1X660 MW BHUSAWAL THERMAL POWER STATION
MAHARASTRA STATE POWER GENERATION CO. LTD.

VOLUME – II

TECHNICAL SPECIFICATION
FOR
EFFLUENT TREATMENT PLANT (ETP)

SPECIFICATION NO.: PE-TS-415-164-A001 REV 00

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

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PROJECT INFORMATION

1.0 INTRODUCTION

The proposed Ix 660 MW Bhusawal Thermal Power Project will be set up by Maharashtra State Power Generation Co. Ltd. (MAHAGENCO) in Dipnagar near Bhusawal, Maharashtra, India.

The Bidder shall acquaint himself by a visit to the site, if felt necessary, with the conditions prevailing at site before submission of the bid. The information given herein under is for general guidance and shall not be contractually binding on the Owner. All relevant site data/information as may be necessary shall have to be obtained / collected by the Bidder.

2.0 APPROACH TO SITE

Deepnagar is well connected by rail and road. By road, it is about 8 Km from Bhusawal city. Nearest railway station is at Bhusawal. The nearest Airport is at Aurangabad. The nearest sea port is at Mumbai. The site is located on the Mumbai-Nagpur Highway.

3.0 LAND

Bhusawal Thermal Power Plant is already having 1x62.5 MW + 2x210 MW Units and Two (2) Units of 5OO MW each are under execution stage. About 108.94 Hectares of land is acquired by MAHAGENCO near existing TPS. It is proposed to install 1x 660 MW unit on this land.

4.0 SOURCE OF COAL

Indian coal would be sourced from Machaakata coal blocks in Orissa state. The Coal will be received at Plant site directly by rail. The coal from the railway wagons would be unloaded by means of wagon tipplers and will be either bunkered or stacked in the stock pile at site.

5.0 SOURCE OF WATER

The main source of water is considered Ozerkheda Reservoir which is located at around 18 lan from plant site.

6.0 ASH DISPOSAL AREA

The ash generated from 1 x 660 MW unit shall be disposed off in slurry form to the existing Ash Pond located at Velhala, approx. 12 Km from the site.

7.0 PROJECT INFORMATION

7.1	Client / Owner	: Maharashtra State Power Generation Co. Ltd.
7.2	Consultant	: Development Consultants Pvt Ltd. Consulting Engineers, Vashi, Navi Mumbai
7.3	Project Title	: BHUSAWAL T.P.5. UNIT-6, lX660MW
7.4	Location	: Dipnagar, Near Bhusawal, Maharashtra, India
7.5	Nearest railway station	: Bhusawal
7.6	Nearest Airport	: Aurangabad
7.7	Nearest Harbour	: Mumbai
7.8	Access Roads	: NH 6 (Mumbai-Nagpur Highway)
7.9	Elevation above MSL	: 210M

7.10 Longitude/ latitude : 75' 51'10" East / 21' 02' 30" North

7.11 Seismic Zone : Zone III as per 15:1893

7.12 AMBIENT TEMPERATURE

7.12.1 Mean of daily maximum temperature : 48.25 'C (during May)

7.12.2 Mean of daily minimum temperature : 18 'C (during January)

7.12.3 Highest temperature recorded : 48.7'C

7.12.4 Lowest temperature recorded : 13"C

7.13 Wet bulb temperature : 27"C (Maximum)

7.14 Rainfall : 112 mm average annually

7.15 Wind Speed : 0 to 39 Km/ hr

7.16 Wind direction : East North East to West South West

ELECTRICAL

7.17 MAIN POWER SOURCE FROM GRID

7.17.1 Rated Voltage : 400kV

7.17.2 Voltage variation : ±1O%

7.17.3 Frequency Variation : ±5%

7.17.4 Rated Short Circuit Level : 50 kA, Three Phase Symmetrical

7.18 AUXILIARY POWER SUPPLY

Auxiliary electrical equipment shall be suitable for operation on the following supply system:

7.18.1 Motors above 1000 kW & other Power devices : 11kV,3Ph,3wire,5OHz system

7.18.2 Motors below 1000 kW & above 160kW earthed & other power devices : 3.3kV, 3 ph, 3 wire 50 Hz, Non Effectively

7.18.3 Motors upto 160 kW & other power devices : 415V, 3 ph, 4 wire 50 Hz

7.18.4 Motor Starting Methods : Direct on Line

7.18.5 (a) Lighting fixtures Space heaters, and single Phase motors : 240V, 1 phase, 50 Hz
: Supply through suitably rated transformers to limit the short circuit level to 9kA - 1 sec.

(b) Control & Instrumentation : 240V, 1 Phase, 50 Hz from UPS

7.18.6 Short circuit levels of l1kV, 3.3 kV and 415V system equipments

The equipment shall be suitable for the following short circuit levels

(a) 11kV Switchgears : 44 kA/3 sec

(b) 3.3kV Switchgears : 40 kA/3sec

(c) 415V PCC/ PMCC/ MCC : 50 kA/1sec

(d) Lighting Distribution Boards & 240V A.C. supply : 9 kA/1sec

7.18.7 Auxiliary DC supply

The auxiliary DC supply will be used for control, indication & protection, Turbine lube oil system, AVR, Emergency DC lighting of power plant and Control & Instrumentation etc.

(a) Voltage : (i) 220V DC for utility purpose
(ii) 24V DC for Control and Instrumentation

(b) Voltage variation : + 10 %, -15 %

7.18.8 Emergency power supply

(a) Purpose : (i)Standby power to normal incomer of emergency MCC
(ii) Alternate power source to Fire Water Pumps

(b) Rated voltage and frequency : 415 V, 3 phase, 3 wire, 50 Hz.

7.18.9 UPS power supply

(a) Purpose : (i) Vital process loads
(ii) Critical lighting
(iii) Control and Instrumentation
(iv) Office for LAN power supply/ Server etc.

(b) Rated Voltage :415V, 3 ph, neutral / 240V single phase, 50Hz

7.19 The variation in voltage and frequency may be ± 10% and ± 5% respectively. The combined voltage and frequency variation may be ± 10%. All devices shall be suitable for continuous operation over the entire range of voltage variation without any change in their performance

7.20 Power socket shall be 415V AC, 50 Hz, 4 pin 32/63 Amps. Power socket outlets for portable tools, hand lamps etc shall be 240 volts, single phase, 3 pin, metal clad industrial type

7.21 All electrical equipment shall be designed for the following ambient conditions

(a) Maximum ambient temperature : 50°C

(b) Minimum Ambient temperature :13°C

SECTION - I
SPECIFIC TECHNICAL REQUIREMENTS

SPECIFIC TECHNICAL REQUIREMENTS:

1.1 This specification is intended to cover design, engineering, manufacture, fabrication, assembly, inspection & testing at vendor's & sub-vendor's works, painting, forwarding, supply and delivery at site including start up and commissioning spares, mandatory spares, properly packed for transportation, unloading / handling and storage at site, in site transportation, assembly, erection and commissioning, trail run, preparation and submission of "As Built" drawings, site testing, carrying out performance guarantee tests at site and handover of **EFFLUENT TREATMENT PLANT (ETP)** including civil design on HRSCC (High Rate Solid Contact type clariflocculator) of Effluent Treatment Plant (excluding RCC work) as per the details in different sections / volumes of this specification for **1X660 MW BHUSAWAL TPS.**

The bidder's scope shall also include any other services, etc. if called for in the succeeding sections of the specification.

1.2 The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve them of the responsibility of providing such facilities to complete the supply, erection and commissioning of Effluent Treatment Plant within quoted price.

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

1.4 The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing.

1.5 Items though not specifically mentioned but needed to make the system complete as stipulated under these specifications are also to be furnished unless otherwise specifically excluded.

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

1.7 While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under Vol-II Section-III of the specification as **"**PRE BID CLARIFICATION SCHEDULE". In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of BHEL/Customer shall prevail and shall be complied by the bidder without any commercial and delivery implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by BHEL/ Customer as and when brought to their notice either by the bidder or by BHEL/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication. The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions. Pre-bid clarification if any must be asked at least ten days before the date of bid opening

1.8 Deviations, if any, should be very clearly brought out clause by clause in the enclosed schedule (in section III); otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification. If no cost of withdrawal is given against the deviation, it will be presumed that deviation can be withdrawn without any cost to BHEL/its customer.

1.9 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.

1.10 Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder/vendor and Customer/Purchaser/Employer will mean BHEL and/or Customer (MAHAGENCO) as interpreted by BHEL in the relevant context. Please refer GCC/SCC for better clarity.

1.11 The equipment covered under this specification shall not be dispatched unless the same have been finally inspected, accepted and dispatch release issued by BHEL/Customer.

1.12 BHEL's/Customer's representative shall be given full access to the shop in which the equipment is being manufactured or tested and all test records shall be made available to him.

1.13 The effluent treatment system shall fully comply to meet all the requirements and limits specified in
Environmental (Protection) Rulers,1986 along with all latest amendments.
Requirements and stipulations of Central pollution control Board (CPCB).
Ministry of Environment & Forests (MOEF)
State Pollution Control Board (SPCB)
And any other central or local statutory requirements regarding environmental pollution and its abatement.

SECTION - IA

(SPECIFIC TECHNICAL REQUIRMENT-MECHANICAL)

1.0 REFERENCE DOCUMENTS

A. PE-DG-415-164-A001 : P & ID FOR EFFLUENT TREATMENT PLANT
B. DATASHEET – A : FOR ABOVE SYSTEM
C. PE-DG-415-100-M001 : PLOT PLAN

2.0 SCOPE OF WORK (MECHANICAL) IN BIDDER SCOPE

The scope of bidder is detailed below for the effluent waste transfer and its treatment which is the part of bidder's scope. Please also refer the P&ID for Effluent Treatment Plant.

2.1 SCOPE FOR AREA CONTAIN OILY WASTE AS BELOW:

Basis of Treatment System (For Oily Waste):

Parameter	Unit	Inlet	TPI Outlet
Oil Concentration	ppm	1000	10
Suspended Solids	ppm	300	20

This shall be considered for Oily waste of Power House area, Transformer Yard area, Fuel oil area and any other area containing oily water.

2.1.1 EFFLUENT FROM POWER HOUSE AREA:

a) Two (2) Nos. (1W+1S) screw pump for power house area oily waste sump complete with drives, valves, piping, instruments, fittings and all accessories required as per P&ID.

2.1.2 EFFLUENT FROM TRANSFORMER YARD AREA

a) Two (2) Nos. (1W+1S) screw pump for transformer yard area oily waste sump complete with drives, valves, piping, instruments, fittings and all accessories required as per P&ID.

2.1.3 EFFLUENT FROM FUEL OIL STORAGE AREA

a) Two (2) Nos. (1W+1S) screw pump for fuel oil storage area oily waste sump complete with drives, valves, piping, instruments, fittings and all accessories required as per P&ID.

2.1.4 Common System for Oily Waste

a) Two (2) Nos. (1W+1S) screw pump for common oily waste retention pit complete with drives, valves, piping, instruments and fittings and all accessories required as per P&ID
b) One (1) No. oil water separator of capacity 50 m^3 consisting of plate packs, oil skimmer system, piping, valves, fitting, mechanism, instrumentation and all accessories required.
c) One (1) No. slop oil storage tank of capacity 3 m^3 complete with piping, valves, fittings, instrumentation and all accessories required
d) Two (2) Nos. (1W+1S) screw pump for OWS treated water complete with drives, valves, piping, instruments, fittings and all accessories required as per P&ID
e) Two (2) Nos. (1W+1S) rotary, twin lobe type blower for CPI Sludge pit complete with drives, valves, piping, instruments, suction filter. Silencer, fittings and all accessories required as per P&ID

f) Two (2) Nos. (1W+1S) vertical centrifugal type pump for CPI Sludge transfer complete with drives, valves, piping, instruments, fittings and all accessories required as per P&ID

2.2 BOILER AREA WASTE WATER

a) Two (2) Nos. (1W+1S) vertical centrifugal type pump for Boiler waste retention pit complete with drives, valves, piping, instruments, fittings and all accessories required as per P&ID

2.3 SSF BACK WASH WATER

a) Two (2) Nos. of (1W+1S) vertical centrifugal type Back Wash waste water transfer pumps each complete with drives, valves, piping, instruments, fittings and all accessories required as per P&ID.

2.4 AC PLANT REJECT

a) Valves, piping, instruments, fittings and all accessories required for gravity flow of ac plant reject from AC Plant Room elevation of 24 meter to ETP clear water storage tank.

2.5 CENTRAL MONITORING BASIN

a) Mechanical, Electrical, Instrumentation etc. as required for One (1) no Central Monitoring Basin with 2 compartments (CMB shall be Earthen Under Ground Construction) with inlet and outlet motorized gate and complete with all accessories required. Minimum Effective capacity (Each Compartment): CMB shall have at least 16 hrs detention period which shall be calculated based on the average hourly flow of total effluents (i.e. 8 hrs for each compartment)
b) Three (3) (2W+1S) nos. Central Monitoring Basin Effluent Transfer Pumps each complete with drives, valves, strainers, piping, instruments, fittings and all accessories required. Self-Priming arrangement & associated tank, valves, piping and fitting as required.
c) One (1) no. Alkali Dosing Tank (RCC Construction in BHEL Scope) complete with agitator, electric drive motor, instruments and all accessories required as per P&ID.
d) Two (2) nos. Alkali Dosing Pumps, each with drive motor, piping, valves, instruments, strainers, fitting and all accessories as per P&ID required.
e) One (1) no. Acid Dosing Tank (RCC Construction in BHEL Scope) complete with electric drive motor, instruments and all accessories required as per P&ID.
f) Two (2) nos. Acid Dosing Pumps, each with drive motor piping, valves, strainers, instruments, fitting and all accessories as per P&ID required.

Equalised waste water from CMB will be further treated in clarification system. Scope of supply is mentioned below.

g) Mechanical, Electrical, Instrumentation etc. for One (1) nos. Stilling chamber (RCC Construction in BHEL Scope) of required capacity complete with all accessories required.
h) Mechanical, Electrical, Instrumentation etc. for One (1) nos. of inlet channel with flow measuring element parshall flume (RCC Construction in BHEL Scope) and complete with all accessories required.
i) Mechanical, Electrical, Instrumentation etc. for One (1) nos. of Flash Mixer with motorised stirrer, motor at the inlet to HRSCC as per P&ID.
j) One (1) no. High Rate Solids Contact type Clariflocculator complete with mixer cum solids recirculation device along with drive and drive motor, cone shaped truncated flocculation skirt, rake mechanism along with drive and drive motor, collection troughs, telescopic type continuous sludge discharge arrangement intermittent timer operated main sludge disposal system and all accessories.
k) Outlet channels (RCC Construction in BHEL Scope) from HRSCC up to the ETP one (1) no. Clear Water storage tank with isolation gates at the inlet and outlet of clear water storage tank and all accessories required.

l) Two (2) nos. Alum solution preparation tanks (RCC Construction in BHEL Scope) each complete with agitator, electric drive motor, instruments and all accessories required as per P&ID.
m) Two (2) nos. Alum Solution Dosing Pumps, each complete with drive motor piping, valves, strainers, instruments, fitting and all accessories as per P&ID required.
n) Two (2) nos. Lime Solution Slaking Tank (RCC Construction in BHEL Scope) each complete with agitator, electric drive motor, instruments and all accessories required as per P&ID.
o) Two (2) nos. Slaked Lime Transfer Pumps each complete with electrical drive motor piping, valves, strainers, instruments, fitting and all accessories as per P&ID required.
p) Two (2) nos. Lime Solution Preparation Tanks (RCC Construction in BHEL Scope) each complete with agitator, electric drive motor, instruments and all accessories required as per P&ID.
q) Two (2) nos. Lime Solution Recirculation cum Dosing Pumps each complete with electrical drive motor piping, valves, strainers, instruments, fitting and all accessories as per P&ID required.
r) Outlet channels (RCC Construction in BHEL Scope) from HRSCC up to the ETP one (1) no. Clariflocculator Sludge Sump (with two compartments) with isolation gates at the inlet and outlet of Clariflocculator Sludge Sump and all accessories required.
s) Two (2) nos. Clariflocculator Sludge Transfer Pumps each complete with drives, valves, piping, instruments, fittings and all accessories required as per P&ID.
t) Two (2) Nos. (1W+1S) rotary, twin lobe type blower for Clariflocculator Sludge Sump complete with drives, valves, piping, instruments, suction filter. Silencer, fittings and all accessories required as per P&ID
u) Three (3) (2W+1S) nos. Clear water transfer pump each complete with drives, valves, strainers, piping, instruments, fittings and all accessories required.
v) Two (2) nos. Electrically Operated Monorail Hoists, each of 1.0 Ton safe working capacity and complete with all accessories for handling of chemicals at ground floor and first floor of Chemical House.
w) One No. EQMS (Effluent Quality Monitoring System) for online monitoring of Liquid Discharge quality as per the norms of statutory requirements of government of India, However the analyse and instruments as shown in P&ID is minimum requirement and the same shall be in bidder's scope, Bidder to refer C&I specification section IC & II C for the detail of scope.

2.6 Rain Water Harvesting Pond

Rain water collected in pond shall be sent to horticulture, Ponds are marked in plot plan at 5(five) location in referred plot plan. For each rain water harvesting pond following shall be provided:
a) Two (2) No. Level Transmitter for each Rain Water Harvesting Pond.
b) Two (2) Nos. (1W+1S) horizontal pump for Rain Water Harvesting Pond complete with drives, valves, piping, instruments as per P&ID and all other accessories required
c) 5 set of 100m hose pipe.

2.7 All instrumentation, piping, valves, fittings and accessories for Sump located inside and outside of ETP area shall be in bidder's scope.

3.0 PIPING AND VALVES IN BIDDER'S SCOPE

1. Complete piping indicated in P & ID of Effluent treatment plant is in bidder's scope of supply and erection. In addition, any additional piping required to make the system complete inside ETP area shall be in bidder's scope.
2. Pipe Distance are given below:

Sl. No.	From	To	Distance (in meters)
01	Transformer Yard ETP Sump	ETP Area	300
02	Power House ETP Sump	ETP Area	450
03	AC Reject Sump	ETP Area	500
04	Boiler ETP Sump	ETP Area	500

05	Fuel Oil OWS ETP Sump	ETP Area	750
06	Clear Water Storage Tank (ETP Area)	Ash Water Tank, CHP Dust Suppression, Service Water, Horticulture	1500
07	Clariflocculator Sludge Sump (ETP Area)	Ash Slurry Sump	600
08	Retention Pit for treated water (ETP Area)	Ash Water Sump	600
09	SSF backwash waste water sump	Ash Sludge Sump	800

Bidder to note that no commercial settlement/ adjustment shall be entertained for variation up to +/- 10% of pipe lengths tabulated above during detailed engineering. Bidder to further note that above piping distances are in bidder's scope. Distances given above are from one area to another area only, however inside piping in respective area shall be in bidder's scope which is not included in above distances.

