the job to the satisfaction of the Project Manager.
4.05.03	The equipment will be generally provided with undrilled gland plates for cables/conduit entry. The Contractor shall be responsible for punching of gland plates, painting and touching up. Holes shall not be made by gas cutting. The holes shall be true in shape. All cable entry points shall be sealed and made vermin and dust proof. Unused openings shall be effectively sealed by 2mm thick aluminium sheets.
4.05.04	Control cable cores entering control panel/switchgear/MCC/miscellaneous panels shall be neatly bunched, clamped and tied with self locking type nylon cable ties with de interlocking facility to keep them in position.
4.05.05	All the cores of the control cable to be terminated shall have identification by providing ferrules at either end of the core, each ferrule shall be indelible, printed single tube ferrule and shall include the complete wire number and TB number as per the drawings. The ferrule shall fit tightly on the core. Spare cores shall have similar ferrules with suffix sp1, sp2, ---etc along with cable numbers and coiled up after end sealing.
4.05.06	All cable terminations shall be appropriately tightened to ensure secure and reliable connections.
5.00.00	
5.01.00	
5.02.00	
5.03.00	
5.04.00	

		QUALITY PLAN	CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01			SPECIFICATION TITLE			
		SHEET 1 OF 2	SYSTEM			ITEM AC ELECT. MOTORS BELOW 55KW (LV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	2	-	-	
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	2	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	2	-	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUFR'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	IS-325/ BHEL SPEC./ DATA SHEET	SAME AS COL.7	TEST REPORT	2	1		NOTE -1 & NOTE-3
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	-	NOTE -1 & NOTE-3

BHEL	**PARTICULARS**	**BIDDER/VENDOR**
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	SIGNATURE	

	QUALITY PLAN	CUSTOMER :		PROJECT TITLE			SPECIFICATION : NUMBER :			
		BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01			SPECIFICATION : TITLE :			
	SHEET 2 OF 2	SYSTEM		ITEM AC ELECT. MOTORS BELOW 55KW (LV)			SECTION VOLUME III			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2	1	-	

NOTES:

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

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

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

Legends for Inspection agency

1. BHEL/CUSTOMER
2. VENDOR (MOTOR MANUFACTURER)
3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)

P. PERFORM
W. WITNESS
V. VERIFY

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

		QUALITY PLAN	CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
		SHEET 1 OF 9	SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.0	RAW MATERIAL & BOUGHT OUT CONTROL											
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-	FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	-DO-	3	-	-	
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	-DO-	-DO-	-DO-	INSPEC. REPORT	3	-	2	
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, UN-EVENNESS ETC.	-DO-	3	-	-	
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	MANFR'S DRG./SPEC BOOK	RELEVENT IS/SPEC.	SUPPLIERS TC & LOG	3	-	2	PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR
1.3	CASTING	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK	3	-	2	
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	MANFR'S DRG./SPEC	RELEVENT IS/	SUPPLIER'S TC	3	-	2	HEAT NO. SHALL BE VERIFIED
		3.DIMENSIONS	MA	MEASUREMENT	100%	MANUFR'S DRG.	MANUFR'S DRG.	LOG BOOK	3	-	2	
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	LOG BOOK	3	-	2	
BHEL			**PARTICULARS**		**BIDDER/VENDOR**							
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ : VENDOR			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 2 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**			**11**
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MFG. DRG. SPEC.	RELEVANT IS	SUPPLIER'S TC	3	-	2	
		3. DIMENSIONS	MA	MEASUREMENT	100%	-DO-	MANUFR'S DRG.	LOG BOOK	3	-	2	
		4.INTERNAL FLAWS	CR	UT	-DO-	ASTM-A388	MANUFR'S SPEC. BHEL SPEC.	-DO-	3	2	1	FOR DIA OF 55 MM & ABOVE
1.6	SPACE HEATERS, CONNEC-TORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	-DO-	MANUFR'S DRG. SPEC.	MANUFR'S DRG. SPEC.	-DO-	3	-	2	
		2. PHYSICAL COND.	MA	-DO-	-DO-	-	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	-DO-	3	-	2	
		3.DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG./ SPEC.	MANUFR'S DRG. / SPEC.	-DO-	3	-	2	
		4.PERFORMANCE/ CALIBRATION	MA	TEST	100%	-DO-	-DO-	INSP. REPORT	3	-	2	