3. The treated water for clear water storage tank as shown in P&ID shall be terminated at Ash water tank, CHP dust suppression, service water and horticulture/gardening green belt development. The termination shall be through a minimum 150NB pipe (the pipe network shall be made in such a way that the total flow can be led to either of the above mentioned location). Total length of the pipe (i.e. from pump discharge to all the termination point shall be minimum of 1500 meter of 150NB pipe). Wherever the pipe is getting branched shall be provided with an isolation valve and NRV. Above shall be the part of bidder's scope
4. Complete piping inside the ETP area is in bidder's scope.
5. The above indicated pipes shall be designed, supplied, erected, laid and tested by the bidder. Elbows, tees, puddle pipes, flanges Hangers and supports, embedment plates with lugs etc. required for the below given piping shall also be provided by the bidder.
6. Inlet and outlet pipes for each sump, pits, pumps, other equipment, etc. with pipe connections to the respective sumps, pits, equipment.
7. Clarified water piping, instrument air piping, service air piping, potable water piping, etc. as applicable as per the Terminal Points.
8. In addition, any additional piping and associated accessories required to complete the system shall be in bidder's scope.
9. Materials of Construction of pipes under various services as envisaged are reproduced below:

Sr. No.	**Service**	**Material**
(i)	Raw Water, Clarified Water, Filtered Water, Clariflocculator Sludge, Service Water, Non- corrosive waste water, sewage water, Back wash water	ERW Carbon Steel Pipe to ASTM 53 Gr. B/IS-1239, Part-I heavy grade for pipe size up to 150 mm NB and IS-3589 for 200 mm NB and above.
(ii)	Alum & Polyelectrolyte Solution	Rubber lined ERW Carbon Steel pipe to ASTM 53 Gr. B/IS-1239, Part-I, heavy grade with rubber lining 3.0 mm thick as per IS 4682 Part-I. (Vide Note-1 below).
(iii)	Lime Solution, Lime Slurry	ERW Carbon Steel Pipe to ASTM 53 Gr. B/IS-1239, Part-I heavy grade.
(iv)	Sludge pipe from different manholes to Sludge Pit	RCC pipe as per IS-458 Class NP-2.
(v)	a. Hydrochloric acid (at all concentration)	Rubber lined ERW carbon steel pipe to ASTM A53 Gr. B/IS-1239, Part-I, Heavy grade (see Note-3 below)
	b. Sodium hydroxide (at all concentration)	Rubber lined ERW carbon steel pipe to ASTM A53 Gr. B/IS-1239, Part-I, Heavy grade (see Note-3 below)
(vi)	Decationised water, Degassed water and Demineralised water	Rubber lined ERW carbon steel pipe to ASTM A53 Gr. B/IS-1239, Part-I, Heavy grade for sizes up to 150 mm NB and IS-3589 for 200 mm NB and above (see Note-1 below)

Sr. No.	Service	Material
(vii)	Neutralized effluent	Rubber lined ERW carbon steel pipe to ASTM A53 Gr. B/IS-1239, Part-I, Heavy grade up to discharge isolation valve (see Note-2 below)
(viii)	Potable Water, Service Air, Instrument Air	Galvanized Steel Pipe to ASTM 53 Gr. B/IS-1239, Part-I, heavy grade.
(ix)	Sampling Pipe	Stainless Steel to ASTM Schedule-10 S.
(x)	Dielectric glass tube	Borosilicate glass (specially for ozone generation) closed at one end.
(xi)	Ozone electrode	SS 316Ti & should comply as per DIN 19627
(xii)	Gas/Cooling ends	SS 316 Ti
(xiii)	Ozone inlet & outlet connection	SS 316 Ti
	Notes:	
1.	For small diameter pipe, where rubber lining is not possible, stainless steel pipe instead of rubber lined steel pipe shall be used.	
2.	For Corrosive service, pipeline of size 32 NB and below where SS-304/316 cannot be used, CPVC pipeline shall be provided.	
3.	For small diameter pipe, where rubber lining is difficult, CPVC PN 10 shall be used for hydrochloric acid. Stainless steel pipe instead of rubber lined steel pipe shall be used for other services	

10. For rubber lined pipe, rubber-lining thickness shall not be less than 3 mm. The lining shall conform to IS: 4682 Part-I

11. Recommended Velocity Chart for Pipe Sizing:

A	Water				
	(i)	Condenser CW	Below 1000 NB	1000-2000 NB	Above 2000 NB
		a. Pump Suction	1.0	1.3	1.5
		b. Pump discharge / distribution	2.4	2.8	3.0
	(ii)	Water-General	Below 200 NB	200-400 NB	400-700 NB
		a. Pump Suction	1.0		
		b. Pump discharge/ distribution	1.8	2.2	2.5
(b)	Fuel Oil				
		Heavy oil (Heated)			
		a. Pump suction	1.0		
		b. Pump discharge/ distribution	1.5-2.0		
(c)	Gases				
		a. Compressed air	15-25		

12. VALVES:

a) The valve design and testing standard shall be as follows:

	Less than 50 mm size		50 mm size and above	
	Design	Testing	Design	Testing
Gate	API - 602	API – 598	API - 600	API – 598
Globe	BS - 5352	BS – 6755	BS - 1873	BS – 6755
Check	BS - 5352	BS – 6755	BS - 1868	BS - 6755

b) On rubber lined pipe (corrosive service), isolation valve shall be Saunder's Diaphragm type (Weir type) with dimension as per BS 5156. The material of construction shall be cast iron body as per IS: 210 FG 260 with inside hard rubber lining (all wetted parts) 3 mm thick as per IS-4682 (hardness 85-90 on shore A) and neoprene diaphragm. The ends shall be flanged as per ANSI B 16.1, 125 class, FF, full-face rubber lined. The testing shall be as per BS 5156 and rubber lining shall be tested as per IS: 4682

c) Check valve in corrosive service shall be flap type cast iron body with all wetted parts fully rubber lined with 3 mm thick hard rubber (hardness 85-90 on shore A). Ends shall be flanged as per ANSI B 16.1, 125 Class, FF, full-face rubber lined.

d) (All sampling valves and analyzing instrument isolation valves shall be needle type with stainless steel (AISI 316) design. For all other instrument, isolation valves shall be full bore ball valve of SS 316 construction as per API - 6D. The rating for screwed ball valves shall be 800 class and that for flanged ball valve shall be 150 class. The inspection and testing of ball valves shall be as per API - 607.

4.0 SCOPE OF SUPPLY (ELECTRICAL) IN BIDDER'S SCOPE

Complete electrical as per specification and details indicated in Section IB & IIB.

5.0 SCOPE OF SUPPLY (C&I) IN BIDDER'S SCOPE

Complete C&I and control philosophy as per specification and details indicated in Section IC & IIC.

6.0 SCOPE OF SUPPLY AC and VENTILATION IN BIDDER'S SCOPE

Complete AC and Ventilation as per specification and details indicated in Section IIA

7.0 SCOPE OF MATERIAL HANDLING SYSTEM IN BIDDER'S SCOPE

Suitable handling arrangement shall be provided by bidder in each sump (sump with vertical pump) located inside and outside ETP area, for details of material handling system please refer IIA

8.0 SCOPE OF SUPPLY AND SERVICE (CIVIL)

All Civil RCC work is excluded from bidder scope. However, ETP HRSCC civil structure and foundation design shall be in bidder scope. Bidder shall provide Civil GA (Construction drawings along with foundation drgs) along with STAAD design and structural calculations for BHEL's review and usage. Clarifier construction is in BHEL scope. However, supervision of civil construction work of HRSCC shall be in bidder's scope. Bidder to note that there could be multiple visit for supervision, for supervision all activities (i.e. travelling, fooding, lodging, medical, insurance etc.) shall be in bidder's scope. Other civil structures required in ETP plant shall be designed by BHEL however civil assignment drawings of all such structures shall be provided by Bidder.

9.0 SCOPE OF SERVICE

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

1. Erection and commissioning, unloading, storage and handling at site.

2. Minor civil work like chipping of foundation, grouting below base plate for all structures, equipment, grouting of anchor bolts wherever these are not placed in the foundation during casting of foundation itself, excavation & filling of earth for buried pipes if and as required. To the extent possible, vendor shall ensure to supply all foundation bolts timely so as to facilitate placement of these bolts while casting the foundation. Wrapping, coating and protection of all the buried pipe shall be as per IS 10221.
3. Pre- Commissioning work such as flushing, hydraulic testing etc. Necessary consumables and instrumentation as required for inspection and testing at works as well as at site including pre-commissioning activities shall be arranged by the successful bidder at their own cost.
4. Erection and Commissioning of entire Effluent Treatment Plant.
5. Arrangement of all instruments, lubricants, reagents, monitoring gadgets for monitoring, & lab facilities to carry out, pre-commissioning, trial run, commissioning, Performance guarantee test & till handover.
6. Monitoring gadgets, instruments and equipment required for maintenance (till demonstration test & Plant Hand over).
7. Complete grouting for equipment, fixing and any concreting inside the vessels and lining.
8. All personnel required during commissioning, trial run and demonstration Test.
9. Trial run for requisite period.
10. Performance guarantee test.
11. Training of plant Owner's personnel, O&M operators' personnel on plant operation and maintenance.
12. All other facilities/ services as described in section on site services in specification and related to Effluent Treatment Plant scope of work.
13. Relevant requirements as per GTR, GCC, ECC & SCC.
14. Any other service required for making the installation complete in all respect within battery limits and for satisfactory erection & commissioning of the system as well as to meet any statutory requirement relevant to the package.
15. Painting as per enclosed painting schedule Section-IIA. However, any variation in the painting schedule as finally approved by customer / BHEL shall be taken care by bidder without any commercial and delivery implication. Color-coding scheme shall be intimated to vendor during detailed engineering.

10.0 TERMINAL POINTS

1. Service water line (50 NB) will be provided by BHEL at 10 m distance from ETP area. Further distribution inside ETP area will be in bidder's scope. Bidder to note that pressure available at terminal point for service water will be 2 kg/cm2 approx (max.); hence bidder will take care for their pump lubrication / cooling accordingly.
2. Instrument air pipe (25 NB) will be provided by BHEL at 10 m distance from ETP area. Further distribution inside ETP area will be in bidder's scope.
3. Service air pipe (25 NB) will be provided by BHEL at 10 m distance from ETP area. Further distribution inside ETP area will be in bidder's scope.
4. Potable Water line (25 NB) will be provided by BHEL at 10 m distance from ETP area. Further distribution inside ETP area will be in bidder's scope.

11.0 EXCLUSIONS

- All civil works including foundation of equipment, excavation & back filling. However complete grouting for equipment, grouting material, fixing and any concreting inside vessels and lining shall be in the scope of the bidder.
- Main pipe trestles.
- Firefighting facilities.
- Other exclusions are mentioned in the electrical & C&I parts of this specification.
- Service water up to terminal points.
- All Chemicals.

12.0 QP AND SUB VENDOR APPROVAL

1. The quality assurance plan is enclosed as Annexure-I/section-IA. However, requirement of detailed QP, inspection checklist, certificate of conformance etc. for each equipment and sub-vendor shall be finalized during detailed engineering stage; decision of BHEL/customer shall be binding on vendor in this regard. Any changes/additional tests insisted upon by Owner during approval of QAP's shall be accepted by bidder without

any commercial and delivery implication to BHEL/Customer. Bidder shall submit the quality plans in BHEL format during detailed engineering stage. Bidder to note further that during detailed engineering all the QAP's/check lists etc. shall be submitted to Customer/BHEL for approval. All inspection & testing etc. shall be carried out accordingly.

2. The sub vendor list enclosed as Annexure-II/section-IA is indicative only and is subject to approval / acceptance by customer (MAHAGENCO/ consultants). Bidder to propose his sub vendor list with back up documents (experience list, end user certificate as applicable) etc. The same shall subject to BHEL and Customer approval during detailed engineering stage without any technical, commercial & delivery implication to BHEL.

13.0 PERFORMANCE GUARANTEE TEST

The Performance guarantee test shall be as per Annexure-III/Section-IA.

14.0 DESIGN CRITERIA AND TECHNICAL DETAILS

The P&ID for Effluent Treatment Plant (Dwg.No.- PE-DG-415-164-A001) is enclosed herein in this section for bidder's compliance.

The material of construction specified in Data Sheet-A are minimum requirements and material of construction for other components not specified shall be similarly selected by the bidder for intended duty which shall be subject to BHEL / Customer approval during detail engineering without any commercial & delivery implication to BHEL.

The other technical requirement shall be as per General Technical Requirement for the Project/Package. Please refer Section-II of this specification.

15.0 DRAWING/DOCUMENTS REQUIREMENT

For the Drawings/Documents Requirement & Distribution submission schedule, please refer Annexure-IV/Section- IA.
The bidder has to submit the revised drawing/document along with the compliance sheet indicating enumerate reply to all BHEL and customer comments or observations. Without compliance sheet the submission of the drawings/documents will not be considered and the delay on this account will be solely on bidder's side only. Bidder to comply with the observations of the BHEL and CUSTOMER without price & delivery implication.

16.0 ADDITIONAL REQUIREMENT IN BIDDER SCOPE

1. Engineering monitoring for this project is to be carried out in Integrated Intelligent Engineering environment at BHEL end. For Details Refer Drawings/Documents Requirement & Distribution submission schedule
2. Initial charge of all lubricants & grease.
3. All special tools necessary for proper maintenance or adjustment of the equipment packaged in permanent box. Finish paints for touch-up painting of equipment after erection at site in sealed container.
4. Wherever pipe racks are not available, pipes shall run on pedestals or below ground. All fixing items such as U clamps, nuts, bolts etc. required to lay the pipes on pedestals shall be in bidder's scope of work. Coating, wrapping and protection required for buries pipes shall be in bidder's scope of work.
5. Wherever pipes are running on pipe rack, Bidder will consider 12 m static head + 10% margin, in addition to the losses in straight length and bend in pipes and valves etc. while selection of pump head during detailed engineering.
6. The pumps shall be designed to operate under discharge valve open and close condition.
7. Pump suction valves, re-circulation valves and discharge valves shall be provided with required limit switches for interlock & control.
8. The starting of pumps (wherever applicable) which are provided with forced water lubrication shall be interlocked with the availability of lube water by means of starting of lubrication water pumps, availability of adequate flow, pressure etc. The standby lubrication pump shall be started automatically during inadequate pressure or while tripping of working pump(s), Lubrication pump shall be in bidder's scope.

9. All the first fill and one Year's topping requirements or 10 % of first fill quantity, whichever is more of consumable such as greases, oil, lubricants, servo fluids/control fluids, gases and etc. which will be required to put the equipment covered under the scope of specifications, into successful commissioning / initial operation and to establish completion of facilities shall be furnished by the bidder. Suitable standard lubricants as available in India are desired. Efforts should be made to limit the variety of lubricants to minimum.
10. Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.
11. In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion.
12. Bidders shall make Site visit in order to familiarize themselves with existing condition of site before submitting the bid in order to make their offer complete. During detail engineering also, the successful bidder shall be responsible for the correctness of details w.r.t. existing facility at site. Customer approval on any drawing having details of existing facility shall not be cited by the successful bidder a valid reason for any shortcoming in the work by them. BHEL shall also not entertain any cost implication for any lack of input data with regard to site during detail engineering.
13. Final Electrical Load list will be submitted by the successful bidder as per agreed drawing/ doc submission schedule. Thereafter any change in the electrical load list shall be entertained only subject to its feasibility, and BHEL reserves the right to debit the vendor cost of any changes necessitated in the switch gear /MCC on account of changed loads.
14. The complete system shall be proven and necessary design documentation in support of proveness shall be submitted by the successful bidder in support of the systems, if asked by the customer without any price and delivery implication to BHEL and customer.
15. Wherever CIVIL works is excluded from the bidder's scope, successful bidder shall furnish civil assignment / scope drawings. The corresponding CIVIL drawing prepared by BHEL / CIVIL agency, based on civil assignment drawing of bidder will be furnished to the site for construction. In case any modification is required in the civil work already carried out based on final civil inputs given by vendor, BHEL reserves the right to debit cost of such rework to vendor".
16. System to be designed to meet all the statutory requirements. Preparation of all necessary drawings/data/ documents for obtaining necessary Approval of statutory authorities like CCOE, IBR, Weight & Measures Department and any other agency/ competent authority, on behalf of the customer, related to installation of ETP (if required) is included in bidder's scope. All expenses required to obtain the approval shall also be borne by the successful bidder. Successful bidder shall inform customer well in advance requirement of authority letter along with format for the same. After issuance of authority letter by customer, it will be vendor's responsibility to regularly follow up with the concerned authorities to obtain timely approval from these authorities. Any delay on account of the same, unless any specific information related to above approval to be furnished by customer is delayed by customer, shall be to vendor's account and shall not be used as a reason for extension in contract completion.
17. Vendor to attend regular engineering meeting with BHEL and customer fortnightly in BHEL or customer office as decided during detail engineering. Vendor will depute all his concerned engineering representative along with the project manager for discussion and approval. Meeting can be held at site also.
18. Space available for ETP Plant is attached, elsewhere in this specification. Bidder to accommodate their equipment within the space provided.
19. Bidder to submit BBU during detailed engineering after approval of Basic documents. Incomplete BBU shall not be reviewed by BHEL.
20. Preparation of e-learning package/module and providing the same to BHEL & MAHAGENCO for the complete ETP. The necessary requirement shall be as per detail specified elsewhere in this specification.
21. Training of plant Owner's personnel, O&M operators' personnel on plant operation and maintenance.
22. Relevant requirements as per GTR, GCC, ECC & SCC.
23. Any statutory requirement / clearance required for the packages from government / local body shall be in bidder's scope. Any change arising out of any new government norms, statutory requirements during the course of execution of the project shall also be complied by the bidder without any commercial implication.
24. Instrument, valves, & piping shown in the flow diagram/ P&IDs are bare minimum requirement. Any additional instrument, valves, and piping required as per system requirement, shall be in the bidder's scope.
25. Wherever gravity flow is not possible the bidder shall provide suitable storage & pumping system (2x100%) along with Piping, valves & instrumentation etc to meet the system & process requirement.
26. Service water shall be available near to Effluent treatment plant/ system building/ area at approximately 1.5 to 2.0 Kg/ Cm2. Hence, bidder to take care for cooling/ lubrication of the pumps being supplied by the bidder

under this technical specification. If service water pressure requirement is more than available pressure, bidder to consider two (2) nos. cooling pump/lubrication pump for ETP.

27. Capacity of monorail hoists, chain pulley blocks are minimum and shall be suitable for handling 125% of maximum weight to be handled during erection and maintenance of the equipment in the pump house, buildings etc. as the case may be.
28. Wherever local instruments for measurement of Flow, Pressure, Level is indicated in the P&ID, Bidder to provide Diaphragm seal type instrument for Chemical (all type and concentration), corrosive, viscous fluids application.
29. Charging platform for all the chemical tanks along with required handrails, accessories etc. Permanent ladder (not rungs) for approaching the top of tanks, valves for All steel inserts plates with lugs, plates, bolts, nuts, sleeves, edge angles and all other embedding components etc as required to grout in civil works and to support/hold the equipment's for opening/maintenance purpose, shall be in bidder's scope.
30. Slings & Lifting lugs shall be provided in all equipment.
31. Provision of laboratory inside chemical house.
32. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.
33. Latest version of all codes and standards to be followed.
34. Pipe racks shall be provided by BHEL wherever available. Wherever pipe racks are not available, pipe shall be laid on pedestal. Construction of pedestal shall be in BHEL scope, however all auxiliary steel structure (U-clamps, nuts, bolts, channels etc.) for fixing pipes on pedestal or racks for complete Effluent treatment plant shall be in bidder's scope.

17.0 SITE VISIT BEFORE SUBMISSION OF OFFER

Bidders shall make Site visit in order to familiarize themselves with existing condition of site before submitting the bid in order to make their offer complete. During detail engineering also, the successful bidder shall be responsible for the correctness of details w.r.t existing facility at site. Customer approval on any drawing having details of existing facility shall not be cited by the successful bidder a valid reason for any shortcoming in the work by them. BHEL shall also not entertain any cost implication for any lack of input data with regard to site during detail engineering.

	TITLE:	BHEL DOCUMENTS NO.: PE-TS-415-158A-A001	
	TECHNICAL SPECIFICATION FOR EFFLUENT TREATMENT PLANT 1X660 MW BHUSAWAL TPS, UNIT # 6	VOLUME II	
		SECTION - IA	
		REV. NO. 00	DATE:

ANNEXURE - I

INSPECTION, TESTING AND QAP

1.0 QUALITY ASSURANCE PROGRAMME

1.1 To ensure that the equipment and services under the scope of Contract whether manufactured or performed within the Contractor's works or at his Sub-contractor's premises or at the Owner's site or at any other place or work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance programme to control such activities at all points, as necessary. Such programmes shall be outlined by the Contractor and shall be finally accepted by the Owner/Authorised representative after discussions before the award of contract. A quality assurance programme of the Contractor shall generally cover the following:

1.1.1 His organisation structure for the management and implementation of the proposed quality assurance programme.

1.1.2 Documentation control system.

1.1.3 Qualification data for Bidder's key personnel.

1.1.4 The procedure for purchase of materials, parts, components and selection of Sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.

1.1.5 System for shop manufacturing and site erection control including process controls and fabrication and assembly controls.

1.1.6 Control of non-conforming items and system for corrective actions.

1.1.7 Inspection and test procedure both for manufacture and all site related works.

1.1.8 Control of calibration and testing of measuring and testing equipment.

1.1.9 System for quality audit.

1.1.10 System for indication and appraisal of inspection status.

1.1.11 System for authorising of release of manufactured product to the Owner.

1.1.12 System for handling storage and delivery.

1.1.13 System for maintenance of records.

1.1.14 Furnishing of quality plans for manufacturing and field activities, detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component.

2.0 GENERAL REQUIREMENTS - QUALITY ASSURANCE

2.1 All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection /tests to be carried out by the Contractor for some of the major items is given in the respective technical specification. This is however, not intended to form a comprehensive programme as it is the Contractor's responsibility to draw up and implement such programme duly approved by the Owner/Consultant. The detailed Quality Plans for manufacturing and field activities shall be drawn up by the Bidder, separately in the format attached at Annexures and shall be submitted to Owner/ Authorised representative for approval. Schedule of finalisation of such quality plans will be finalised before award.

2.2 Manufacturing Quality Plan shall detail out for all the components and equipment, various tests/inspection to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor's Quality Control organisation, the relevant reference

documents and standards, acceptance norms, inspection documents raised etc, during all stages of materials procurement, manufacture, assembly and final testing/performance testing.

2.3 Field Quality Plans shall detail out for all the equipment, the quality practices and procedures etc to be followed by the Contractor's site Quality Control organisation, during various stages of site activities from receipt of materials/equipment at site.

2.4 The Bidder shall also furnish copies of the reference documents / plant standards / acceptance norms/tests and inspection procedure etc. as referred in Quality Plans along with Quality Plans. These Quality plans and reference documents/standards etc. shall be subject to Owner's approval without which manufacture shall not proceed. These approved documents shall form a part of the contract. In these approved quality plans, Owner/Authorised representative shall identify Customer Hold Points (CHP), test/ checks which shall be carried out in presence of the Owner's Engineer or his authorised representative and beyond which the work will not proceed without consent of Owner/Authorised representative in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Owner/Authorised representative for approval and disposal.

2.5 Dispatch Clearance:

2.5.1 On completion of tests of equipment at manufacturer's works, the Contractor shall furnish 4 copies of test certificate(s) as required as per the approved quality plan to the Controller of Quality for approval under intimation to the Project Manager. The test report shall invariably indicate identification data, including Model No., Sr. No. etc. of the equipment, method of application and duration of test along with test results.

2.5.2 For the purpose of transmission of the test reports and speedy approvals, the owner may utilise the provision of the c-Folders module of ERP system being operated by the owner. The contractor shall have access to the respective folder of the system to enable him to upload/transmit the soft copies of inspection report (in*.pdf form). Decision in this regard shall be taken during the execution of the contract by mutual agreement. However, the report in physical form shall also be invariably submitted.

2.5.3 Only on approval of these test results by the Controller of Quality and the despatch clearance thereafter by the Project Manager, the material shall be despatched to site. The despatch clearance shall be notified by way of e-mail/fax/letters as may be mutually agreed during execution of the contract.

2.6 All materials used or supplied shall be accompanied by valid and approved materials certificates and tests and inspection report. These certificates and reports shall indicate the sheet numbers or other such acceptable identification numbers of the material. The material certified shall also have the identification details stamped on it.

2.7 Castings and forgings used for construction shall be of tested quality. Details of results of chemical analysis, heat treatment record and mechanical property test results shall be furnished.

2.8 All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section-IX/BS-4870 or other International equivalent standard acceptable to the Owner.

All brazers, welders etc. employed on any part of the contract at Contractor's / Sub-Contractor's works or at site shall be qualified as per ASME Section-IX or BS- 4871 or equivalent international standard approved by the Owner. Such qualification tests shall be conducted in presence of Owner/his authorised representative.

For welding of pressure parts and high pressure piping, the requirements of IBR shall also be complied with.

2.9 All Non-Destructive Tests (NDT) shall be carried out in accordance with approved International Standard. The NDT operator shall be qualified as per SNT-TC-IA (of American Society of non- destructive examination)/EN/Equivalent. Results of NDT shall be properly recorded and submitted for approval.

2.10 List of all the sub-vendors proposed by the Contractor for procurement of major bought out items including castings, forgings, semi-finished and finished components/ equipment shall be drawn up by the Contractor and finalised with the Owner. Such list shall be subject to Owner's approval. Quality Plans of the successful vendors shall be discussed, finalised and approved by the Owner/Authorised representative and form part of the Purchase Order between the Contractor and the Vendor.

2.11 All the purchase specifications for the major bought-out items, list of which shall be drawn up by the Contractor and finalised with the Owner shall be furnished to the Owner for comments and subsequent approval before orders are placed.

Owner reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their sub-vendor's quality management and control activities. The Contractor shall provide all necessary assistance to enable the Owner carry out such audit and surveillance.

Quality audit/approval of the results of tests and inspection will not prejudice the right of the Owner to reject equipment not giving the desired performance after erection and shall not in no way limit the liabilities and responsibilities of the Contractor in earning satisfactory performance of equipment as per specification.

2.12 Quality requirements for main equipment shall equally apply for spares and replacement items.

2.13 Repair/rectification procedures to be adopted to make any job acceptable shall be subject to the approval of the Owner.

2.14 For quality assurance of all civil works refer to the specifications for civil works.

3.0 QUALITY ASSURANCE DOCUMENTS

3.1 The Contractor shall be required to submit two (2) copies and two (2) sets of softcopies in the form of CD of the following Quality Assurance documents within three (3) weeks after despatch of the equipment:

3.1.1 Material mill test reports on components as specified by the specification.

3.1.2 The inspection plan with verification, inspection plan checks points, verification sketches, if used and methods used to verify that the inspection and testing points in the inspection plan were performed satisfactorily.

3.1.3 Non-destructive examination results/reports including radiography interpretation reports.

3.1.4 Factory tests results for testing required as per applicable codes and standards referred in the specification.

3.1.5 Welder identification list incorporating welder's and welding operator's qualification procedure and welding identification symbols.

3.1.6 Sketches and drawings used for indicating the method of traceability of the radiographs to the location on the equipment.

3.1.7 Stress relief time temperature charts.

3.1.8 Inspection reports duly signed by QA personnel of the Owner and Contractor for the agreed inspection hold points. During the course of inspection, the following shall also be recorded:

(a) When some important repair work is involved to make the job acceptable.

(b) The repair work remains part of the accepted product quality.

3.2 Letter of conformity certifying that the requirement is in compliance with finalised specification requirements.

4.0 INSPECTION, TESTING AND INSPECTION CERTIFICATES

4.1 The Engineer, his duly authorised representative and/or an outside inspection agency acting on behalf of the Owner shall have access at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Contractor shall obtain for the Engineer and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.

4.2 Stage Inspection/Pre-Dispatch Inspection by the Owner/his Authorised Representative

4.2.1 The inspection of goods to be supplied by the owner's authorised representative shall be generally carried out as stipulated hereunder at pre-identified customer hold points as per the approved Quality Plan. However, the owner or his authorised representative shall have unrestricted access to the premises of contractor/subcontractor where goods to be supplied against this contract are manufacture during the process of manufacturing of goods.

4.2.2 The authorised representative of the owner/Independent Inspection Agency (IIA) appointed by the owner shall carry out inspection at customer hold points. All the costs of deputing owner's representative/IIA of such inspection shall be borne by the owner.

4.2.3 The contractor, at-least one month prior to expected date of attaining the respective stage of manufacturing/readiness of the goods, shall submit the inspection call indicating the date of inspection to the Controller of the Quality appointed by the owner/IIA under intimation to the Controller of Quality.

4.2.4 The Controller of the Quality appointed by the owner/IIA, within fifteen days from the date of receipt of such notice, shall intimate the contractor, the probable date of visit for the inspection. Such date in any case shall not be later than eight days from the date of inspection as intimated by the contractor.

4.2.5 The inspection shall be carried out by the authorised representative of the owner/Independent Inspection Agency (IIA) strictly as per the approved quality plan. However, in the event of owner grants waiver for such inspection or the owner's representative/IIA is not able to attend the inspection on the date confirmed as per Clause No. 4.2.4 above, the contractor shall carryout the inspection as per the approved Quality Plan and submit the report of the same to the Controller of the Quality.

4.2.6 In the event the inspection is not be carried out on the date confirmed as per Clause No. 4.2.4 above and inspection call is required to be cancelled, all the costs of deputing owner's representative/IIA shall be recovered from the contractor's invoices.

4.3 In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Engineer/ Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contractor and shall give facilities to the Engineer/ Inspector or to his authorised representative to accomplish testing.

4.4 To facilitate advance planning of inspection in addition to giving inspection notice, the Contractor shall furnish quarterly inspection programme indicating schedule dates of inspection at customer hold point and final inspection stages. Updated quarterly inspection plans shall be made for each three consecutive months and shall be furnished before beginning of each calendar month.

5.0 INSPECTION AND TESTING FOR RAW WATER TREATMENT PLANT

5.1 GENERAL

The testing and inspections listed herein are the minimum requirements as perceived by the Owner; the bidder shall consider this only as a general guidance and is not meant to be exhaustive. The bidder shall consider requisite testing and inspections across the equipments/systems forming the proposed power plant unit based on his own experience and in line with the current industry practices for

identically rated power plant for the technology under consideration and relevant codes and standards. The comprehensive list of tests considered for each of the equipment/systems shall be furnished as part of the bid.

5.2 TESTS AT MANUFACTURER'S WORKS

Shop tests shall include all tests to be carried out at Bidder's works, works of their sub-vendors and at works where raw materials to be used for fabrication of equipment are manufactured. The tests to be carried out shall include but not be limited to the following:

(a) Composition of all material, castings, forgings etc.

(b) Hydraulic tests for pressure vessels, pipes, valves, pump casing etc.

(c) Tests to check faults in rubber lining [as per IS-4682 (Part-I) or its equivalent] and painting. Static balancing tests on agitators, stirrers, paddles, etc.

(d) Static and dynamic balancing tests on all impellers.

(e) Performance tests (Head, Capacity and Power) for each of pumps and blowers.

(f) Tests of all electrical equipment/accessories as specified in respective electrical sub-sections.

(g) Control Systems are to be checked for dimensions, wiring continuity, insulation, tubing leakage etc.

(h) All instruments and accessories are to be checked for performance, over range protection etc as per I.S.A. or other relevant standards.

(i) Calibration tests of all standard orifices, nozzles, pressure & other instruments.

(j) Control valves are to be tested for body/seat/diaphragm leakage, lift characteristics and material compositions of body, seat & bonnet.

(k) Functional tests of the control system.

(l) Load tests for monorail hoists.

(m) Calibration tests for Weigh Machine/Load Indicator.

5.3 TESTS AT SITE BEFORE TRIAL RUN

Bidder shall carry out tests at site to prove to the Purchaser that each equipment of the plant complies with the requirements stipulated and is erected in accordance with requirements. Before the plant is put on trial run, the Bidder shall be required to conduct tests to demonstrate to the Purchaser that each item of the plant is capable of correctly performing the functions for which it was specified to. These tests may be conducted concurrently with those required under commissioning sequence. Tests required shall in general be as follows:

5.3.1 All piping and valves, after installation, shall be tested hydrostatically at a pressure, one and half times of the maximum attainable pressure in the system, to check against leak tightness.

5.3.2 All valves/gates (Manual/Automatic/Remotely Operated) shall be operated throughout 100% of the travel and these should function without any trouble whatsoever.

5.3.3 All pumps shall be run with the specified fluid from shut off conditions to valve wide-open condition. Head developed shall be checked from the discharge pressure gauge reading. Capacity may be checked from flow indicators where applicable. If flow indicators are not available in the system, capacity can be checked from the volume of fluid handled (determined from level indicator reading of concerned tank) and duration of test.

During the test, the pumps and drive motors shall run smoothly without any undue vibration, leakage through gland, temperature rise in the bearing parts, noise, flow pulsation etc.

(a) Pumps, blowers etc. shall be tested at site to run smoothly without undue vibration, flow pulsation, temperature rise in bearing parts, noise etc.

(b) The tests to be carried out for the fabricated storage vessels shall include:

(i) During fabrication and before lining:

a. Bottom testing for leakage by soap solution, after the bottom and at least the bottom course of the shell plate have been welded.

b. Hydraulic shell testing for leakage.

c. Fixed roof test for leakage by soap solution.

(ii) After rubber lining:

a. Water leakage test for storage tank by filling it with water up to the overflow level.

(c) All the rubber lining shall be subjected to the following tests as per IS: 4682 (Part-I).

(i) Adhesion test

(ii) Resistance to bleeding

(iii) Thickness measurement

(iv) Shore hardness

(v) High voltage spark test

(d) Epoxy painting shall be checked by dry type thickness gauge.

(e) Visual check on all structural components, welding, rubber lining, painting etc. and if doubt arises these shall be tested again.

(f) All testing and calibrating instruments and equipment shall be arranged by the Bidder free of cost to the satisfaction of the Purchaser.

(g) All monorail hoists shall be subjected to full working load during all motions without showing any sign of defect.

(h) All the rotating/moving components shall be run at the rated speed with water/chemicals up to the normal water level for a period of twenty-four (24) hours. During this period all the components shall function smoothly without any unbalance, vibration, overheating at bearing parts etc.

(i) Checks on electrical items as mentioned under electrical specifications.

NOTE: - 1) The above mentioned requirement are bare minimum. However, any additional comments provided by BHEL / Customer shall be adhered by successful bidder without any commercial and delivery implication to BHEL/Customer.

2) For electrical and C&I items testing procedure and QAP mentioned in respective specification shall be applicable/referred.

Annexure – II

SUB VENDORS LIST

SR. NO.	ITEM		VENDORS
1.0	ETP ITEMS, a. TPI & API Separators, b. Filter Press	(a)	K-PACK SYSTEMS
		(b)	ISHA ENGINEERS & CO.
2.0	VERTICAL TURBINE PUMPS	(a)	KIRLOSKAR BROTHERS LTD. (KBL)
		(b)	MATHER & PLATT
		(c)	WPIL
		(d)	JYOTI PUMPS
		(e)	FLOWMORE
		(f)	SAM
3.0	HORIZONTAL CENTRIFUGAL PUMPS	(a)	KBL
		(b)	KSB PUMPS
		(c)	MATHER & PLATT
		(d)	SAM TURBO
		(e)	WPIL
		(f)	JYOTI PUMPS
		(g)	FLOWMORE
		(h)	SULZER
		(i)	KISHOR PUMPS
4.0	METERING/ DOSING PUMPS	(a)	MILTON ROY INDIA (P) LTD.
		(b)	V.K. PUMPS
		(c)	SHAPO TOOLS
5.0	SUMP PUMP	(a)	KIRLOSKAR BROTHERS LTD. (KBL)
		(b)	SAM
		(c)	KISHOR PUMPS
		(d)	FLOW MORE
		(e)	KSB
		(f)	VARTAK PUMPS
		(g)	MAXFLOW

6.0	FUEL OIL PUMPS	(a)	TUSHACO
		(b)	ALKETON, MADRAS
		(c)	PSI ENGINEERING
		(d)	ROTOPUMPS
		(e)	BOURNMEN, GERMANY
		(f)	DELTA CORPORATION
			ALL WEILER, GERMANY
		(h)	IMO, SWEDEN
7.0	AIR BLOWER (LOBE TYPE)	(a)	EVEREST TRANSMISSION
		(b)	KAY ENGG. WORKS
		(c)	SWAM PNEUMATICS
		(d)	ROOTS
8.0	BUTTERFLY VALVES (MANUAL/PNEUMATIC)	(a)	KIRLOSKAR BROTHERS LTD.
		(b)	FOURESS
		(c)	L&T
		(d)	INTERVALVE (INDIA) LTD
		(e)	R&D MULTIPLES
		(f)	AUDCO
		(g)	INSTRUMENTATION LTD
		(h)	HAWA VALVES
		(i)	VENUS PUMPS & ENGINEERING WORKS
		(j)	BHEL
		(k)	FLOW VEL
		(1)	LEADER VALVES
9.0	RUBBER EXPANSION JOINT	(a)	D'WAREN & CO
		(b)	S.L. MANEKLAL
		(c)	SRMEX'OFLEX PVT LTD
		(d)	CORI ENGINEERS
10.0	STRAINERS	(a)	SPIRAX MARSHALL

		(b)	MICON VALVES (1) PVT. LTD.
		(c)	FLOWTECH ENGINEERS
		(d)	FOURESS LTD.
		(e)	KSB LTD.
		(f)	L&T
		(g)	LEADER
		(h)	PROCEDYNE ENGINEERS
11.0	CAST IRON VALVE (GATE /GLOBE/CHECK/AIR RELEASE VALVE)	(a)	LEADER VALVE
		(b)	VENUS PUMP
		(c)	FOURESS
		(d)	LEVCON
		(e)	DURGA ENGG CO.
		(f)	L&T
		(g)	R & D MULTIPLES
		(h)	FLUIDLINE VALVES CO PVT LTD
		(i)	INTER VALVE (INDIA) LTD
		(j)	NSSL LIMITED
12.0	CAST STEEL VALVES (GATE/GLOBE/CHECK/ BALL VALVE)	(a)	L&T
		(b)	KIRLOSKAR BROS. LTD
		(c)	CRESENT VALVES
		(d)	AUDCO
		(e)	KSB
		(f)	LEVCON
		(g)	FOURESS
		(h)	R & D MULTIPLES
		(i)	FLUIDLINE VALVES
		(j)	NSSL LIMITED
		(k)	VENUS PUMP

DOCUMENT TITLE:	BHEL DOCUMENTS NO.: PE-TS-415-164-A001	
TECHNICAL SPECIFICATION FOR EFFLUENT TREATMENT PLANT BHUSAWAL TPS (1 X 660MW)	Volume: II	
	Section: IA	
	REV. NO. 00	DATE:

		(1)	DURGA CO.
		(m)	HAWA VALVES
		(n)	A.V.VALVES
13.0	ST AINLESS STEEL (GATE/GLOBE/CHECK VALVE)	(a)	CRESCENT
		(b)	FOURESS
		(c)	R & D MULTIPLES
14.0	GUN METAL/BRASS/ BRONZE VALVES	(a)	LEADER VALVES
		(b)	SARKAR
		(c)	LEVCON
		(d)	BOMBAY METAL & ALLOYS
		(e)	SANT ENC,G
		(f)	BANKIM & COMP.
		(g)	BDK
15.0	FORGED STEEL VALVE	(a)	FOURESS LIMITED
		(b)	KSB LIMITED
		(c)	L&T
		(d)	BANKIM
		(e)	BDK VALVES
		(f)	LEADER
		(g)	A.V.ENGG
		(h)	CRESCENT
		(i)	BHEL
16.0	L.D. PIPING	(a)	SETH & SURA ENGG. CO. LTD.
		(b)	IVCRL
		(c)	RAUNAQ
		(d)	ZUBERI
		(e)	INDIAN HUME PIPES LTD
		(f)	DYNAMIC ENGG PVT LTD

17.0	L.P.PIPING	(a)	UNITECH MACHINES, NEW DELHI
		(b)	AARTI INFRASTRUCTURE, NAGPUR
		(c)	ZUBERI, JAIPUR
		(d)	SETH & SURA ENGG CO. LTD
18.0	DIESEL ENGINES	(a)	KIRLOSKAR CUMMINS
		(b)	GREAVES COTTON
		(c)	ASHOK LEYLAND
19.0	FLANGES & FITTINGS	(a)	ALLIANCE
		(b)	JYOTI
		(c)	EBY
20.0	PAINTINGS	(a)	ASIAN PANTS (1) LTD.
		(b)	BERGER PAINTS INDIA LTD.
		(c)	SHALIMAR PAINTS LTD
		(d)	NEROLAC
		(e)	JHONSON & NICHOLSON
21.0	EOT CRANE (More than 100 Ton)	(a)	UNIQUE IND. HANDLERS
		(b)	ANUPAM INDUSTRIES
		(c)	MUKAND
		(d)	WMI
		(e)	FAFECO
		(f)	CENTURY CRANE ENGINEERS (P) LTD.
22.0	EOT CRANE (Less than 100 T)	(a)	UNIQUE INDUSTRIAL HANDLERS
		(b)	ANUPAM INDUSTRŒS
		(c)	MUKAND
		(d)	FAFECO
		(e)	TURBO FUEGUSON
		(f)	WMI
		(g)	CONSOLIDATED HOIST
		(h)	HERCULES

		(i)	ELECON
		(j)	HASK ENGINEERS
		(k)	BRADY & MORRIS ENGG. CO. LTD.
		(1)	McNALLY BHARAT KOLKATA
		(m)	SHREE ENGINEERS
		(n)	CENTURY CRANE ENGINEERS (P) LTD.
23.0	MANUAL HOIST & CHAIN PULLEY BLOCK	(a)	TRACTEL TRIFOR INDIA (P) LTD.
		(b)	LIFTING EQUfflåENT & ACCESSORIES
		(c)	INDEF (HERCULES)
		(d)	BATLIBOI
		(e)	UNIVERSAL
		(f)	ABHAY INDUSTRIES
24.0	ELECTRICAL HOIST	(a)	BATLIBOI
		(b)	PBL
		(c)	GREAVES
		(d)	HOISTOMECH
		(e)	SHREE ENGINEERS
		(f)	ABHAY INDUSTRIES
		(g)	INDEF
		(h)	UNIVERSAL
		(i)	SWIFT
		(j)	TRACI'EL TRIFOR INDIA (P) LTD.
		(k)	CENTURY CRANE ENGINEERS (P) LTD.
		(1)	HERCULES HOISTS LIMITED

TECHNICAL SPECIFICATION
ELECTRIC HOISTS & CHAIN PULLEY BLOCKS
1X660 MW BHUSAWAL TPS UNIT-6

Material Handling Sub Vendor List

Package Name	Vendor Name
ELECTRIC HOIST	Alpha Services
	CONSOLIDATED HOISTS PVT LTD
	CENTURY CRANE ENGINEERS PVT. LTD.
	TECHNO INDUSTRIES
	EDDY CRANES PVT. LTD.
	Grip Engineers Pvt. Ltd.,
	TRACTEL TIRFOR INDIA PVT. LTD.
	Mangla Hoists Pvt Ltd
	BRADY & MORRIS ENGINEERING CO. LTD.
	REVA INDUSTRIES LTD.
	UNIVERSAL HOIST-O-FABRIK
CHAIN PULLEY BLOCK	UNIVERSAL HOIST-O-FABRIK
	CENTURY CRANE ENGINEERS PVT. LTD.
	BAKELITE ELECTRICAL MFG. CO. PVT. LTD.
	TRACTEL TIRFOR INDIA PVT. LTD.
	BRADY & MORRIS ENGINEERING CO. LTD.
	TUOBRO FURGUSON (INDIA) PVT LTD
	TECHNO INDUSTRIES

Note: No other make will be acceptable, until and unless specifically got approved by BHEL/Customer / Customer's consultant during detail engineering only. Acceptance/non acceptance of same shall not have any impact on manufacturing, delivery schedule and on cost of the Electric hoists/CPB.

MAKES OF SUB VENDORS ITEMS AS APPLICABLE TO ELECTRIC HOIST:

Sl no.	ITEM	MAKES
1.0	STEEL	SAIL/IISCO/TATA STEEL / JINDAL
2.0	HOOKS	MOOZUMDAR / SIMRITI FORGING / HARMAN MOHTA / STEEL FORGING & ENGG. CO., KOLKATA /
3.0	GEAR COUPLINGS	ALLIANCE / HICLIFF / OEM
4.0	WIRE ROPE	USHA MARTIN Black / BOMBAY WIRE ROPES / FORT WILLIAMS / UNITED WIRE ROPE/BHARAT WIRE ROPES.
5.0	BEARINGS	SKF/ FAG
6.0	MOTORS	SIEMEN/ ABB /NGEF/ CROMPTON /KIRLOSKAR /GECA / BHARAT BIJLI / MARATHON / LHP.
7.0	BRAKES	STROM CRAFT/ ELECTROMAG /SPEED-O- CONTROL / EMCO LENZE
8.0	CONTACTOR	SIEMENS / L&T /TELE MECHANIQUE / BCH
9.0	OVER LOAD RELAYS	SIEMENS / L&T / TELE MACHANIQUE / ABB
10.0	HRC FUSES	SIEMENS / L&T/ ENGLISH ELECTRIC/GE Power
11.0	ISOLATING SWITCH	SIEMENS/ L&T / CONTROL & SWITCH GEAR
12.0	SWITCH FUSE UNITS	SIEMENS/ L&T/ CONTROL/ & SWITCH GEAR/ GEC A
13.0	TIME DELAY RELAYS	SIEMENS/ L&T/ ABB/ BCH/ GEC A
14.0	TRANSFORMERS	INDCOIL/AE / LOGICSTAT/ PRAGATI / KAPPA / SOUTHERN ELECTRIC
15.0	BULB & FLOURESCENT TUBES/FITTINGS	PHILIPS/ BAJAJ/ CROMPTON
16.0	CABLE LUGS (HEAVY DUTY)	DOWELLS
17.0	CABLES	
a)	POWER CABLES	NICCO / UNIVERSAL / INCAB / FORT GLOSTER TORRENT / CCI / ICL / RADIANT / FINOLEX/ POLYCAB/KEI/HAVELL
b)	CONTROL CABLES	NICCO / UNIVERSAL / INCAB / FORT GLOSTER / DELTON / FINOLEX / TORRENT / CCI / ICL / RADIANT POLYCAB / KEI/ HAVELL.
c)	TRAILING CABLE	UNIVERSAL/ FGL/CCL/HVP/KEI/RADIANT.

18.0	CABLE GLAND	COMMET / SIEMEN / SUNIL&CO.
19.0	PUSH BUTTONS	SIEMENS / L&T / BCH /TEKNIC/VAISHNO
20.0	LIMIT SWITCHES	SPEED-O-CONTROL / ELECTROMAG / JAI BALA JI / KAYCEE / BCH
21	SELECTOR SWITCHES	KAYCEE/ SULZER
22	PENDENT PUSH BUTTON STATION	OEM
23	INDICATING LAMPS	TECKNIC / BCH / SIEMENS / STANDARD/ VAISHNO
24	MCB	MDS / INDO COPP / STANDARD
25	PANELS	OEM/BCH
26	DSL	SUSHEEL/STROMAG
27	TERMINAL BLOCKS	ELMEX/CONNECTWELL/WAGO (FOR CONTROL ONLY)
28	VVVF	YASAKAWA(L&T)/ABB/SIEMENS/SCHNIDER
29	CASTING	KOLHAPUR STEEL / GNAT FOUNDARY / KIRTI ALLOYS
30	Tools & tackles	Reputed make

MAKES OF SUB VENDORS ITEMS AS APPLICABLE TO MANUAL HOIST:

Sl no.	ITEM	MAKES
1.0	STEEL	SAIL/IISCO/TATA STEEL / JINDAL
2.0	HOOKS	STEEL FORGINGS/ KARACHIWALA/SMRITI/NASIK FORGE.
3.0	STEEL FORGINGS	CHOWDHARY/WESTERN INDIA FORGINGS/ HINDUSTAN STEEL FORGINGS/ RUBY FORGINGS OR AS APPROVED BY BHEL.
4.0	BRAKES	OEM

NOTE:

1. THE SUB VENDOR LIST ABOVE IS INDICATIVE ONLY AND IS SUBJECT TO BHEL AND CUSTOMER APPROVAL DURING DETAILED ENGINEERING STAGE WITHOUT ANY COMMERCIAL & DELIVERY IMPLICATION TO BHEL.

4.0	LIST OF APPROVED VENDORS – CONTROL & INSTRUMENTATION		
SR. NO.	NAME OF EQUIPMENT / ITEM		APPROVED VENDORS
1.0	FIELD / PRIMARY INSTRUMENTS:		
1.1	RTD & THERMOCOUPLES	(a)	PYRO ELECTRIC INSTRUMENTS GOA PVT. LTD.
		(b)	GENERAL INSTRUMENTS CONSORTIUM, MUMBAI
		(c)	DETRIVE, MUMBAI
		(d)	TEMSENS INSTRUMENTS(I) PVT. LTD, UDAIPU
1.2	SMART ELECTRONIC TRANSMITTERS (PRESSURE, DIFF. PRESSURE)	(a)	EMERSON PROCESS MANAGEMENT (I) LTD
		(b)	FUJI, JAPAN
		(c)	YOKOGAWA, JAPAN/ YOKOGAWA INDIA
		(d)	ABB, GERMANY / FARIDABAD
		(e)	HONEYWELL, USA / PUNE
1.3	DISPLACER TYPE LEVEL TRANSMITTER	(a)	CHEMTROL MIL
		(b)	DRESSER, COIMBTORE
		(c)	V-AUTOMAT, DELHI
		(d)	ECKARDT, GERMANY
1.4	LEVEL TRANSMITTERS (DISPLACEMENT TYPE)	(a)	DRESSER MASONIELAN, FRANCE (DRESSER VALVES INDIA LTD. COIMBATORE)
		(b)	CHEMTROLS, MUMBAI (ECKARDT, GERMANY)
		(c)	ECKARDT, GERMANY

SR. NO.	NAME OF EQUIPMENT / ITEM		APPROVED VENDORS
1.5	LEVEL TRANSMITTERS (ULTRASONIC TYPE)	(d)	ENDRESS+HAUSER, GERMANY/INDIA
		(e)	KROHNE, FRANCE
		(f)	PEPPERL+FUCHS, GERMANY/INDIA
		(g)	VEGA, GERMANY
		(h)	KAB INSTRUMENTS LTD.
1.6	RADAR TYPE LEVEL TRANSMITTERS	(a)	SIEMENS MILLTRONICS
		(b)	ENDRESS & HAUSER
		(c)	SBEM
		(d)	EMERSON
		(e)	AMETEKEDREXELBRROK (CHEMTROLS)
1.7	TEMPERATURE TRANSMITTERS	(a)	EMERSON PROCESS (FORMERLY FISHER ROSEMOUNT), USA/DAMAN
		(b)	ABB, GERMANY / FARIDABAD
		(c)	FUJI, JAPAN
		(d)	HONEYWELL, USA / PUNE
		(e)	YOKOGAWA, JAPAN/ YOKOGAWA INDIA
		(f)	MOORE, USA
1.8	MAGNETIC LEVEL SWITCHES	(a)	LEVCON INSTRUMENTS PVT. LTD., KOLKATA
		(b)	V.AUTOMAT, NEW DELHI
		(c)	ASIAN INDUSTRIAL VALVES, CHENNAI
1.9	LEVEL SWITCHES CONDUCTIVITY TYPE	(a)	BHARAT HEAVY ELECTRICALS LTD.
		(b)	YARWAY, USA

SR. NO.	NAME OF EQUIPMENT / ITEM		APPROVED VENDORS
		(c)	LEVELSTATE, UK
		(d)	SOLARTON, UK (PRESENTLY CALLED AS MOBREY)
		(e)	CHEMTROL
		(f)	LEVEL STATE (HITECH SYSTEMS)
		(g)	MOBREY
1.10	FLOW SWITCHES	(a)	SWITZER, CHENNAI
		(b)	KRONHE MARSHALL
		(c)	GENERAL INSTRUMENTS MUMBAI
		(d)	CHEMTROL
1.11	BYPASS ROTAMETER	(a)	IEPL, HYDERABAD
		(b)	PLACKA INSTRUMENTS INDIA PVT. LTD., CHENNAI
		(c)	TRAC, HYDERABAD
		(d)	EUREKA, PUNE
1.12	ROTAMETER	(a)	INSTRUMENTATION ENGINEERS PVT. LTD.
		(b)	SIGMA INSTRUMENTS CO.
		(c)	EUREKA INDUSTRIAL EQPT. PVT. LTD.
		(d)	TELACE EQUIPMENT PVT. LTD.
1.13	FLOW INTEGRATOR (ELECTRONIC TYPE)	(a)	ABB, GERMANY / FARIDABAD
		(b)	MASIBUS, GANDHINAGAR
		(c)	YOKOGAWA, JAPAN/ YOKOGAWA INDIA
		(d)	LEKKTROTEK, PUNE
		(e)	EMERSON

SR. NO.	NAME OF EQUIPMENT / ITEM		APPROVED VENDORS
		(f)	ENDRESS & HAUSER
		(g)	FORBES MARSHALL
1.14	GAUGES (PRESSURE, DIFF. PRESSURE)	(a)	A N INSTRUMENTS PVT. LTD., KOLKATA
		(b)	GENERAL INSTRUMENTS CONSORTIUM, GOA / MUMBAI
		(c)	GOA THERMOSTATIC INSTRUMENTS, GOA
		(d)	FORBES MARSHALL LTD., HYDERABAD
		(e)	WAAREE INDUSTRIES, MUMBAI
		(f)	H.GURU INSTRUMENTS (SOUTH INDIA), BANGALORE
		(g)	WIKA INSTRUMENTS INDIA PVT. LTD., PUNE
		(h)	GOA INSTRUMENTS PVT. LTD.,
		(i)	MONOMETER, MUMBAI
		(j)	BELLS CONTROLS LTD., KOLKATA
		(k)	SWITZER INSTRUMENTS LTD., CHENNAI
		(l)	WIKA ALEXANDER WIEGAND GMBH&CO., GERMANY
		(m)	BUDENBURG GUAGE CO. LTD
		(n)	INSTRUMENTATION PVT. LTD., BANGALORE
		(o)	INDOSONIC INSTRUMENT, MUMBAI
		(p)	PRECISION
		(q)	ASHCROFT

SR. NO.	NAME OF EQUIPMENT / ITEM		APPROVED VENDORS
1.15	TEMPERATURE GAUGE	(a)	GOA THERMOSTATIC INSTRUMENTS, GOA
		(b)	GENERAL INSTRUMENTS CONSORTIUM,
		(c)	A.N. INSTRUMENTS PVT. LTD., KOLKATA
		(d)	H. GURU INSTRUMENTS (SOUTH INDIA), BANGALORE
		(e)	FORBES MARSHALL, HYDERABAD
		(f)	WIKA INSTRUMENTS INDIA PVT. LTD., PUNE
		(g)	WAREE, DADRA GOA INSTRUMENTS PVT. LTD.,
		(h)	BELLS CONTROLS LTD., KOLKATA
		(i)	SWITZER INSTRUMENTS LTD., CHENNAI
		(j)	WIKA ALEXANDER WIEGAND GMBH&CO., GERMANY
		(k)	BUDENBURG GUAGE CO. LTD.
		(l)	INDOSONIC INSTRUMENT, MUMBAI
1.16	SWITCHES (PRESSURE, DIFF. PRESSURE)	(a)	INDFOSS INDUSTRIES LTD., GHAZIABAD
		(b)	SWITZER INSTRUMENTS COMPANY, CHENNAI
		(c)	SOR INC., USA
		(d)	PYROELECTRIC, GOA
		(e)	DRESSER INDUSTRIES INC, USA
		(f)	REGULATEURS GEORGIN, FRANCE

SR. NO.	NAME OF EQUIPMENT / ITEM		APPROVED VENDORS
		(g)	DELTA CONTROLS LTD., U.K.
		(h)	KDG INSTRUMENTS LTD. U.K.
		(i)	ASHCROFT
		(j)	DWAYER, USA
		(k)	GENERAL INSTRUMENTS CONSORTIUM
1.17	TEMPERATURE SWITCH	(a)	INDFOSS INDUSTRIES LTD., GHAZIABAD
		(b)	SWITZER INSTRUMENTS COMPANY, CHENNAI
		(c)	GENERAL INSTRUMENTS CONSORTIUM, MUMBAI
		(d)	SOR INC., USA
		(e)	PYROELECTRIC, GOA DRESSER INDUSTRIES INC, USA
		(f)	REGULATEURS GEORGIN, FRANCE
		(g)	DELTA CONTROLS LTD., U.K.
		(h)	KDG INSTRUMENTS LTD. U.K.
1.18	AIR FILTER REGULATOR	(a)	PLACKA, CHENNAI
		(b)	SHAVO NORGREN, INDIA
1.19	MASS FLOW METER (CORROLIOUS PRINCIPLE)	(a)	EMERSON PROCESS MANAGEMENT (I) LTD
		(b)	ABB
		(c)	YOKOGAWA
		(d)	ENDRESS+ HAUESER
		(e)	GE SENSING & INSPECTION TECHNOLOGIES
		(f)	FORBES MARSHALL

SR. NO.	NAME OF EQUIPMENT / ITEM		APPROVED VENDORS
1.20	I/P CONVERTER	(a)	ECKHARDT, GERMANY
		(b)	MTL, CHENNAI
		(c)	ABB
		(d)	WATSON SMITH (PRESENTLY NORGREN)
		(e)	EMERSON PROCESS MGMT ASIA PACIFIC LTD.
		(f)	MOORE CONTROLS
1.21	FLOW ELEMENTS	(a)	INSTRUMENTATION LTD.
		(b)	MICRO PRECISION PRODUCTS
		(c)	ENGINEERING SPECIALITIES PVT. LTD.
		(d)	GENERAL INSTRUMENTS
1.22	LEVEL GAUGES (FLOAT TYPE)	(a)	SB ELECTRO
		(b)	SIGMA
		(c)	V AUTOMAT
		(d)	LEVCON
		(e)	CHEMTROLS
		(f)	ASIAN INDUSTRIAL VALVES
1.23	ORP TRANSMITTERS	(a)	FORBES MARSHALL
1.24	DENSITY METER (NUCLEONIC TYPE)	(a)	ENDRESS + HAUSER
		(b)	THERMO MEASURE TECH.
		(c)	CHEMTROL (THERMO FISHER)
1.25	DENSITY METER (NON-NUCLEONIC TYPE)	(a)	ENDRESS + HAUSER
		(b)	THERMO MEASURE TECH.
		(c)	CHEMTROL (THERMO FISHER)