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
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	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ : VENDOR			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 3 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC.	MA	VISUAL	100%	-	NO VISUAL DEFECTS	INSPT. REPORT	3	-	2	
		2. OTHER CHARACTERISTICS	MA	TEST	SAMPLE	MANUF'S SPEC.	MANUF'S SPEC.	LOG BOOK AND OR SUPPLIER'S TC	3	-	2	
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND.	MA	VISUAL	100%	-	NO VISUAL DEFECTS (FREE FROM BURS)	LOG BOOK	3	-	-	
		2.DIMENSIONS INCLUDING BURS HEIGHT	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG. .	MANUFR'S DRG.	-DO-	3	-	2	FOR MV MOTOR INSULA-TION/VARNISH THICKNESS SHALL BE MORE THAN THE BURS HEIGHT
		3. ACCEPTANCE TESTS	MA	ELECT. & MECH TESTS	-DO-	MANUF'S SPEC./ RELEVANT IS	RELEVANT IS	SUPPLIER'S TC	3	-	2	
1.9	CONDUCTORS	1. SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	LOG BOOK	3*	-	2*	* MOTOR MANUFACTURER TO CONDUCT VISUAL CHECK FOR SURFACE FINISH ON RANDOM BASIS (10% SAMPLE) AT HIS WORKS AND MAINTAIN RECORD FOR VERIFICATION BY BHEL/CUSTOMER.
		2.ELECT. PROP, & MECH. PROP	MA	ELECT. & MECH.TEST	SAMPLES	RELEVANT IS/ BS OR OTHER STANDARDS	RELEVANT IS/ BS OR OTHER STANDARDS	SUPPLIERS TC & VENDOR'S INSPN. REPORTS	3	-	2	

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

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ : VENDOR			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 4 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
		3.DIMENSIONS	MA	MEASUREMENT	-DO-	-DO-	-DO-	Log Book	3	-	2	
1.10	BEARINGS	1.MAKE & TYPE	MA	VISUAL	100%	MANFR'S DRG./ APPROVED DATASHEET	MANFR'S DRG./ APPROVED DATASHEET	-DO-	3	-	2	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	BHEL DATA SHEET	BHEL DATA SHEET BEARING MANUF'S CATALOGUES	-DO-	3	-	2	
		3.SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	2	
1.11	SLIP RING (WHEREVER APPLICABLE)	1.SURFACE COND.	MA	VISUAL	100%	-	-DO-	-DO-	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
		3.TEMP.WITH-STAND CAPACITY	MA	ELECT.TEST	-DO-	MANUF'S SPEC./ BHEL SPEC.	MANUF'S SPEC./ BHEL SPEC.	-DO-	3	-	2	
		4.HV/IR	MA	-DO-	100%	-DO-	-DO-	-DO-	3	-	2	
1.12	OIL SEALS & GASKETS	1.MATERIAL OF GASKET	MA	VISUAL	100%	MANUF'S DRG/SPECS	MANUF'S DRG./ SPECS.	-DO-	3	-	-	
		2.SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
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	QUALITY PLAN	CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
		BIDDER/ : VENDOR			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 5 OF 9	SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
2.0	IN PROCESS											
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNESS	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	3/2	2	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	2	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
		3.SHAFT SURFACE FLOWS	MA	PT	-DO-	RELEVENT SPEC./ ASTM-E165	MANUFR'S SPEC./ BHEL SPEC./	-DO-	2	-	1	
2.3	PAINTING	1.SURFACE PREPARATION	MA	VISUAL	100%	MANFR'S SPEC/BHEL SPEC./ RELEVANT STAND	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-DO-	-DO-	-DO-	2	-	-	
		3.SHADE	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	-DO-	-DO-	-DO-	Log Book	2	-	-	

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
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	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ : VENDOR			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 6 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**			**11**
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	MANUFR'S SPEC.	MANUFR'S SPEC.	Log Book	2	-	-	
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-DO-	-DO-	Log Book	2	-	-	
		3.CORE LOSS & HOTSPOT	MA	ELECT.TEST	-DO-	-DO-	-DO-	Log Book	2	1*	1	(FOR MOTORS OF 2MW AND ABOVE) * ON 10% RANDOM SAMPLE
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	MANUFR'S SPEC./BHEL SPEC.	MANUFR'S SPEC./BHEL SPEC.	Log Book	2	-	-	
		2.CLEANLINESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.IR-HV-IR	CR	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2	-	1	
		4.RESISTANCE	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
		5.INTERTURN INSULATION	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		6.SURGE WITH STAND AND TAN. DELTA TEST	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	FOR MV MOTOR
2.6	IMPREGNATION	1.VISCOSCITY	MA	PHY. TEST	AT STARTING	-DO-	-DO-	Log Book	2	-	-	
		2.TEMP. PRESSURE VACCUM	MA	PROCESS CHECK	CONTINUOUS	-DO-	-DO-	Log Book	2	-	-	
		3.NO. OF DIPS	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	THREE DIPS TO BE GIVEN

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	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ : VENDOR			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 7 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	**W**	**V**	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**			**11**
		4.DURATION	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
2.7	COMPLETE STATOR ASSEMBLY	1.COMPACTNESS & CLEANLINESS	MA	VISUAL	100%	-DO-	-DO-	Log Book	2	-	-	
2.8	BRAZING/COMPRESSION JOINT	1.COMPLETENESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.SOUNDNESS	CR	MALLET TEST & UT	-DO-	-DO-	-DO-	Log Book	2		1	
		3.HV	MA	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2		1	
2.9	COMPLETE ROTOR ASSEMBLY	1.RESIDUAL UNBALANCE	CR	DYN. BALANCE	-DO-	MFG SPEC./ ISO 1940	MFG. DWG.	Log Book	2		1	VERIFICATION FOR MV MOTOR ONLY
		2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	-DO-	MFG. SPEC.	MFG. SPEC.	Log Book	2		1	
2.10	ASSEMBLY	1.ALIGNMENT	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.WORKMANSHIP	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.AXIAL PLAY	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	1	
		4.DIMENSIONS	MA	-DO-	-DO-	MFG.DRG./ MFG SPEC.	MFG. DRG/ RELEVANT IS	Log Book	2	-	-	
		5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2	-	-	
		6. RTD, BTD & SPACE HEATER MOUNTING.	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2		1	

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
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	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 8 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC.	MA	ELECT.TEST	1/TYPE/SIZE	IS-325/ BHEL SPEC./ DATA SHEET	IS-325/ BHEL SPEC./ DATA SHEET	TEST REPORT	2	1*	1	* NOTE - 1
		2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1$	1	$ NOTE - 2
		3.VIBRATION & NOISE LEVEL	MA	-DO-	100%	IS-12075 & IS-12065	IS-12075 & IS-12065	-DO-	2	1$	1	$ NOTE - 2
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPC. REPORT	2	1	-	
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	RELEVANT IS	BHEL SPEC. AND DATA SHEET	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		6. MEASUREMENT OF RESISTANCE OF RTD & BTD	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1$	1	$ NOTE - 2
		7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1$	1	$ NOTE - 2
		8. NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPC. REPORT	2	1$	1	$ NOTE - 2
		9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	IS-3682 IS-8239 IS-8240	IS-3682 IS-8239 IS-8240	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	2	1$	1	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY $ NOTE - 2

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

	QUALITY PLAN	CUSTOMER :	PROJECT TITLE	SPECIFICATION : NUMBER :	
		BIDDER/ : VENDOR	QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03	SPECIFICATION : TITLE	
	SHEET 9 OF 9	SYSTEM	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)	SECTION	VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11

NOTES:

1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED.

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

3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED.

4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.

Legends for Inspection agency

1. BHEL/CUSTOMER
2. VENDOR (MOTOR MANUFACTURER)
3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)

P. PERFORM
W. WITNESS
V. VERIFY

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

MOTOR

TESTS/CHECKS / TEMS/COMPONENTS	Visual	Dimensional	Make/Type/Rating /General Physical Inspection	Mech/Chem. Properties	NDT /DP/MPI/UT	Metallography	Electrical Characteristics	Welding/Brazing(WPS/PQR)	Heat Treatment
Plates for stator frame, end shield, spider etc.	Y	Y	Y	Y	Y				Y
Shaft	Y	Y	Y	Y	Y	Y			Y
Magnetic Material	Y	Y	Y	Y			Y		
Rotor Copper/Aluminium	Y	Y	Y	Y			Y		Y
Stator copper	Y	Y	Y	Y			Y		Y
SC Ring	Y	Y	Y	Y	Y		Y	Y	Y
Insulating Material	Y		Y	Y			Y		
Tubes, for Cooler	Y	Y	Y	Y	Y				Y
Sleeve Bearing	Y	Y	Y	Y	Y				Y
Stator/Rotor, Exciter Coils	Y	Y	Y				Y	Y	
Castings, stator frame, terminal box and bearing housing etc.	Y	Y	Y	Y	Y			Y	
Fabrication & machining of stator, rotor, terminal box	Y	Y			Y			Y	Y
Wound stator	Y	Y					Y	Y	
Wound Exciter	Y	Y					Y	Y	
Rotor complete	Y	Y					Y		
Exciter, Stator, Rotor, Terminal Box assembly	Y	Y					Y		
Accessories, RTD, BTD,CT, Space heater, antifriction bearing, gaskets etc.	Y	Y	Y						
Complete Motor	Y	Y	Y						