SR. NO.	NAME OF EQUIPMENT / ITEM		APPROVED VENDORS
1.26	SOLID MASS FLOW METER	(a)	SIEMENS MILLTRONICS
		(b)	CHEMTROL (THERMO FISHER)
		(c)	SIEMENS INSTRUMENTS, CANADA
1.27	PULL CORD SWITCH	(a)	JAYASHREE ELECTRODEVICES PVT. LTD.
		(b)	A.G. SYSTEM CONTROLS, MUMBAI
1.28	BELT SWAY SWITCH	(a)	JAYASHREE ELECTRODEVICES PVT. LTD.
		(b)	A.G. SYSTEM CONTROLS, MUMBAI
1.29	ZERO SPEED SWITCH	(a)	A.G. ELECTRONICS
		(b)	JAYASHREE ELECTRODEVICES PVT. LTD.
1.30	PROXIMITY SWITCH	(a)	AW
		(b)	JAYASHREE ELECTRODEVICES PVT. LTD.
1.31	LEVEL SWITCH (RF TYPE)	(a)	EIP ENVIRO LEVEL CONTROLS
2.0	**DCS, HMI, MONITORING AND PLC SYSTEMS:**		
2.1	DDCMIS	(a)	ABB.
		(b)	YOKOGAWA
		(c)	SIEMENS.
		(d)	BHEL
		(e)	EMERSON PROCESS MANAGEMENT
		(f)	MHI
2.2	PLC	(a)	ALLEN BRADLEY.
		(b)	SCHNEIDER
		(c)	ROCKWELL

SR. NO.	NAME OF EQUIPMENT / ITEM		APPROVED VENDORS
		(d)	GE FANUC
2.3	MASTER SLAVE CLOCK	(a)	SYMMETRICOM INC., USA
		(b)	HOPF, GERMANY
		(c)	HATHWAY, USA
		(d)	SERTEL ELECTRONICS, CHENNAI
		(e)	ADVANCE MICRONIC
2.4	DOT MATRIX PRINTER	(a)	HP / EPSON / WIPRO / TVS / SAMSUNG
2.5	LASER & COLOUR INKJET PRINTERS	(b)	HP / EPSON / CANON / IBM / XEROX / SAMSUNG
2.6	COMPUTERS FOR OPERATOR / ENGINEER / HISTORY STATION, SHIFT SUPERVISOR, STORIAN, SOFT LINK STATION FOR INTERFACING WITH OTHER SYSTEMS, PERFORMANCE CALCULATION AND SER STATION	(a)	IBM
		(b)	DELL
		(c)	HP/COMPAQ
2.7	TFT MONITOR	(a)	LG / SAMSUNG / HP / COMPAQ / IBM / DELL
2.8	VIBRATION MONITORING SYSTEM & TURBO-SUPERVISORY INSTRUMENTS	(a)	ROCKWELL AUTOMATION, USA
		(b)	BENTLEY NEVADA, USA / INDIA
		(c)	SHINKAWA, JAPAN / FORBES MARSHALL,
		(d)	VIBROMETER, SWITZERLAND
2.9	LARGE VIDEO SCREENS	(a)	BARCO BELGIUM / BARCO, INDIA
		(b)	PLANAR, USA / PYROTECH, INDIA
		(c)	CHRISTIE, USA / CHRISTIE, INDIA

SR. NO.	NAME OF EQUIPMENT / ITEM		APPROVED VENDORS
		(d)	SYNELEC
		(e)	DELTA, THAILAND / DELTA POWER SYSTEMS, INDIA
2.10	HART COMMUNICATOR	(a)	HONEYWELL, USA/PUNE
		(b)	EMERSON PROCESS (FORMERLY FISHER ROSEMOUNT), USA / DAMAN
		(c)	YOKOGAWA, JAPAN / YOKOGAWA, INDIA
		(d)	MERIAM, USA / CHEMTROLS, MUMBAI
		(e)	ABB, GERMANY / INDIA
		(f)	FUJI, JAPAN
2.11	HART MANAGEMENT SYSTEM	(a)	PEPPERL+FUCKS, GERMANY / INDIA
		(b)	MTL, UK / INDIA
		(c)	EMERSON PROCESS, USA / DAMAN
2.12	ALARM ANNUNCIATION SYSTEM	(a)	PROCON, CHENNAI
		(b)	I I C, HYDERABAD
		(c)	MINILEC, PUNE
		(d)	IIC, MUMBAI
		(e)	PIRIE, MUMBAI
		(f)	PECON, VADODARA
		(g)	POSITRONICS
2.13	RMCMS (ROTATING MACHINE CONDITION MONITORING SYSTEM)	(a)	VIBROTECH (M/S MEGITT INDIA PVT. LTD.)
		(b)	M/S SKF INDIA LTD.
2.14	ACOUSTIC PYROMETER	(a)	BONNENBERG + DRESCHER GMBH, GERMANY

SR. NO.	NAME OF EQUIPMENT / ITEM		APPROVED VENDORS
2.15	ACOUSTIC STEAM LEAK DETECTION SYSTEM (ASLD)	(a)	HI-TECH SYSTEM & SERVICES LTD, NEW DELHI (AMI MAKE)
		(b)	SARTECH INTL, CHENNAI (INSTROTECH MAKE INSPECTA FFT
2.16	EPABX SYSTEM	(a)	SIEMENS
		(b)	BPL
2.17	FURNACE TV CAMERA SYSTEM	(c)	HITECH SYSTEM & SERVICES LTD. (M/S LENOX INSTRUMENT COMPANY INC., USA
3.0	**ELECTRICAL & SECONDARY INSTRUMENTS:**		
3.1	DIGITAL INDICATOR	(a)	ABB, GERMANY / FARIDABAD
		(b)	MASSIBUS, GANDHINAGAR PYROTECH, UDAIPUR
		(c)	LEKTROTEK, PUNE
		(d)	GOSSEN / CAMILLE BAUER / METRAWATT YOKOGAWA, JAPAN / INDIA
		(e)	SIEMENS
3.2	BARGRAPH INDICATORS	(a)	ABB, GERMANY / FARIDABAD
		(b)	MASSIBUS, GANDHINAGAR
		(c)	PYROTECH, UDAIPUR
		(d)	LEKTROTEK, PUNE
		(e)	GOSSEN / CAMILLE BAUER / METRAWATT
		(f)	M-SYSTEM, JAPAN (CHINO LAXSONS DAMAN)
		(g)	SIEMENS

SR. NO.	NAME OF EQUIPMENT / ITEM		APPROVED VENDORS
3.3	PEN, POINT AND CHARTLESS RECORDERS	(a)	EUROTHERM, UK
		(b)	TATA HONEYWELL
		(c)	YOKOGAWA, JAPAN (YOKOGAWA, INDIA)
		(d)	CHINO (LAXSON), JAPAN
		(e)	ABB, UK / GERMANY
		(f)	FUJI ELECTRIC, JAPAN
3.4	TRANSDUCERS	(a)	SEIMENS
		(b)	AUTOMATIC ELECTRIC LTD., MUMBAI
		(c)	PYROTECH, UDAIPUR
		(d)	SOUTHERN TRANSDUCERS, CHENNAI
		(e)	ACCORD, PUNE MECO, MUMBAI
		(f)	ABB
		(g)	SITU, MUMBAI
		(h)	RISHABH
		(i)	ADEPT, PUNE
3.5	ELECTRICAL ANALOG (PANEL) METERS	(a)	AUTOMATIC ELECTRIC LTD., MUMBAI
		(b)	MECO, MUMBAI
		(c)	RISHAB, NASIK
3.6	SELECTOR SWITCHES AND CONTROL SWITCHES	(a)	KAYCEE
		(b)	ALSTOM
		(c)	L & T
		(d)	SIEMENS

SR. NO.	NAME OF EQUIPMENT / ITEM		APPROVED VENDORS
3.7	MOSAIC ANALOG (MOVING COIL) INDICATORS	(a)	GOSSEN, GERMANY
		(b)	WEIGEL, GERMANY
3.8	MOSAIC DIGITAL INDICATORS	(a)	GOSSEN, GERMANY
		(b)	WEIGEL, GERMANY
3.9	INTERPOSING RELAYS FOR COMMAND OUTPUT TO MCC	(a)	JYOTI
		(b)	H&B
		(c)	ALSTOM
		(d)	ELASTA
		(e)	OEN SIEMENS
		(f)	ABB
3.10	RELAYS / AUX. CONTACTORS	(a)	TELEMECANIQUE & CTRLS
		(b)	ABB
		(c)	SIEMENS
		(d)	GEC – ALSTOM
		(e)	L & T
3.11	LIMIT SWITCHES	(a)	BHARTIYA CUTLER & HAMMER, FARIDABAD
3.12	MINIATURIZED PUSH BUTTONS / ILPB (24X48MM) MOSAIC GRID COMPATIBLE	(a)	SIEMENS
		(b)	TEW, GERMANY (OLD NAME SUBKLEW)
4.0	CONTROL DESKS & PANELS:		
4.1	UNIT CONTROL PANELS (UCP)/ ELECTRICAL CONTROL PANEL (ECP)/ CONTROL DESK (MOSAIC GRID BASED)	(a)	BHEL EDN
		(b)	PYRO TECH, UDAIPUR
		(c)	INSTRUMENTATION LTD. KOTA
		(d)	KHODAY CONTROL SYSTEMS, BANGALORE

SR. NO.	NAME OF EQUIPMENT / ITEM		APPROVED VENDORS
		(e)	CHEMIN CONTROLS, PONDICHERRY
4.2	CRT DESK / OPERATOR DESK	(a)	PYRO TECH, UDAIPUR
		(b)	INSTRUMENTATION LTD. KOTA
		(c)	KHODAY CONTROL SYSTEMS, BANGALORE
		(d)	CHEMIN CONTROLS, PONDICHERRY
4.3	MOSAIC GRID/ MOSAIC TILES & OTHER MOSAIC ITEMS	(a)	SYMO, SWITZERLAND
		(b)	TEW, GERMANY (OLD NAME SUBKLEW)
		(c)	PYROTECH
4.4	LOCAL PANELS / DISTRIBUTION BOARDS	(a)	CONTROL & SCHEMATICS
		(b)	PYROTECH
		(c)	RITTAL
		(d)	L&T
4.5	TERMINAL BLOCKS	(e)	ELMEX
		(f)	PHOENIX
		(g)	WAGO
5.0	**ANALYSERS:**		
5.1	SWAS ANALYSERS	(a)	POLYMETRON / ZELLWEGGER – ANALYTICALS
		(b)	ABB
		(c)	ORION, USA
		(d)	ROSEMOUNT ANALYTICAL-CHEMPURE,
		(e)	HACH ULTRA FRANCE,
		(f)	HACH USA

SR. NO.	NAME OF EQUIPMENT / ITEM		APPROVED VENDORS
		(g)	YOKOGAWA
		(h)	AMETECH
		(i)	FORBES MARSHALL
		(j)	EMERSON
5.2	SWAS (STEAM AND WATER ANALYSIS SYSTEM) PANELS	(a)	ABB KENT, U.K.
		(b)	ABB LTD. FARIDABAD
		(c)	FORBES MARSHAL
		(d)	EMERSON PROCESS MANAGEMENT INSTRUMENTATION LTD., KOTA
		(e)	YOKOGAWA
5.3	CO ANALYSER (IN SITU TYPE)	(a)	AMETEK, USA / SINGAPORE
		(b)	CODEL INTERNATIONAL LTD. UK
		(c)	LAND COMBUSTION UK
5.4	OXYGEN IN FLUE GAS ANALYSER (ZIRCONIA PROBE TYPE)	(a)	AMETEK, USA / SINGAPORE
		(b)	LAND INSTRUMENTS, UK
		(c)	EMERSON PROCESS MANAGEMENT (I) LTD
		(d)	YOKOGAWA, JAPAN
		(e)	ENOTECH, GERMANY
		(f)	ABB, UK
		(g)	TELEDYNE, USA
		(h)	FUJI (AIC)
5.5	SMOKE DENSITY ANALYSER / PARTICULATE EMISSION ANALYSER / OPACITY ANALYSER	(a)	DURAG, GERMANY
		(b)	CODEL, UK
		(c)	LAND COMBUSTION UK

SR. NO.	NAME OF EQUIPMENT / ITEM		APPROVED VENDORS
		(d)	EMERSON
		(e)	ABB
		(f)	FUJI (AIC)
5.6	NOX / SO2 ANALYSER (IN SITU)	(a)	CODEL, UK
		(b)	FORBES MARSHALL
		(c)	LAND COMBUSTION, UK
5.7	OZONE ANALYSER	(a)	BMT MESSTECHNIK, GMBH
5.8	RESIDUAL OZONE ANALYSER	(a)	ECO SENSORS / KAUFFMANN UMWITTECHNIK .EK
5.9	OZONE LEAK DETECTOR	(a)	OTTPL
6.0	**CONTROL VALVES / ACTUATORS / SOLENOID VALVES:**		
6.1	ELECTRICAL ACTUATORS FOR REGULATING & OPEN / CLOSE VALVES	(a)	ROTORK CONTROL (INDIA) LTD.,
		(b)	AUMA (INDIA) LTD.,
		(c)	LIMITORQUE INDIA LTD.
6.2	PNEUMATIC ACTUATORS-REGULATING & OPEN / CLOSE	(d)	INSTRUMENTATION LTD., PALGHAT
		(e)	KELTRON CONTROLS, KERALA
6.3	SH/RH SPRAY CONTROL VALVES SH/RH SPRAY BLOCK VALVES FEED CONTROL VALVES	(a)	MIL CONTROLS LTD.
		(b)	INSTRUMENTATION LTD. PALGHAT
		(c)	FISHER SANMAR LTD.
		(d)	CONTROL COMPONENT INC., USA
		(e)	HORA (HOLTER REGELARMATUREN GMBH & CO.)
6.4	LFO/HFO CONTROL, AND TRIP VALVES, FLOW CONTROL, PRESSURE	(a)	MIL CONTROLS LTD.
		(b)	INSTRUMENTATION LTD. PALGHAT

SR. NO.	NAME OF EQUIPMENT / ITEM		APPROVED VENDORS
	CONTROL, TEMP. CONTROL, AND BURNER TRIP VALVES, BALL VALVES	(c)	FOURESS ENGG (I) LTD, BANGALORE
		(d)	SAMSON CONTROLS , PUNE
6.5	SOOT BLOWER PRESSURE REDUCING VALVE	(a)	MIL CONTROLS LTD.
		(b)	INSTRUMENTATION LTD., PALGHAT
		(c)	FISHER SANMAR LTD.
		(d)	CONTROL COMPONENT INC., USA
		(e)	HORA (HOLTER REGELARMATUREN GMBH & CO.)
6.6	APRDS CONTROL VALVES	(a)	INSTRUMENTATION LTD.
		(b)	CONTROL COMPONENT INC., USA
		(c)	HORA (HOLTER REGELARMATUREN GMBH & CO.)
6.7	CONTROL VALVES- NON CRITICAL	(a)	DEZURIK COPES VULCAN LTD., U.K.
		(b)	CONTROL COMPONENT INC., USA
		(c)	FISHER SANMAR LIMITED
		(d)	INSTRUMENTATION LTD
		(e)	MIL CONTROL LTD.
		(f)	FISHER XOMOS SANMAR LTD.
		(g)	HORA (HOLTER REGELARMATUREN GMBH & CO.)
6.8	SOLENOID VALVE	(a)	ASCO, CHENNAI
		(b)	ROTEX AUTOMATION LTD., GUJRAT
		(c)	AVCON CONTROLS, MUMBAI
6.9	HP/LP BYPASS VALVES	(a)	BOPP & REUTHER SR GMBH CONTROL COMPONENTS INC (CCI)

SR. NO.	NAME OF EQUIPMENT / ITEM		APPROVED VENDORS
6.10	ELECTRO-HYDRAULIC ACTUATOR	(a)	LEONARDO AUTOMATION (INDIA) PVT. LTD.
7.0	ERECTION HARDWARES:		
7.1	LOCAL INSTRUMENT RACK (LIR) AND LOCAL INSTRUMENT ENCLOSURES (LIE)	(a)	PYROTECH, UDAIPUR
		(b)	INSTRUMENTATION LTD., KOTA
		(c)	ELECTRONICS CORPORATION OF INDIA LTD., HYDERABAD
		(d)	CHEMIN CONTROLS, PONDICHERRY
		(e)	PRAMMEN INDUSTRIES
7.2	INSTRUMENT VALVES	(a)	EXCEL HYDRO PNEUMATICS PVT. LTD., MUMBAI
		(b)	BHEL
		(c)	METPRESS ENGINEERING WORKS, KOLKATA
		(d)	BALDOTA VALVE & FITTING CO. PVT. LTD., MUMBAI
		(e)	AURA INC., NEW DELHI
		(f)	INSTRUMENTATION LTD. PALGHAT
		(g)	PRECISSION ENGG. INDUSTRIES, MUMBAI
		(h)	VIKAS INDUSTRIAL PRODUCTS, NEW DELHI
7.3	VALVE MANIFOLDS	(a)	EXCEL HYDRO PNEUMATICS PVT. LTD., MUMBAI
		(b)	METPRESS ENGINEERING WORKS, KOLKATA

SR. NO.	NAME OF EQUIPMENT / ITEM		APPROVED VENDORS
		(c)	BALDOTA VALVE & FITTING CO. PVT. LTD., MUMBAI
		(d)	AURA INC., NEW DELHI
		(e)	PRECISSION ENGG. INDUSTRIES, MUMBAI
		(f)	HP VALVES AND FITTINGS, CHENNAI
7.4	COMPRESSION FITTINGS / SOCKET WELD FITTINGS	(a)	SWAGELOCK, USA
		(b)	ASTEC VALVES & FITTINGS PVT. LTD.
		(c)	MET-LOK HYDRO PNEUMATICS PVT. LTD.
7.5	CONDENSATE POTS	(a)	EXCEL HYDRO-PNEUMATICS PVT. LTD., MUMBAI
		(b)	MICROPRECISION, FARIDABAD
		(c)	INSTRUMENTATION LTD. PALGHAT
		(d)	METPRESS ENGINEERING WORKS, KOLKATA
		(e)	BALDOTA VALVES & FITTINGS CO. PVT. LTD., MUMBAI
		(f)	PRECISSION ENGG. INDUSTRIES, MUMBAI
7.6	IMPULSE & SAMPLE PIPINGS	(a)	TPS TECHNITUBE ROHREN WERKE GMBH, GERMANY
		(b)	MAHARASHTRA SEAMLESS LTD.
		(c)	BHEL
		(d)	CHOKSI TUBE COMPANY LTD., INDIA
		(e)	INDIAN SEAMLESS METAL TUBES LTD., INDIA
		(f)	MANNESMANN AG, GERMANY