Note:
1. This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed along with relevant supporting documents during QP finalization. However, No QP for LT motor upto 50KW.
2. Additional routine tests for Flame proof motors shall be applicable as per relevant standard
3. Makes of major bought out items for HT motors will be subject to NTPC approval.

Y1 = for HT Motor / Machines only.

MOTOR

TESTS/CHECKS / ITEMS/ COMPONENTS	Magnetic Characteristics	Hydraulic/Leak/Pressure Test	Thermal Characteristics	Run out	Dynamic Balancing	Routine & Acceptance tests as per IS-325/IS-4722 /IS- 9283/IS 2148/IEC60034\IEC 60079-I	vibration	Over speed	Tan delta, shaft voltage & polarization index test	Paint shade, thickness & adhesion
Plates for stator frame, end shield, spider etc.										
Shaft										
Magnetic Material	Y		Y							
Rotor Copper/Aluminium										
Stator copper			Y							
SC Ring										
Insulating Material			Y							
Tubes for Cooler		Y								
Sleeve Bearing		Y								
Stator/Rotor, Exciter Coils										
Castings, stator frame, terminal box and bearing housing etc.										
Fabrication & machining of stator, rotor, terminal box										
Wound stator										
Wound Exciter										
Rotor complete				Y	Y					
Exciter, Stator, Rotor, Terminal Box assembly										
Accessories, RTD, BTD,CT, , Space heater, antifriction bearing, gaskets etc.										
Complete Motor						Y	Y	Y	Y1	Y

Note: 1. This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed along with relevant supporting documents during QP finalization. However, No QP for LT motor upto 50KW.

2. Additional routine tests for Flame proof motors shall be applicable as per relevant standard

3. Makes of major bought out items for HT motors will be subject to NTPC approval.

Y1 = for HT Motor / Machines only.

	TITLE	SPECIFICATION NO.
	LV MOTORS	VOLUME II B
		SECTION D
	DATA SHEET-A	REV NO. 00 DATE 30.05.2018
		SHEET 1 OF 1

1.0	Design ambient temperature	:	50 °C
2.0	Maximum acceptable kW rating of LV motor	:	≤200KW
3.0	Installation (Indoors/ Outdoors)	:	As required
4.0	Degree Of Protection (Indoor/Outdoor)	:	IP54/IP55
5.0	Type of Cooling	:	TEFC/CACA/TETV
6.0	Details of supply system		
	a) Rated voltage (with variation)	:	415V ± 10%
	b) Rated frequency (with variation)	:	50 Hz (Variation: +3% TO –5%)
	c) Combined voltage & freq. variation	:	10%
	d) System fault level at rated voltage	:	50 kA for 1 sec
	e) Short time rating for terminal boxes		
	o 110kW & Above (Breaker controlled)	:	50 kA for 1 sec
	o Below 110kW (SFU+ Contactor controlled)	:	50 KA for 0.20 sec.
	f) LV System grounding	:	Solidly
7.0	Class of insulation	:	Refer clause 7.03.00 of Customer Motor Specification
8.0	Minimum voltage for starting (As percentage of rated voltage)	:	Refer clause 6.03.00 of Customer Motor Specification
9.0	Power cables data	:	Shall be given during Detailed engg.
10.0	Earth Conductor Size & Material	:	Shall be given during Detailed engg.
11.0	Space heater supply	:	240 V, 1Φ , 50 Hz
12.0	Rating up to which Single phase motor	:	Acceptable upto 0.20 kW
13.0	Tests	:	As per Customer motor spec. (enclosed)
14.0	Energy efficient/ Flame proof motor	:	As per Customer spec. requirement

- **Also detail Customer spec. for Motors to be referred as enclosed with the specification.**

DATASHEET C

CLAUSE NO.	Bidder's Name ……..

DE-1B	LT MOTORS	
A.	**GENERAL**	
5.	Manufacturer & Country of origin. (Shall be as per approved QA make)	
6.	Equipment driven by motor	
7.	Motor type	
8.	Quantity	
B.	**DESIGN AND PERFORMANCE DATA**	
18.	Frame size	
19.	Type of duty	
20.	Type of enclosure /Method of cooling/ Degree of	
21.	Applicable standard to which motor generally	
22.	Efficiency class as per IS 12615	
23.	(a)Whether motor is flame proof	Yes/No
	(b)If yes, the gas group to which it conforms as per IS:2148	
24.	Type of mounting	
25.	Direction of rotation as viewed from DE END	
26.	Standard continuous rating at 40 deg.C. ambient temp. as per Indian Standard (KW)	
27.	Derated rating for specified normal condition i.e. 50 deg. C ambient temperature (KW)	
28.	Maximum continuous load demand of driven	
29.	Rated Voltage (volts)	
30.	Permissible variation of :	
	a. Voltage (Volts)	
	b. Frequency (Hz)	
	c. Combined voltage and frequency	
31.	Rated speed at rated voltage and	
32.	At rated Voltage and frequency:	
	a. Full load current	

	b. No load current	
33.	Power Factor at	
	a. 100% load	
	b. NO load	
	c. Starting.	
34.	Efficiency at rated voltage and frequrecy,	
	a.100% load	
	b. 75% load	
	c. 50% load	
35.	Starting current (amps) at	
	a. 100 % voltage	
	b. 85% voltage	
	c. 80% voltage	
36.	Minimum permissible starting Voltage (Volts)	
37.	Starting time with minimum permissible voltage	
	a. Without driven equipment coupled	
	b. With driven equipment coupled	
38.	Safe stall time with 100% and 110% of rated	
	a. From hot condition	
	b. From cold condition	
39.	Torques :	
	a. Starting torque at min. permissible voltage(kg-	
	b. Pull up torque at rated voltage.	
	c. Pull out torque	
	d. Min accelerating torque (kg.m) available	
	e.Rated torque (kg.m)	
40.	Stator winding resistance per phase (ohms at 20	
41.	GD^2 value of motors	

42.	No of permissible successive starts when motor is in hot condition	
43.	Locked Rotor KVA Input	
44.	Locked Rotor KVA/KW	
45.	Vibration limit :Velocity (mm/s)	
46.	Noise level limit (dBA)	
C.	**CONSTRUCTIONAL FEATURES**	
1.	Stator winding insulation	
	a. Class & Type	
	b. Winding Insulation Process	
	c. Tropicalised (Yes/No)	
	d. Temperature rise over specified maximum ambient temperature of 50 deg C	
	e. Method of temperature measurement	
	f. Stator winding connection	
2.	Main Terminal Box	
	a. Type	
	b. Location(viewed from NDE side)	
	c. Entry of cables(bottom/side)	
	d. Recommended cable size(To be matched with cable size envisaged by owner)	
	e. Fault level (MVA),Fault level duration(sec)	
	f. Cable glands & lugs details (shall be suitable for	
3.	Type of DE/NDE Bearing	
4.	Motor Paint shade	
5.	Weight of	
	a. Motor stator (KG)	
	b. Motor Rotor (KG)	
	c. Total weight (KG)	
D.	**List of accessories.**	

1. 3.	Space Heaters (Applicable for 30 KW & above motor) (Nos./Power in watts/supply voltage)	
2.	Terminal Box for Space Heater (Yes/No)	
3.	Speed switch (Yes/No)	
4.	Insulation of bearing (Yes/No)	
5.	Noise reducer(Yes/No)	
6.	Grounding pads	
	i) No and size on motor body	
	ii) Nos on terminal Box	
7.	Vibration pads	
	i) Nos and size	
	ii) Location	
8.	Any other fitments	
E.	**List of curves.**	
1.	Torque speed characteristic of the motor	
2.	Thermal withstand characteristic	
3.	Starting. current Vs. Time	
4.	Starting. current Vs speed	
5.	P.F. and Effi. Vs Load	
F.	**Additional Data to be filled for each rating of DC Motor**	
1.	Rated armature voltage (Volt)	
2.	Rated field excitation (Amp)	
3.	Permissible % variation in voltage	
4.	Minimum Permissible Starting voltage (volt)	
5.	At rated voltage	
	i)Full load Armature current.(Amp)	
	ii)Full load Field current (Amp)	