SR. NO.	NAME OF EQUIPMENT / ITEM		APPROVED VENDORS
		(g)	TOUVAY AND CAUVIN GULF EC, DUBAI
		(h)	JINDAL SAW PIPES LTD., INDIA
		(i)	SUMITOMO CORPORATION, JAPAN / KAWASAKI
		(j)	RATNAMANI METALS & TUBES LTD., AHMEDABAD
7.7	JUNCTION BOX (FRP)	(a)	DEVI POLYMERS, CHENNAI
		(b)	SUCHITRA INDUSTRIES, BANGALORE
		(c)	RITTAL
		(d)	PYROTECH
		(e)	L&T
		(f)	HENSEL ELECTRIC INDIA PVT. LTD., SRIPERUMBUDUR
7.8	AIR CYLINDER	(a)	VELJAN HYDRAIR, HYDERABAD
		(b)	NUCON INDUSTRIES, HYDERABAD
		(c)	PRECISION ENGG. (PREAC), BANAGALORE
		(d)	ASCO, CHENNAI
8.0	**CABLES:**		
8.1	CONTROL CABLES	(a)	DELTON CABLES, FARIDABAD
		(b)	UNIVERSAL CABLES, SATNA
		(c)	NICCO CABLE, KOLKATA
		(d)	POLYCAB, DAMAN
		(e)	GAYOLENE, MUMBAI
		(f)	RELIANCE ENGRS, BANGALORE
		(g)	CORDS CABLES, RAJASTHAN

SR. NO.	NAME OF EQUIPMENT / ITEM		APPROVED VENDORS
		(h)	PARAMOUNT CABLES, ALWAR
		(i)	THERMOCABLES, BANGALORE,
		(j)	KEI INDUSTRIES LTD., CHENNAI
8.2	INSTRUMENTATION CABLE	(a)	DELTON CABLES, FARIDABAD
		(b)	UNIVERSAL CABLES, SATNA
		(c)	NICCO CABLE, KOLKATA
		(d)	POLYCAB, DAMAN
		(e)	GAYOLENE, MUMBAI
		(f)	RELIANCE ENGRS, BANGALORE
		(g)	CORDS CABLES, RAJASTHAN
		(h)	PARAMOUNT CABLES, ALWAR
		(i)	THERMOCABLES, BANGALORE / HYDERABAD
		(j)	KEI INDUSTRIES LTD., CHENNAI
		(k)	CABLE CORPRN OF (I) LTD., CHENNAI
		(l)	RPG CABLES LTD., CHENNAI
		(m)	FORT GLOSTER INDUSTRIES LTD. KOLKATA
		(n)	DECO CABLES, DELHI
		(o)	KRISHNA CABLES, GWALIOR
		(p)	THERMAPADS (P) LTD
		(q)	ELKAY TELELINKS LTD.
		(r)	INCAB INDUSTRIES LTD
		(s)	TORRENT CABLE LTD.
8.3	COMPENSATING CABLES	(a)	DELTON CABLE

SR. NO.	NAME OF EQUIPMENT / ITEM		APPROVED VENDORS
		(b)	TOSHNIWAL, MUMBAI RELIANCE, BANGALORE
		(c)	LAPP INDIA, MUMBAI/ BANGALORE
		(d)	CORDS CABLES, RAJASTHAN
		(e)	PARAMOUNT CABLE
8.4	SPECIAL CABLES (PTFE /FEP INSULATED CABLES)	(a)	TOSHNIWAL CABLE
		(b)	RELIANCE CABLES
		(c)	LAPP INDIA, MUMBAI
		(d)	PARAMOUNT CABLES
		(e)	FINOLEX, PUNE
8.5	POWER CABLES (LT)	(a)	DELTON CABLES, FARIDABAD
		(b)	UNIVERSAL CABLES, SATNA
		(c)	NICCO CABLE, KOLKATA
		(d)	CORDS CABLES, RAJASTHAN
		(e)	FORTGLASTER INDUSTRIES
		(f)	INCAB, PUNE
		(g)	CCIL, BANGALORE
		(h)	KEI INDUSTRIES LTD., CHENNAI
		(i)	POLYCAB, DAMAN PARAMOUNT CABLES, ALWAR
9.0	**UPS / DC SYSTEM:**		
9.1	UPS WITH ACDB	(a)	HI-REL ELECTRONICS
		(b)	EMERSON NETWORK (FORMERLY TATA LIEBERT)
		(c)	DB POWER ELECTRONICS
9.2	24 VDC BATTERY CHARGER	(a)	CALDYNE, KOLKATA

SR. NO.	NAME OF EQUIPMENT / ITEM		APPROVED VENDORS
	WITH DCDB	(b)	AMARARAJA, TIRUPATI
		(c)	CHHABI ELECTRICALS, JALGAON
		(d)	HBL POWER SYSTEMS, HYDERABAD
		(e)	MASS TECH CONTROLS
9.3	BATTERY (TUBULAR/PLANTE) (TUBULAR) (TUBULAR)	(a)	EXIDE, KOLKATA
		(b)	HBL NIFE, HYDERABAD UNION BATTERY (BUI PUNE)
9.4	BATTERY (NICKEL-CADMIUM)	(a)	HBL POWER SYSTEMS, HYDERABAD
		(b)	AMCO, BANGALORE

Laboratory Instruments:

Bidder shall submit the vendor list with credentials for Mahagenco's approval.

NOTE : **The vendors indicated in the above list are Mahgenco's approved vendors, however, the product of above vendors proposed for this project shall meet the requirements stipulated in 'Proven Product' Cl. No. 5.0 of Vol. V, Section I of Tender Specification.**

Electrical Sub Vendor List

The list of approved make of the LT Motors are as mentioned below:

S.No.	LIST OF LT MOTORS
1.	BHARAT BIJLEE LTD.
2.	CROMPTON GREAVES
3.	ASEA BROWN BOVERI
4.	KIRLOSKAR ELECTRIC CO LTD.
5.	NGEF
6.	SIEMENS
7.	MARATHON
8.	GE-POWER
9.	RAJINDRA ELECT INDUSTRIES
10.	LAXMI HYDRAULICS PVT. LTD

However, the final list of makes for the LT Motors is subjected to BHEL/Customer approval, during contract stage, without any commercial implications.

Note –

1) THE SUB VENDOR LIST ABOVE IS INDICATIVE ONLY AND IS SUBJECT TO BHEL AND CUSTOMER APPROVAL DURING DETAILED ENGINEERING STAGE WITHOUT ANY COMMERCIAL & DELIVERY IMPLICATION TO BHEL.

BIDDER TO PROPOSE SUB VENDOR WITHIN 4 WEEKS OF PLACEMENT OF LOI. THEREAFTER NO REQUEST FOR ADDITIONAL SUB-VENDOR SHALL BE ENTERTAINED.

2) DEALERS ARE NOT ACCEPTABLE FOR ANY ITEM OF THE PACKAGE. BIDDER SHALL PROCURE ALL ITEMS INCLUDING PLATES, STRUCTURAL, FLANGES; COUNTER FLANGES ETC. FROM APPROVED SUB VENDOR ONLY

3) THE INSPECTION CATEGORY WILL BE INTIMATED AFTER AWARD OF CONTRACT BY BHEL/CUSTOMER. HOWEVER, THE SAME WILL BE ADHERED BY THE BIDDER WITHOUT ANY COMMERCIAL AND DELIVERY IMPLICATION TO BHEL/ CUSTOMER.

ANNEXURE-III

FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES

1.0 PERFORMANCE GUARANTEES

1.1 GENERAL REQUIREMENTS

1.1.1 The equipment shall meet the ratings and performance requirements stipulated for various equipment. The guaranteed performance parameters shall be without any tolerance values and all margins required for instrument inaccuracies and other uncertainties shall be deemed to have been included in the guaranteed figures.

1.1.2 All the guarantees shall be demonstrated during functional guarantee/ acceptance test. The various tests which are to be carried out during performance guarantee/ acceptance test are listed in this Sub-section. The guarantee tests shall be conducted at site.

1.1.3 All instruments required for performance testing shall be of the type and accuracy required by the code and prior to the test, these shall be calibrated in an independent test Institute. The protecting tubes, pressure connections and other test connections required for conducting guarantee test shall conform to the relevant codes.

1.1.4 Tools and tackles, thermowell (both screwed and welded) instruments/ devices including flow devices, matching flanges, impulse piping & valves etc and any special equipment, required for the successful completion of the tests, shall be provided by the bidder.

1.1.5 All cost associated with the tests shall be included in the bid price.

1.1.6 Detailed Performance/Capability Test procedures containing the following shall be furnished:

(a) Objective of the test.

(b) Various guaranteed parameters & tests as per contract.

(c) Method of conductance of test and test code.

(d) Duration of test, frequency of readings & number of test runs.

(e) Method of calculation.

(f) Correction curves

(g) Instrument list consisting of range, accuracy, least count and location of instruments.

(h) Scheme showing measurement points.

(i) Sample calculation.

(j) Acceptance criteria.

(k) Any other information required for conducting the test.

1.1.7 The test procedure for all conditions shall be furnished one year before the scheduled commissioning date.

1.1.8 In case during performance guarantee test(s), it is found that the equipment/ system has failed to meet the guarantees, all necessary modifications and/or replacements shall be carried out to make the equipment/system comply with the guaranteed requirements & the same shall be demonstrated by conducting another performance guarantee test. However, if the specified performance guarantee(s) are still not met but are achieved within the Acceptable Shortfall Limit specified, the equipment will be accepted after levying liquidated damages. If, however, the demonstrated guarantee(s) continue to be more than the stipulated Acceptable Shortfall Limit, even after the above modifications/replacements within ninety (90) days or a reasonable period allowed, after the tests have been completed, the Owner will have the right to either of the following:

(I) For Category-I Guarantees

Reject the equipment/system/plant and recover from the contractor.

OR

Accept the equipment/system/plant after levying Liquidated Damages

(II) For Category-II Guarantees

Reject the equipment/system/plant and recover from the Contractor the payments already made. The performance guarantees under this category shall be called 'Category II' Guarantees. Conformance to the performance requirements under Category-II is mandatory.

(III) For Category-III Guarantees

Reject the equipment/system/plant and recover from the Contractor.

OR

Accept the equipment/system after assessing the deficiency in respect of the various ratings, performance parameters and capabilities and recover from the contract price an amount equivalent to the damages as determined by the Owner. Such damages shall however be limited to the cost of replacement of the equipment(s)/system(s), replacement of which shall remove the deficiency so as to achieve the guaranteed performance.

The P. G. test shall be carried out within four (4) months after first synchronisation. If the P.G. test is conducted beyond four (4) months from first synchronisation due to any reason attributable to Owner, the deterioration in performance shall be increased by the following amount for each month or part of the month by which the period between the first synchronisation and PG test exceeds four (4) months.

(i) 0.1 % for the following eight (8) months

(ii) 0.06 % for the period following thereafter.

1.2 GUARANTEES UNDER CATEGORY- I

The performance guarantees which attract liquidated damages are as follows:

The auxiliary power consumption shall be considered at 100 % TMCR.

Auxiliary power consumption - Summation of power consumption of working drives at their rated capacities for Effluent Treatment Plant. Base auxiliary power consumption for Effluent Treatment Plant and penalties shall be as per Section III (GPC format). Bidder to furnish its guaranteed auxiliary power consumption with its technical offer (Not in sealed price).
Bidder to refer guaranteed auxiliary power requirement for Effluent Treatment Plant package in GPC format. The base auxiliary power consumption is specified in the format for guaranteed auxiliary power consumption figures (GPC format). Auxiliary power consumption shall be used for technical loading as per below mentioned criteria during bid evaluation stage & during demonstration / PG test.

LOADING CRITERIA FOR AUXILIARY POWER CONSUMPTION DURING BID EVALUATION STAGE:

As long as bidder's quoted guaranteed power consumption (GPC) above remains within Base auxiliary power consumption figure, there will be no technical loading of bid on power consumption for evaluation. However, if bidder's quoted GPC exceeds base auxiliary power consumption figure, there shall be technical loading of bid for evaluation @ 3,00,000/- (Rupees Three lakhs per Kilowatt) per KW of additional power over Base auxiliary power consumption figure.

LIQUIDATED DAMAGES CRITERIA FOR AUXILIARY POWER CONSUMPTION DURING DEMONSTRATION / PG TEST

Bidder's guaranteed power consumption as furnished in GPC format shall be demonstrated by the successful bidder during performance testing at works/ site. In case power consumption is noted higher than Base auxiliary power consumption figure / bidder's quoted GPC whichever is higher, during inspection/ PG test, penalty @ 4,50,000/- (Rupees Four lacs and fifty thousand per Kilowatt) per additional KW shall be levied on vendor.
If the bidder is not able to demonstrate the guarantees, Customer / BHEL will have the right to Reject the equipment / system / plant and recover the payments already made or accept the equipment / system after levying liquidated damages.

1.3 GUARANTEES UNDER CATEGORY-II

Not Applicable for ETP

1.4 GUARANTEES UNDER CATEGORY-III

The parameters/capabilities to be demonstrated for various systems/ equipment shall include but not be limited to the following:

1.4.1 Noise

All the plant, equipment and systems shall perform continuously without exceeding the noise level over the entire range of output and operating frequency specified.
Noise level measurement shall be carried out using applicable and internationally acceptable standards. The measurement shall be carried out with a calibrated integrating sound level meter meeting the requirement of IEC 651 or BS 5969 or IS 9779. Maximum permissible noise level for Blowers shall be 85 dB (A)

Sound pressure shall be measured all around the equipment at a distance of 1.0 m horizontally from the nearest surface of any equipment/ machine and at a height of 1.5 m above the floor level

in elevation. Corrections for background noise shall be considered in line with the applicable standards.

PERFORMANCE GUARANTEE PARAMETERS FOR EFFLUENT TREATMENT PLANT

a) Each pump shall be guaranteed for capacity, total dynamic head and power consumption.

b) All blowers shall be guaranteed for head and power consumption.

c) Capacity and qualities for effluents from different streams are as follows:

(a) Treatment System for Miscellaneous Plant Service Waste Water Oil Water Separator
(i) The unit shall have rated output capacity not less than 50 m3/hr (net).
(ii) Oil content not to exceed 10 ppm for oil concentration 1000 ppm maximum in feed waste to the Separator.
(iii) Suspended Solids not to exceed 20 ppm for Suspended Solids 300 ppm maximum in feed waste to the Separator.
(b) Performance Guarantee Parameters for ETP
(i) Solid Contact Clariflocculator Unit shall be guaranteed for treated water output of not less than 300m3/ hr (indicative) continuous at rated condition.
(iii) Treated water quality from Solid Contact Clariflocculator shall be guaranteed for the following:
Turbidity: Less than 15 NTU.

	TITLE:	BHEL DOCUMENTS NO.: PE-TS-415-158A-A001	
	TECHNICAL SPECIFICATION FOR EFFLUENT TREATMENT PLANT 1X660 MW BHUSAWAL TPS, UNIT # 6	VOLUME II	
		SECTION: IA	
		REV. NO. 00	DATE:

ANNEXURE IV

DRAWING/ DOCUMENTS REQUIREMENT & DISTRIBUTION SCHEDULE

After award of LOI, the drawing documents listed in MDL are minimum drawing/documents, which shall be submitted by the bidder for BHEL and Customer approval. However, any additional drawing/document if found necessary for completion of the engineering, the same shall be submitted by bidder without any commercial & delivery implication to BHEL.

The bidder has to submit the revised drawing/document along with the compliance sheet indicating enumerate reply to all BHEL and customer comments or observations. Without compliance sheet the submission of the drawings/documents will not be considered and the delay on this account will be solely on bidder's side only. Bidder to comply with the observations of the BHEL and CUSTOMER without price & delivery implication.

Every revised submission incorporating BHEL/Customer comments shall be resubmitted within 7 days by bidder.

Bidder to further note that the submitted drawings/revised drawing, should be complete in all respects. Any incomplete drawing submitted shall be treated as non-submission with delays attributable to bidder's account. For any clarification/ discussion required to complete the drawings, the bidder shall himself depute his personal to BHEL's / Customer's office for across the table discussions/ finalizations/ submissions of drawings.

- (a) List and schedule of drawings/documents to be submitted after award of contract shall be as per MDL.

- Bidder to note that drawings/documents submission shall be through web based Document Management System. Bidder would be provided access to the DMS for drawings/documents approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end.
  - Internet explorer version – Minimum Internet Explorer 7
  - Internet speed – 2 mbps (Minimum preferred)
  - Pop ups from our external DMS IP (124.124.36.198) should not be blocked
  - Vendor's internal proxy setting should not block DMS application's link
    - (http://124.124.36.198/wrenchwebaccess/login.aspx)

  - DMS user manuals to be used by BHEL PEM vendors for uploading, viewing, revising, commenting and tracking documents on PEM's DMS have been uploaded on PEM internet website (www.bhelpem.com) under the Vendor session.
  - For quick access bidder may refer the link http://bhelpem.com/DMSManuals/DMSManuals.html

- Bidder shall submit soft copy/hard copy/CD ROMs of all the finally approved drawings and O&M Manuals as required by Customer/Customer consultant/BHEL-site/BHEL-PEM. The exact number of hard copies/CD ROMs of these documents to be submitted shall be notified to the bidder at the time of detailed engineering and bidder shall submit the same without any commercial/delivery implications to BHEL/Customer.

- All the drawing documents along with the O&M manual (of all the revisions) are necessarily to be submitted in soft copies in addition to hard copies.

- Bidder to submit soft copies of all the drawing and document along with quality plans for BHEL review and approval.

- Editable copy of all the drawings and documents shall be provided.

- The date of submission of drawing documents shall be considered as the date of submission of hard and soft copes whichever is later.

- All the drawings shall be prepared on computer auto cad and other documents (like datasheet etc.) on MS office software. Bidder not complying to the requirement shall not be considered. For the execution of the contract regular meeting (generally once in 15 days or as per project requirement) is required.

- Vendor to come for meeting with the concerned dealing persons as per BHEL or customer requirement in a short notice.

- Bidder to submit instrument schedule, cable schedule and valve schedule in MS- Excel format during detailed engineering.

- Bidder to also furnish the auto cad copy/MS-Excel/MS-word (as applicable) of the following documents after award of contract. However, any other auto cad copy/MS-Excel/MS-word of any other document as per the insistence of BHEL and customer will also be submitted by the bidder without any delivery and commercial implication to BHEL and customer.

  - P&IDs.
  - Equipment lay out of ETP.
  - Equipment Cable tray layout of ETP.
  - Civil assignment drawings.
  - Piping lay out drawing of ETP.

Other requirements

- Engineering for this project is to be carried out in Integrated Intelligent Engineering environment at BHEL end. The engineering platform on which BHEL is doing the project is based on Smart Plant Suite. This is being done to have automated interface checking and thereby minimising rework at site. The engineering for packages placed in TG Hall will essentially be done using Intelligent P&ID, Intelligent Electrical and Intelligent Instrumentation. For other BOPs i.e. those outside TG hall, though the same level of integration is preferable to be done and review model in compatible format is to be provided to BHEL on stages to be agreed.

  Hence in line with above, bidder is required to prepare PIDs, Electrical drawings and all layout drawings using intelligent software with capability for transfer of data to and from corresponding Software being used by PEM.

- The data of models of facilities will be made available to BHEL as per the BHEL schedule for importing into BHEL model for interface checking and raising of integrated plant model. Layout and PID/electrical drawings will be extracted from the model.