	iii)No load Armature current (Amp)	
6.	Full load Field current (Amp)	
7.	No load Aramature current (Amp)	
8.	Minimum permissible field current(Amp) to avoid	
	i) Maximum permissible voltage	
	ii) Rated voltage	
	iii) Minimum Permissible Voltage	
9.	Resistance (indicative Values) in ohm	
	i)Armature winding(Arm + IP + Series) at 25	
	ii) Field Winding at 25 deg. C	
10..	Inductance (indicative values)	
	i) Armature winding	
	ii) Field winding	
11	Value of trimmer resistance (ohm) to be connected in series with the shunt field to	
	i) 220 V DC	
	ii) 250 V DC	
	iii) 187 V DC	
12	Value of the external resistance (ohm)required to be connected in series with armature during starting only	
13	Technical data sheet for external resistance box	
14	GA drawing of motor	
15	Starting time calculation	
16	Starter resistance design calculation	
17	Electrical connection diagram of motor	

Vendor to refer to this list for items in their scope only(as indicated in Electrical scope sheet between BHEL & Vendor)

ANNEXURE III

एनटीपीसी NTPC	PROJECT :PATRATU STPS (3X800 MW) PACAKGE : EPC Sub Package: MOTORS & VVF Drive Panels CONTRACTOR : M/S BHEL CONT. NO. CS-9585-001-2	LIST OF ITEMS REQUIRING QP APPROVAL & ACCEPTABLE VENDOR ; CONTRACTOR-M/S BHEL	REF NO : 9585-001-QOE-R-01 REVISION NO. 00 DATE 20th April 2017

Sl. No.	ITEM	QP / INS CAT.	QP No:- 9585-001-QVE-	QP SUB. SCH.	QP APPL SCHE DULE	SUB-SUPPLIERS	PLACE	SUB-SUPPLIER APPL. STATUS AS PER NTPC	SC APPL SCHE DULE	REMARKS
1)	L T (415 V) Motors	Refer Note 1				ABB	FARIDABAD	A		UPTO 55KW
						ABB	BANGALORE	A		55KW – 200KW
						BHARAT BIJLEE	MUMBAI	A		RQP, FOR FLAME PROOF ALSO
						CGL	AHMEDNAGAR	A		FOR FLAME PROOF ALSO
						JYOTI	BARODA	A		
						KEC	BANGALORE	A		FOR FLAMEVPROOF ALSO
						KEC	HUBLI	A		UPTO 90KW; FOR FLAME PROOF ALSO
						LHP	SOLAPUR	A		UPTO 200KW
						MARATHON	KOLKATA	A		FOR FLAME PROOF ALSO
						NGEF	BANGALORE	A		UPTO 15KW
						SIEMENS	MUMBAI	A		
2)	HT MOTOR	1				BHEL	BHOPAL	A		

Deptt.

Dist-Ramgarh(Jharkhand)

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एनटीपीसी NTPC	PROJECT :PATRATU STPS (3X800 MW) PACAKGE : EPC Sub Package: MOTORS & VVF Drive Panels CONTRACTOR : M/S BHEL CONT. NO. CS-9585-001-2	LIST OF ITEMS REQUIRING QP APPROVAL & ACCEPTABLE VENDOR ; CONTRACTOR-M/S BHEL	REF NO : 9585-001-QOE-R-01 REVISION NO. 00 DATE 20th April 2017

Sl. No.	ITEM	QP / INS CAT.	QP No:- 9585-001-	QP SUB. SCH.	QP APPL SCHE DULE	SUB-SUPPLIERS	PLACE	SUB-SUPPLIER APPL. STATUS AS	SC APPL SCHE	REMARKS

NOTE 1 : FOR LT MOTORS

a) Less than 30 KW

Acceptance of Motor less than 30 KW is based on COC of the manufacturer & the contractor confirming as follows:
It is hereby confirmed that the above mentioned motor /motors was/ were manufactured taking care of NTPC specific requirements regarding ambient temp., voltage & frequency variation, hot starts, pull out torque, starting KVA/KW, temp. rise, distance between centre of stud & gland plate and tested in accordance with approved drawing /data sheets.

b) 30 KW -50KW

Acceptance of Motor rating between 30 KW & 50 KW is based on NTPC review of Routine Test inspection report as per IS 325 witnessed by main contractor along with COC of the manufacturer & the contractor confirming as follows:
It is hereby confirmed that the above mentioned motor /motors was/ were manufactured taking care of NTPC specific requirements regarding ambient temp., voltage & frequency variation, hot starts, pull out torque, starting KVA/KW, temp. rise, distance between centre of stud & gland plate, space heater and tested in accordance with approved drawing /data sheets.

c) Above 50 KW as per NTPC approved quality plan

Approval Conditions attached to above vendors-as applicable shall prevail.

General Notes:

1) Vendor list & category of the mandatory spares shall be as mentioned above.
2) For item not appearing in the above list, main contractor to approach NTPC for acceptable vendors & inspection categorization of the same.
3) NTPC Approval conditions to above identified vendors shall be adhered to. Vendor's approval conditions will be informed on specific request of Main Contractor.

NTPC

Bharat Heavy Electricals Limited ★ PS-MKTG Delhi

JATIN GAHLAWAT, BHEL

Patratu Vidyut Utpadan Nigam Limited ★ Distt-Ramgarh (Jharkhand) ★ C&M Deptt.

Vendor to refer to this list for items in their scope only(as indicated in Electrical scope sheet between BHEL & Vendor)

एनटीपीसी NTPC	PROJECT :Patratu STPP (2X660 MW) PACAKGE :EPC Sub Package: Electrical Equipment Supply & Erection CONTRACTOR : M/S BHEL CONT. NO. CS-9585-001-2	LIST OF ITEMS REQUIRING QP APPROVAL & ACCEPTABLE VENDOR Contractor-M/S BHEL	REF NO : 9585-001-QOE-R-01 REVISION NO. 00 DATE 24th April 2017

Sl. No.	ITEM	QP / INS CAT.	QP No:- 9578-001-QVE-	QP SUB. SCH.	QP APPL SCHEDULE	SUB-SUPPLIERS	PLACE	SUB-SUPPLIER APPL STATUS AS PER NTPC	SC APPL SCHEDULE	REMARKS
10.	GI cable trays, fitting	I				Inar Profiles Ltd	Enkapalli	A		

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Patratu Vidyut Utpadan Nigam Limited ★ Distt-Ramgarh(Jharkhand) ★ C & M Deptt.

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एनटीपीसी NTPC	PROJECT :Patratu STPP (2X660 MW) PACAKGE :EPC Sub Package: Electrical Equipment Supply & Erection CONTRACTOR : M/S BHEL CONT. NO. CS-9585-001-2	LIST OF ITEMS REQUIRING QP APPROVAL & ACCEPTABLE VENDOR Contractor-M/S BHEL	REF NO : 9585-001-QOE-R-01 REVISION NO. 00 DATE 24th April 2017

Sl. No.	ITEM	QP / INS CAT.	QP No:- 9578-001-QVE-	QP SUB. SCH.	QP APPL SCHEDULE	SUB-SUPPLIERS	PLACE	SUB-SUPPLIER APPL STATUS AS PER NTPC	SC AP PL SC HE DU LE	REMARKS
	& accessories including bends					Vatco	Mumbai	A		Galvanization at Sigma Mumbai
						Indiana cable trays	Mumbai	A		Galvanization at Karamtara galvaniser
						Industrial Perforation	Kolkata	A		
						Ratan Engineering	Kolkata	A		Galvanization at B.P. Projects
						India Electric Syndicate	Kolkata	A		Galvanization at BMW Industries/B.P Projects
						Steelite engg.	Mumbai	A		
						Premier Power Products	Kolkata	A		Galvanising at Neha Galvaniser
						Indiana Gratings	Pune	A		Galvanization at Poona Galvanizer/ Anand Yeknow Aids Engg
						M.J. Engineering	Okhla/ Bhiwadi	A		
						Jamna Metal	Delhi/ Kundli	A		
						T.R.G	Chennai	A		Galvanization at TM Radhakrishna Chetty & Co
						Amtech	Pune	A		Galvanization at B.G. Shirke - Pune
						Kannade Anand Udyog	Mumbai	A		Fabrication at their units: Plot No. 42, Moriv District Thane & Plot No.: D-35 Anand Nagar MIDC, Addl. Ambernath , Dist.Thane Galvanization and offer the galvanized cable trays for inspection at D-34 Anand Nagar MIDC, Addl. Ambernath, Dist.Thane.
						Rukmani	Raipur	A		Ladder type cable trays only
						Passive Infra	Hasangarh (Rohtak)	A		
						Unitech Fabricators &	Howrah/	A		