- **e-Learning Package/Module:**

  e-learning packages shall be supplied for the equipment / system for the complete effluent treatment plant along with associated electrical and C&I system.

- Data/Reports other than listed drawings/documents will also be made available to BHEL as and when required for import into BHEL model.

- Successful bidder shall furnish detailed erection manual for each of the equipment as well as complete system supplied under this contract at least 3 months before the scheduled erection of the concerned equipment / component or along with supply of concerned equipment / component whichever is earlier.

- Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.

- In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion. However, in case changes are necessitated due to any constraints at customer end, delay in review/ approval of such revised drawing beyond one month will be to customer's account.

Sl. No	DOCUMENT / DRAWING NO.	DRAWING / DOCUMENT TITLE	SCHEDULE OF SUBMISSION FROM LOI (In Weeks)
1	PE-V6-415-164-A001	P&ID FOR EFFLUENT TREATMENT PLANT	4
2	PE-V6-415-164-A002	LAYOUT OF EFFLUENT TREATMENT PLANT	4
3	PE-V6-415-164-A003	PROCESS DESIGN & SIZING CALCULATIONS, PRESSURE DROP CALCULATIONS AND WATER BALANCE DIAGRAM OR ETP*	4
4	PE-V6-415-164-A004	HYDRAULIC FLOW DIAGRAM AND CALCULATION	4
5	PE-V6-415-164-A005	THICKNESS CALCULATION OF VESSELS AND TANKS	6
6	PE-V6-415-164-A006	SUB VENDOR LIST AND INSPECTION CRITERIA	6
7	PE-V6-415-164-A007	CONTROL WRITE UP	6
8	PE-V6-415-164-A008	TECHNICAL DATA SHEET AND GA DRG OF VERTICAL CENTRIFUGAL PUMPS ALONG WITH MOTOR	8
9	PE-V6-415-164-A009	TECHNICAL DATA SHEET AND GA DRG OF HORIZONTAL CENTRIFUGAL PUMPS ALONG WITH MOTOR	8
10	PE-V6-415-164-A010	TECHNICAL DATA SHEET AND GA DRG OF SCREW PUMPS ALONG WITH MOTOR	8
11	PE-V6-415-164-A011	TECHNICAL DATA SHEET AND GA DRG FOR METERING PUMPS ALONG WITH MOTOR	8
12	PE-V6-415-164-A012	TECHNICAL DATA SHEET AND GA DRG OF BLOWERS ALONG WITH MOTOR	8
13	PE-V6-415-164-A013	GA DRAWING OF PRESSURE VESSELS	10
14	PE-V6-415-164-A014	GA DRAWING OF ATMOSPHERIC TANKS	10
15	PE-V6-415-164-A015	GA DRAWING OF LAMELLA CLARIFIER / TUBE SETTLER INCLUDING FLASH MIXER, FLOCCULATION TANK	10
16	PE-V6-415-164-A016	DATASHEET AND GA DRG OF BASKET STRAINER AND SIMPLEX STRAINER	10
17	PE-V6-415-164-A019	DATASHEET AND GA DRG OF SAFETY ITEMS	10
18	PE-V6-415-164-A020	DATASHEET AND GA DRG OF AGITATORS AND MIXERS ALONG WITH MOTOR	10
19	PE-V6-415-164-A021	DATASHEET AND GA DRG OF BUTTERFLY VALVE MANUAL AND PNEUMATIC	10
20	PE-V6-415-164-A022	DATASHEET AND GA DRG OF DIAPHRAGM VALVE MANUAL AND PNEUMATIC	10
21	PE-V6-415-164-A023	DATASHEET AND GA DRG OF GLOBE VALVE	10
22	PE-V6-415-164-A024	DATASHEET AND GA DRG OF PRV, SRV & NEDDLE VALVE	10
23	PE-V6-415-164-A025	DATASHEET AND GA DRG OF GATE VALVE MANUAL, PNUEMATIC AND MOTORIZED	10
24	PE-V6-415-164-A026	DATASHEET AND GA DRG OF NRV	10

Sl. No	DOCUMENT / DRAWING NO.	DRAWING / DOCUMENT TITLE	SCHEDULE OF SUBMISSION FROM LOI (In Weeks)
25	PE-V6-415-164-A027	VALVE SCHEDULE	10
26	PE-V6-415-164-A028	PIPING SCHEDULE	10
27	PE-V6-415-164-A029	PAINTING SCHEDULE	10
28	PE-V6-415-164-A030	MECHANICAL GA OF OIL WATER SEPARATOR	12
29	PE-V6-415-164-A031	CIVIL INPUT DRAWING OF INDUSTRIAL SHED	12
30	PE-V6-415-164-A032	CIVIL INPUT DRAWING OF FOUNDATION OF EQUIPMENT INSIDE AND OUTSIDE OF INDUSTRIAL SHED	12
31	PE-V6-415-164-A033	GA DRG OF MCF	10
32	PE-V6-415-164-A034	GA DRG OF DEGASSER TOWER	10
33	PE-V6-415-164-A035	GA DRAWING OF CLARIFIER MECHANISM	10
34	PE-V6-415-164-A036	MECHANICAL GA DRG OF STILLING CHAMBER, FLASH MIXER FOR CLARIFIER	12
35	PE-V6-415-164-A037	MECHANICAL GA DRG OF CLARIFIER AND OUTLET CHANNEL	12
36	PE-V6-415-164-A041	MECHANICAL GA of CENTRAL MONITORING BASIN (CMB)	12
37	PE-V6-415-164-A042	MECHANICAL GA DRG OF ETP FILTERED WATER STORAGE TANK	12
38	PE-V6-415-164-A044	MECHANICAL GA DRG OF RCC SUMPS INSIDE ETP AREA	12
39	PE-V6-415-164-A045	MECHANICAL GA DRG OF RCC SUMPS OUTSIDE ETP AREA	12
40	PE-V6-415-164-A046	PIPING LAYOUT INSIDE ETP AREA ALONG WITH DETAILS OF SUPPORTS	16
41	PE-V6-415-164-A047	YARD PIPING LAYOUT ALONG WITH DETAILS OF SUPPORTS	16
42	PE-V6-415-164-A048	PG test procedure for ETP	20
43	PE-V6-415-164-A050	O& M MANUAL	20
44	PE-V6-415-164-A101	ELECTRICAL LOAD LIST	8
45	PE-V6-415-164-A103	CABLE TRAY/TRENCH & CONDUIT ROUTING DIAGRAM INCLUDING JB LOCATION OF INSIDE	12

Sl. No	DOCUMENT / DRAWING NO.	DRAWING / DOCUMENT TITLE	SCHEDULE OF SUBMISSION FROM LOI (In Weeks)
		AND OUTSIDE ETP	
46	PE-V6-415-164-A104	EARTHING LAYOUT OF INSIDE AND OUTSIDE ETP	12
47	PE-V0-415-164-I901	CONTROL & OPERATIONAL WRITE-UP FOR THE SYSTEM	3
48	PE-V0-415-164-I902	INSTRUMENT & DRIVE LIST WITH SET POINTS	8
49	PE-V0-415-164-I903	FIELD JB/LIE/LIR,DRIVES TERMINATION DETAILS	9
50	PE-V0-415-164-I904	DATASHEETS FOR INSTRUMENTS, ANALYSERS, JBs, etc. along with CATALOGUES*	8
51	PE-V0-415-164-I905	INPUT / OUTPUT SIGNAL LIST (ANALOG & BINARY)	8
52	PE-V0-415-164-I906	ANNUNCIATION LIST	8
53	PE-V0-415-164-I907	QUALITY PLANS (INSTRUMENTS,LCP etc.)	6
54	PE-V0-415-164-I908	INSTRUMENT INSTALLATION/ HOOK-UP DRAWING	6
55	PE-V0-415-164-I909	CABLE SCHEDULE & CABLE INTERCONNECTION DETAILS IN BHEL FORMAT	8
56	PE-V0-415-164-I910	O & M MANUAL	10
57	PE-V0-415-164-I911	GA & Wiring diagram of Local Control Panels	8
58	PE-V6-415-164-A301	QAP FOR VERTICAL CENTRIFUGAL PUMP	9
59	PE-V6-415-164-A302	QAP FOR HORIZONTAL CENTRIFUGAL PUMP	9
60	PE-V6-415-164-A303	QAP FOR VERTICAL SCREW PUMP	9
61	PE-V6-415-164-A304	QAP FOR METERING PUMP	9
62	PE-V6-415-164-A305	QAP FOR BLOWER	9
63	PE-V6-415-164-A306	QAP FOR PRESSURE VESSEL	9
64	PE-V6-415-164-A307	QAP FOR ATMOSPHERIC TANK	9
65	PE-V6-415-164-A308	QAP FOR BUTTERFLY VALVE MANUAL AND PNEUMATIC	9
66	PE-V6-415-164-A309	QAP FOR DIAPHRAGM VALVE MANUAL AND PNEUMATIC	9
67	PE-V6-415-164-A310	QAP FOR GLOBE VALVE	9
68	PE-V6-415-164-A311	QAP FOR PRV, SRV & NEDDLE VALVE	9
69	PE-V6-415-164-A312	QAP FOR GATE VALVE	9
70	PE-V6-415-164-A313	QAP FOR NRV	9
71	PE-V6-415-164-A314	QAP FOR MS/CS PIPES	9
72	PE-V6-415-164-A315	QAP FOR SS PIPES	9
73	PE-V6-415-164-A316	QAP FOR HDPE PIPES	9
74	PE-V6-415-164-A317	QAP FOR CPVC PIPES	9
75	PE-V6-415-164-A318	QAP FOR PVC PIPES	9

Sl. No	DOCUMENT / DRAWING NO.	DRAWING / DOCUMENT TITLE	SCHEDULE OF SUBMISSION FROM LOI (In Weeks)
76	PE-V6-415-164-A319	QAP FOR UPS	9
77	PE-V6-415-164-A321	QAP FOR MOTOR	9
78	PE-V6-415-164-A323	QAP FOR AGITATOR	9
79	PE-V6-415-164-A324	QAP / ICL OF ETP (FOR BALANCE OF ITEMS)	9
80	PE-V6-415-164-A325	QAP FOR CONTROL VALVE	9
81	PE-V6-415-164-A326	QAP FOR OIL WATER SEPARATOR	9
82	PE-V6-415-164-A401	MANDATORY SPARES LIST FOR MECHNICAL, ELECTRICAL & CONTROL AND INSTRUMENTATION ITEMS	14

Note:

- Quantity of prints may change during detailed engineering stage based on BHEL / Customer requirement. However, the same will be adhered by the bidder without any delivery/commercial implication to BHEL.
- All the drawing documents along with the O&M manual (of all the revisions) are necessarily to be submitted in soft copies in addition to hard copies.
- Bidder to submit soft copies of all the drawing and document along with quality plans for BHEL review and approval.
- The date of submission of drawing documents shall be considered as the date of submission of hard and soft copes whichever is later.
- All the drawings shall be prepared on computer auto cad and other documents (like datasheet etc.) on MS office software. Bidder not complying to the requirement shall not be considered. For the execution of the contract regular meeting (generally once in 15 days or as per project requirement) is required.
- Bidder has to come for meeting with the concerned dealing persons as per BHEL or customer requirement in a short notice.
- Bidder to submit instrument schedule, cable schedule and valve schedule in MS- Excel format during detailed engineering.
- Bidder to also furnish the auto cad copy / MS-word (as applicable)/MS-Excel (as applicable) of the documents after award of contract. However, any other auto cad copy/MS-Excel/MS-word of any other document as per the insistence of BHEL / customer will also be submitted by the bidder without any delivery/commercial implication to BHEL.

Annexure - V

MANDATORY SPARES LIST

SR. NO.	EQUIPMENT/PACKAGE NAME	QUANTITY
	SR. No. 1.0 to 7.0 - Not Applicable	
8.0	**EFFLUENT TREATMENT SYSTEM**	
8.1	SPARES FOR HORIZONTAL CENTRIFUGAL PUMPS	
8.1.1	Shaft	One (1)
8.1.2	Shaft Sleeve	Two (2)

SR. NO.	EQUIPMENT/PACKAGE NAME	QUANTITY
8.1.3	Impeller	One (1)
8.1.4	Impeller locking nut and bolt	Four (4)
8.1.5	Impeller wear ring	Four (4)
8.1.6	Casing wear ring	Four (4)
8.1.7	Oil Seal	Four (4)
8.1.8	Oil Deflector	Three (3)
8.1.9	Oil Ring	Three (3)
8.1.10	Gland Packing	400%
8.1.11	Lantern Ring	Three (3)
8.1.12	Mech Seal Assembly	One (1)
8.1.13	Stationary/Carbon Packing and "O" Ring for Mechanical Seal	Three (3) Sets
8.1.14	Oil Level Gauge	Three (3)
8.1.15	Coupling	Two (2)
8.1.16	Rubber Bush for Coupling	Two (2)
8.1.17	"O" Rings	Two (2) Sets
8.1.18	Suction Strainers Element	Three (3)
8.1.19	Bearing for Pump Motor	Two (2) Sets
8.2	SPARES FOR VERTICAL TYPE CENTRIFUGAL PUMPS	For each Service & duty
8.2.1	Complete Bowl assembly	One (1) Set
8.2.2	Impeller (s)	One (1) Set

SR. NO.	EQUIPMENT/PACKAGE NAME	QUANTITY
8.2.3	Shafts	One (1) Set
8.2.4	Casing wearing (s)	One (1) Set
8.2.5	Impeller wear ring (s)	One (1) Set .
8.2.6	Shaft Sleeves	Two (2) Set
8.2.7	Shaft Couplings	One (1) Set
8.2.8	Shaft nuts & keys	One (1) Set
8.2.9	Lantern rings	One (1) Set .
8.2.10	Bell mouth liner	One (1) Set
8.2.11	Bearings	One (1) Set .
8.2.12	Pump motor coupling	One (1) Set .
8.3	SPARES FOR SCREW PUMPS	For each type & Service
8.3.1	Rotor	One (1)
8.3.2	Shaft	One (1)
8.3.3	Mechanical seal	One (1)
8.3.4	Packing for Stuffing Boxes	200%
8.3.5	Bearing	One (1) for each shaft
8.4	SPARES FOR CLARIFIERS	For each service & rating
8.4.1	Floculator Assembly	One (1) Set
8.4.2	Gear box for Floculator Driver	One (1) Set of LHS & RHS as applicable
8.4.3	Gear box for Floculator Driven	One (1) Set of LHS & RHS as applicable

SR. NO.	EQUIPMENT/PACKAGE NAME	QUANTITY
8.4.4	Gear box for Rail drum drive	One (1) Set of LHS & RHS as applicable
8.4.5	Oil seals for all type of gear box	Five (5) Sets
8.4.6	Worm wheel	One (1) Set for each type
8.4.7	Worm wheel worm shaft	One (1) Set for each type
8.4.8	Coupling complete set	One (1) Set for each type
8.5	SPARES FOR AGITATORS	
8.5.1	Gear Box Unit Complete	One (1) each type
8.5.2	Bearing for Gear Box Unit	One (1) Set each type
8.5.3	Coupling complete (Motor/Gear box and gear box/agitator)	One (1) Set each type
8.5.4	Coupling Bolts	One (1) Set each type
8.5.5	Coupling shim pack (if applicable)	Four (4) Sets each type
8.5.6	Oil seals	Four (4) Sets each type
8.6	SPARES FOR VALVES	
8.6.1	(a) Manual Diaphragm valves	20% of total quantity used for each type and size with minimum two (2) for each type and size.
	(b) Auto Diaphragm valves	20% of total quantity used for each type and size with minimum two (2) for each type and size.
	(c) Spare Diaphragm for above	20% of total quantity used for each type and size with minimum two (2) for each type and size.

SR. NO.	EQUIPMENT/PACKAGE NAME	QUANTITY
	(d) Diaphragm	20% of total quantity used for each type and size with minimum one (1) for each type and size.
8.6.2	(a) Non return valves (NRV)	Two (2) of each size & type
	(b) Flaps for above NRV	Two (2) of each size
8.6.3	Gate/ Globe/ Ball valves / plug valve / needle valve	
	(a) Upto 100 NB	20% of total quantity used for each type and size with minimum two (2) for each type and size.
	(b) Above 100 NB	One (1) each type and size.
8.6.4	Butter fly valve	
	(a) Upto 100 NB	20% of total quantity used for each type and size with minimum two (2) for each type and size.
	(b) Above 100 NB	One (1) each type and size
8.7	SPARES FOR OIL SEPARATOR	
8.7.1	Tube Packs	10% of total quantity
8.8	SPARES FOR AIR BLOWERS	
8.8.1	Impeller with shaft	One (1) Set
8.8.2	Bearings	One (1) Set
8.8.3	Oil seals	Five (5) sets
8.8.4	Filter	One (1) Set

MANDATORY SPARE LIST AC and Ventilation System:

S. no.	Description	Quantity
1	Roof exhauster fans (for each type, rating and capacity)	1 Lot (5 % of total population or one (1) whichever is higher)
2	Supply air fans (wall mounted) (for each type, rating and capacity)	1 Lot (5 % of total population or one (1) whichever is higher)
3	exhaust air fans (wall mounted) (for each type, rating and capacity)	1 Lot (5 % of total population or one (1) whichever is higher)
4.	SPLIT AIR CONDITIONERS	
4.1	Fan –motor bearing for outdoor unit	Lot (One set for each rating of SAC unit)
4.2	Vibration Isolators	Lot (One set each for outdoor unit & Indoor unit for each SAC unit)
4.3	Filter	Lot (One set for each SAC unit)
4.4	Expansion Valve	Lot (One set for each rating of SAC unit)
4.5	Any other spare parts recommended by the Manufacturer	Lot (As recommended by the Manufacturer)

13.0 MANDATORY SPARES:

MANDATORY SPARES FOR ELECTRIC HOIST AND MANUAL HOIST (AS APPLICABLE)

A. Mechanical spares for Electric Hoist

	Mandatory Spares for Electric Hoists (for each type and rating)	
1	Brake linings	Two (2) sets of each type
2	Rope guide and rope tighter	One (1) of each type
3	Limit switch	Two (2) of each type and size
4	Bearings for long travel wheels	Two (2) sets
5	Bearings for gear boxes for each type of hoist	Two (2) sets
6	Break liners for all the brakes	100% of total population of each type & size
7	Oil seals	100% of total population of each type, size rating
8	Brake springs for all brakes	100% of total population of each type, size rating
9	Wire ropes for hooks	100% installed on each crane and hoist
10	Solenoid coils for brakes	Two (2) sets
11	Overload relay for motors	Two (2)
12	Limit switches for hoists and travel mechanisms	Two (2) sets
13	Spare motors for hoists	Two (2)
14	Long travel machinery	
14.1	Gear wheel	One (1) set
14.2	Internal clip	Two (2)
14.3	Pinion	One (1)

B. Mechanical spares for Manual hoist

	Mandatory Spares for Chain Pulley Blocks (for each type and rating)	
1	Load chain wheel	One (1)
2	Load chain stripping fork	Five (5)
3	Hand chain wheel	Two (2)
4	Ratchet pawl	One (1)
5	Locking ratchet wheel	Two (2)
6	Guide roller	Two (2)

7	Brake disc	Two (2)

Note:-

1. “One (1) Set” is defined as 100% requirement for one hoist for the entire hoists of similar size & capacity.