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एनटीपीसी NTPC	PROJECT :Patratu STPP (2X660 MW) PACAKGE :EPC Sub Package: Electrical Equipment Supply & Erection CONTRACTOR : M/S BHEL CONT. NO. CS-9585-001-2	LIST OF ITEMS REQUIRING QP APPROVAL & ACCEPTABLE VENDOR Contractor-M/S BHEL	REF NO : 9585-001-QOE-R-01 REVISION NO. 00 DATE 24th April 2017

Sl. No.	ITEM	QP / INSCAT.	QP No:- 9578-001-QVE-	QP SUB. SCH.	QP APPL SCHEDULE	SUB-SUPPLIERS	PLACE	SUB-SUPPLIER APPL STATUS AS PER NTPC	SC AP PL SC HE DU LE	REMARKS
						Engineers	Hoogly (Kolkata)			
						Patny System	Hyderabad	A		Galvanisation at Gurpreet galvaniser - Hyderabad
						Rabi Engg	Kolkata	A		Galvanizing from NTPC approved sources
						Advance Power Products	Howrah	A		
						Maheswari Electricals	Noida	DR		
						Saral Industries	Raibareli	DR		
						Parmar Metal	Rajkot	DR		
						Pentax	Mumbai	DR		
						Eros metal	Nagpur	DR		
						Vinfab	Thane	DR		
						Namdhari	Ludhiana	DR		
						Indmark Formtech	PUNE	DR		
11.	Cable tray flexible support system (GI)	I	9			Vatco	Mumbai	A		Galvanising at Sigma Mumbai
						Inar profiles	Enkapalli	A		
						Industrial perforations	Kolkata	A		
						Premier power products	Kolkata	A		Galvanising at Neha Galvaniser
						Steelite engg.	Mumbai	A		
						Indiana gratings	Pune	A		Galvanising at Poona Galvaniser
						Amtech	Pune	A		Galvanising at B.G. Shirke
						Ratan Projects	Kolkata	A		Galvanization at NTPC approved sources
						Indmark Formtech	PUNE	DR		
12.	Lead coated steel flexible conduits	III				M/s PLICA	Ghaziabad	A		
						M/s Lapp	Germany	DR		
						M/s Bansal Labs	Bhopal	A		

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एनटीपीसी NTPC	PROJECT :Patratu STPP (2X660 MW) PACAKGE :EPC Sub Package: Electrical Equipment Supply & Erection CONTRACTOR : M/S BHEL CONT. NO. CS-9585-001-2	LIST OF ITEMS REQUIRING QP APPROVAL & ACCEPTABLE VENDOR Contractor-M/S BHEL	REF NO : 9585-001-QOE-R-01 REVISION NO. 00 DATE 24th April 2017

Sl. No.	ITEM	QP / INS CAT.	QP No:- 9578-001-QVE-	QP SUB. SCH.	QP APPL SCHEDULE	SUB-SUPPLIERS	PLACE	SUB-SUPPLIER APPL STATUS AS PER NTPC	SCAPPLSCHEDULE	REMARKS
13.	Junction boxes / Link Boxes/ Test Link Box/ Adopter box, Switch Boxes, Pull Boxes (Hot Dip Galvanized)	III				Main contractor approved sources with galvanization from NTPC approved sources (Note-2)		Noted		
14.	FRP Junction boxes	II	10			Main Contractor approved sources		Noted		
16.	Cable glands	III				Main contractor approved sources		Noted		
17.	Cable lugs	III				M/s Dowell	Mumbai	A		
						M/s Billets Elektro Werke Ltd.	Umbergaon	A		

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एनटीपीसी NTPC	PROJECT :Patratu STPP (2X660 MW) PACAKGE :EPC Sub Package: Electrical Equipment Supply & Erection CONTRACTOR : M/S BHEL CONT. NO. CS-9585-001-2	LIST OF ITEMS REQUIRING QP APPROVAL & ACCEPTABLE VENDOR Contractor-M/S BHEL	REF NO : 9585-001-QOE-R-01 REVISION NO. 00 DATE 24th April 2017

Sl. No.	ITEM	QP / INS CAT.	QP No:- 9578-001-QVE-	QP SUB. SCH.	QP APPL SCHEDULE	SUB-SUPPLIERS	PLACE	SUB-SUPPLIER APPL STATUS AS PER NTPC	SCAPPL SCHEDULE	REMARKS
						(3 D)				
						M/s Chetna	Nasik	A		
						Additionally Any make's model with VDE or CE or UL or CSA marking or BIS approved with CML no. Refer Note-3		Noted		

Deptt. Patratu Distt-Ramgarh(Jharkhand)