SR. NO.	EQUIPMENT/PACKAGE NAME	QUANTITY
1.0 & 2.0	Not Applicable	
3.0	MEASURING INSTRUMENTS	
3.1	ELECTRONIC TRANSMITTERS	
3.1.1	Transmitters of all types, ranges and model no. (for the measurement of Pressure, differential pressure flow, level etc.)	10% or 2 no. of each type and model, whichever is more
3.1.2	Electronic cards / PCB's for each type and model and model of transmitters	10% or 5 nos. of each type, whichever is more
3.2	TEMPERATURE ELEMENTS	
3.2.1	RTDs of each type & length	10% or 2 nos. whichever is more
3.2.2	Thermocouples of each type like K-type, R-type, metal etc and length	10% or 2 nos. whichever is more
3.2.3	Thermowell for T/C & RTDs	10% or 1 no. of each type, rating, length used in the system whichever is more
3.2.4	Process actuated switch devices Including all types of pressure, differential pressure, flow, temperature, differential temperature, level switch devices	10% or 1 no. of each type and model whichever is more
3.3	INDICATORS/RECORDERS	
3.3.1	Digital Indicators of each model, type & range (including relevant digital indicators of electrical system)	10% or 2 nos. min. whichever is more

SR. NO.	EQUIPMENT/PACKAGE NAME	QUANTITY
3.3.2	Vertical Indicators of each type & model	5% or 1 no. of each model whichever is more
3.3.3	Recorders for each type and model	5% or 1 no. whichever is more.
3.3.4	Consumables for continuous recorders Charts Ink capsules	25 rolls per recorder/ 25 nos per recorder/ 20 nos. per recorder / Ink Pads /Pens.
3.3.5	Consumables for multi point recorders	
(a)	Charts	5 nos. per recorder
(b)	Ink pads	5 nos. per recorder
(c)	Print mechanism/ print head assembly	10% or 5 nos. of each type whichever is more
3.3.6	Level transmitters (displacer type)	
(a)	Electronic cards / PCB's of level transmitters	10% of total quantity used or 1 for each type/rating whichever is more
(b)	Level transmitters	10% of total quantity used or 1 for each type/rating whichever is more
(c)	Electronic water level indicator	10% or 2 nos. min. whichever is more
3.3.7	PD type flow transmitters	10% of total quantity used or 1 for each type/rating whichever is more
3.4	SWITCHES	
3.4.1	Switches (Pressure, DP, Level, Flow, Temperature etc)	10% of each type of total nos. used in the system or minimum 1 no. of each type, model & range whichever is more

SR. NO.	EQUIPMENT/PACKAGE NAME	QUANTITY
3.5	Rotameter	10% of each type of total nos. used in the system or minimum 2 no. of each type, model & range whichever is more
3.6	SOLENOID VALVE	10% of each type of total nos. used in the system or minimum 2 no. of each type, model & range whichever is more
3.6.1	Assembly	10% of total quantity used or minimum 2 no. of each type whichever is more
3.6.2	Coil	10% of toatal quantity used or 5 no. whichever is more
3.7	E/P Converter	10% of each type of total nos. used in the system or minimum 2 no. of each type, model & range whichever is more
3.8	SPECIAL INSTRUMENTS	
3.8.1	Nucleonic /non-nucleonic density meter, solid flow meter etc.	1 no. and spare parts as per manufacturer
3.9	Electrical Transducers	10% of total quantity used or minium 1 no. of each type and range whichever is more
4.0	POWER SUPPLY SYSTEM (24 V DC POWER SUPPLY SYSTEM)	
4.1	Silicon controlled thyristors, diodes power transistors	100%

SR. NO.	EQUIPMENT/PACKAGE NAME	QUANTITY
4.17	Rubber gloves	1 no.
4.18	Voltmeter for measuring cell voltage (centre zero type)	1 no.
4.19	Thermometer	1 no.
4.20	Insulated socket spanner with handle	1 no.
5.0	**PROCESS CONNECTION PIPING** (for impulse piping /tubing, sampling piping/ tubing and air supply piping as applicable)	
5.1	Valves of all types and models	10% or 2 no. of each type, class, size and model whichever is more.
5.2	2 way, 3way, 5way valve manifolds	10% or 2 no. of each type, class size and model whichever is more.
5.3	Fittings	10 nos. of each type
5.4	Purge meters	10 % of each model or 2 Nos. whichever is more
5.5	Filter regulators	10% of each model or 2 Nos. whichever is more
5.6	Impulse pipe & tubing of all type	20 mtrs each type & size
5.7	Impulse line root valve	10% of total quantity used or 4 no. whichever is more for each type and rating of each size
5.8	SS tube	40 mtrs of each type/size
5.9	Fitting for SS tube	40 nos. of each type/size

SR. NO.	EQUIPMENT/PACKAGE NAME	QUANTITY
6.0	INSTRUMENTATION CABLE, INTERNAL WIRING AND ELECTRICAL FIELD	
6.1	Pre fabricated cable of each type	10% of installed quantity
6.2	Pre fabricated cable connector	10% or1no.of each type and model, whichever is more.
6.3	Other cables	10% of each type, pair and size of actual installed quantity
7.0	ELECTRICAL ACTUATORS	
7.1	Actuators	10% or 1 no. of each type, model and rating, whichever is more.
7.2	Power unit for modulating actuator	10% or 2 nos. of each type, whichever is more.
7.3	DC-DC unit/power pack units	10% or 2 nos. of each type, whichever is more.
7.4	Electronic cards	10% or 5 nos. of each type, whichever is more
7.5	Brake assembly	10% or 2 nos. of each type, whichever is more..
7.6	Brake coils	10% or 2 nos. of each type whichever is more.
7.7	Position feed back transmitters	10% or 2 nos. of each type whichever is more.
7.8	Control unit	10% or 2 nos. of each type whichever is more
7.9	Torque and limit switch assembly of each unit	10% or 2 nos. of each type, whichever is more.
7.10	O-ring	1 set of each size

SR. NO.	EQUIPMENT/PACKAGE NAME	QUANTITY
7.11	Motor	1 no. of each type & rating
7.12	Auxiliary contact	10% of total quantity used or 2 nos. whichever is more for each type and rating of each size
7.13	Seal kit	1 set of each type & size
8.0	**PLC CONTROL SYSTEM FOR PLANT AUXILIARIES & OFF-SITE PLANTS**	
8.1	CPU Card	10% of total quantity of each type used in all systems.
8.2	Communication Processor Module	10% of total quantity of each type used in all systems.
8.3	Binary Input Card	10% of total nos. used in the system or minimum 4(four) nos. whichever is more.
8.4	Pulse Input Card	10% of total nos. used in the system or minimum 2(two) nos. whichever is more.
8.5	Analog Input Card (4 to 20 mA type)	10% of total nos. used in the system or minimum 2(two) nos. whichever is more.
8.6	Analog Input Card (RTD input type)	10% of total nos. used in the system or minimum 2(two) nos. whichever is more.
8.7	Binary Output Card for contact	10% of total nos. used in the system or minimum 4(four) nos. whichever is more.

SR. NO.	EQUIPMENT/PACKAGE NAME	QUANTITY
8.26	PLC Network End connector	10% of total quantity for each System
8.27	MCB	1 no. of each type and rating.
9.1	CONDUCTIVITY	
9.1.1	Conductivity Sensor/cell for each type of Cell Constant	20% of the total no. used in the system or minimum 2(two) nos. whichever is higher.
9.1.2	Conductivity Transmitter Complete Set	20% of the total no. used in the system or minimum 2(two) nos. whichever is higher.
9.2	pH	
9.2.1	pH Sensor	20% of the total no. used in the system or minimum 2(two) nos. whichever is higher.
9.2.2	pH Transmitter Complete Set	20% of the total no. used in the system or minimum 2(two) nos. whichever is higher.
9.2.3	Sensor recharger	20% of the total no. used in the system or minimum 2(two) nos. whichever is higher.
9.3	SODIUM ANALYSER	
9.3.1	Sodium Analyser Electrode	1 (one) no.
9.3.2	Critical Electronic spare part for Sodium Analyser Analyser/Monitor	1 (one) no. each type
9.3.3	Reagent container	1 no.
9.3.4	Refurbishment kit for sodium analyser	1 no.

SR. NO.	EQUIPMENT/PACKAGE NAME	QUANTITY
9.3.5	Consumable kit/ Chemical Reagent for Sodium Analyser	For maintaining the system for 1(one) Year continuous operation
9.4	SILICA ANALYSER	
9.4.1	Critical Electronic spare part for Silica Analyser/Monitor	1(one) no. each type
9.4.2	Reagent container	1 no.
9.4.3	Cuvette assy for silica	1 no.
9.4.4	Pump motor for silica	1 no.
9.4.5	Tube replacement kit	1 set
9.4.6	Fuses of each type	2nos. each
9.4.7	Consumable kit/ Chemical Reagent for Silica Analyser	For maintaining the system for 1(one) Year continuous operation
9.5	HYDRAZINE ANALYSER	
9.5.1	Critical Electronic spare part for Hydrazine Analyser/Monitor	1(one) no. each type
9.5.2	Cell Recharge kit	1 no.
9.5.3	Porus Disc	1 no.
9.5.4	Seal rings	1 set
9.5.5	Fuses of each type	2nos. each
9.5.6	Consumable kit/ Chemical Reagent for Hydrazine Analyser	For maintaining the system for 1(one) Year continuous operation
9.6	DISSOLVE OXYGEN	
9.6.1	Dissolve Oxygen Sensor Complete Set	1(one) no.

SR. NO.	EQUIPMENT/PACKAGE NAME	QUANTITY
9.6.2	Dissolve Oxygen Analyser Complete Set	1(one) no.
9.7	PHOSPHATE ANALYSER	
9.7.1	Electrode	1(one) no.
9.7.2	Critical Electronic Spare Parts for Phosphate analyser/monitor	1(one) no. each MPC
9.7.3	Consumable kit/Chemical Reagent for Phosphate Analyser	For maintaining the system for 1(one) year continious operation
9.8	OTHER HARDWARE	
9.8.1	Stainer each type	2(two) nos.
9.8.2	Sample Cooler	2(two) nos.
9.8.3	High Pressure Reducing Valve	5(five) nos.
9.8.4	Cation column	5(five) nos.
9.8.5	Pressure Gauge, Pressure Switch, Temperature Gauge, Temperature Switch, Isolating Valve, Solenoid Valve, Rota Meter etc.	10% of total quantity of each item and type/rating used in the system or minimum 1(one) no. whichever is higher.
9.8.6	Annunciation System	
(a)	Each type of PCB	1(one) No. each
(b)	Lamp Box with Facia & Lamps (LED type)	5(five)Nos.
(c)	Hooter	1(one) No.
9.8.7	Auxiliary/Power Contactor, Push Button, Indicating Lamp, Fuse etc. for Chiller Unit	10% of total quantity of each type of items used in the system or minimum 2(two) nos. whichever is more.

SR. NO.	EQUIPMENT/PACKAGE NAME	QUANTITY
9.9	CHILLER UNIT	
9.9.1	Auxiliary/Power Contactor, Push Button, Indicating Lamp, Fuse, thermal overload etc. for Chiller Unit	10% of total quantity of each type of items used in the system or minimum 1(one) nos. whichever is more.
9.9.2	Pressure Switch, Temperature Switch, Isolating Valve, Solenoid Valve, Thermostat etc.	10% of total quantity of each type of items used in the system or minimum 1(one) nos. whichever is more.
10.0	**FLUE GAS ANALYZERS**	
10.1	Analyzers spares like transmitter lens & receiver lens, protection windows for transmitters & receivers, integral pressure & temp. sensors, signal processing unit	1 no. of each type receiver
10.2	Light source and detector unit for opacity, Nox, Sox, CO	1 set of each type
10.3	Cooling and purging air blower unit	1 for each type and set of filters
10.4	Electronic modules comprising of at least 1 no. of each type of module for each analyzer	1 set
10.5	Zirconia oxygen analyzer	1 set
11.0	**RADAR TYPE LEVEL TRANSMITTER**	
11.1	Transmitter/Receiver	10% or 1 no. of each type transmitter/ receiver
11.2	Electronic card	10% or 1 no. of each type electronic card

SR. NO.	EQUIPMENT/PACKAGE NAME	QUANTITY
17.0	CONTROL PANEL AND LOCAL/ REMOTE CONTROL DESK (AS APPLICABLE)	
17.1	Recorder	1(one) No. each type and model
17.2	Bar graph indicator	10% of total quantity used in the system or minimum 1(one) no. whichever is more for each type and model.
17.3	Digital indicator	10% of total quantity used in the system or minimum 1(one) no. whichever is more for each type and model.
17.4	Mosaic/Conventional Type Push button Station	10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.
17.5	Mosaic Type Push button Station with LED Indication	10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.
17.6	Mosaic Type LED Indication Station	10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.
17.7	Simaphore Indicator	2(two)Nos. each type
17.8	ANNUNCIATION SYSTEM (For offsite / Auxiliary Plants)	
17.8.1	Each type of PCB (for non-PLC driven system)	1(one) No. each

SR NO.	EQUIPMENT/PACKAGE NAME	QUANTITY
17.8.2	Lamp Box with Facia & Lamps (LED type)	10% with minimum 2 nos.
17.8.3	Hooter	1(one) No.

SR. NO.	EQUIPMENT/PACKAGE NAME	QUANTITY
18.1	Solenoid Coil for Pneumatic type Power Cylinder	5Nos. for each type & ratings
18.2	Position Limit Switch for Pneumatictype Power Cylinder	10Nos. for each type & ratings
18.3	Air Lock Relay	10Nos. for each type
18.4	Signal Air Booster Unit	2Nos. for each type
19.0	MANDATORY SPARES NOT COVERED ABOVE	Bidder to supply 10% electronic modules/ cards or any other electronic components required for system such as annunciation system for offsite/auxiliary plant, online condensate tube cleaning system, ambient air monitoring system, plant simulator.

List of Mandatory Spares for Electrical Items

SR. NO.	EQUIPMENT/PACKAGE NAME	Qty	Unit of Measurement	Remarks
6.1.6	Phase segregated and non phase segregated terminal boxes	1	Lot (1 set For each type & rating of Motor)	
6.1.7	Heaters	1	Lot (1 set For each type & rating of Motor)	Space heater offered.
6.1.8	Couplings	1	Lot (1 set For each type & rating of Motor)	Couplings offred for MDBFP and CEP motors only. Cuopling between main eqpt and motors for ID Fan, PA Fan, FD Fan, mills, CEP, AHP, CHP are covered respective sections. Hence, not offered again.
6.1.9	Bearings (DE and NDE)	1	Lot (1 set For each type & rating of Motor)	Motor Bearing for CEP and Boiler fill pumps are offered. As bearing for ID, PA, FD fan motors, mill motros, BFP motor, DMCW pumps motor and ACW Pumps motors are covered under their respective sections.
6.1.10	Motor of each type and rating	1	Lot (One number of each type and rating)	
6.1.11	Cooling fan Internal & External	1	Lot (1 set For each type & rating of Motor)	
6.1.12	Neutral end terminal bushing with fasteners	1	Lot (1 set For each type & rating of Motor)	
6.1.13	Bearing Temperature Gauge Driving & Non Driving End	1	Set for each type -Refer Sr No. 75 of Corrigendum-XII	Dial type thermometer offered
6.1.14	RTD for Bearing Temperature	1	1 Set for each type & rating of Motor -Refer Sr No. 76 of Corrigendum-XII	
6.1.15	HT bushing for BFP Motor	1	One (1) No. Refer Sr No. 77 of Corrigendum-XII	Elastimold bushing offered
6.1.16	Oil seal ring for BFP Motor	1	One (1) Set . Refer Sr No. 78 of Corrigendum-XII	
6.2	**415V MOTORS**	1	**Lot consisting of following:**	Lot price for applicable items of sl no 6.2.1 to 6.2.10. For applicable spares for AHP , prices are included above in Lot Price quoted against AHP
6.2.1	Terminal plates for motors upto 30kw for each rating	1	Lot (1 no. For each type & rating of Motor)	
6.2.2	Terminal plates for motors above 30kw for each rating	1	Lot (1 no. For each type & rating of Motor)	
6.2.3	Heaters	1	Lot (1 set For each type & rating of Motor)	
6.2.4	Greasing arrangements	1	Lot (1 set For each type & rating of Motor)	

SR. NO.	EQUIPMENT/PACKAGE NAME	Qty	Unit of Measurement	Remarks
6.2.5	Motor of each type and rating	1	Lot (10% of the installed quantity or minimum 1 number whichever is higher)	
6.2.6	Bearings (DE and NDE)	1	Lot (1 set For each type & rating of Motor)	
6.2.7	End shield cover driving ~~of~~ and non driving end . Refer Sr No. 79 of Corrigendum-XII	1	Lot (1 set For each type & rating of Motor)	
6.2.8	Cooling fan	1	Lot (1 set For each type & rating of Motor)	
6.2.9	Motor terminal block	1	Lot (1 set For each type & rating of Motor)	
6.2.10	Complete set of coupling	1	Lot (1 set For each type & rating of Motor)	
6.3	DC MOTORS	1	Lot consisting of following:	Lot price for applicable items of sl no 6.3.1 to 6.3.7.
6.3.1	Carbon brushes of each type	10	10 sets	
6.3.2	Brush assemblies of each type	2	2 sets	
6.3.3	Terminal blocks of each type	2	2 sets	
6.3.4	Heaters of each type	2	2 sets	
6.3.5	Pulley of each type	2	2 sets	
6.3.6	Motor of each type and rating	1	Lot (10% of the installed quantity or minimum 1number whichever is higher)	
6.3.7	Bearing (DE and NDE)	1	Lot (1 set For each type & rating of Motor)	
7.0	**11 KV AND 3.3 KV SWITCHGEARS**			
7.1	11 kV SWITCHGEAR			
7.1.1	Breaker complete pole assembly (Bottle) of each rating - Refer Sr No. 80 of Corrigendum-XII	1	Lot (1 Set (1 set consists of 3 nos.))	(set comprising 3 nos. Eaton VI)
7.1.2	Spring charging motor complete of each type	5	~~6~~ 5 nos. Refer Sr No. 81 of Corrigendum-XII	
7.1.2 a)	Spring charging motor with complete mechanism	1	One (1) No Refer Sr No. 82 of Corrigendum-XII	
7.1.3	Spring charging limit switch	10	~~15~~ 10 nos. Refer Sr No. 83 of Corrigendum-XII	
7.1.4	Shunt trip coil of each type	10	10 nos.	
7.1.5	Closing coil each type	10	10 nos.	
7.1.6	Current transformer of each type, ratio & rating	3	3 nos.	(set of 15 type)
7.1.7	Potential transformer of each type and ratio of each type	1	1 nos.	(1 type)
7.1.8	Numerical Protective relay of each type	2	2 nos.	(set of 5 types)
7.1.9	Anti-pumping relay of each type and rating	1	1 nos.	(1 type)
7.1.10	Auxiliary relays of each type	5	5 nos.	(set of 5 types)

Note:

1) If any item as listed above under mandatory spare list is not applicable, then bidder to supply its equivalent spares.
2) if any item which is considered as not applicable by bidder and if the same is found to be applicable during detailed engineering, bidder to supply the same without any cost implication.

ANNEXURE - VI

WATER ANALYSIS

ANALYSIS OF RAW WATER

SR. NO.	PARAMETERS	UNITS	VALUES
1.0	pH		8.0 – 8.5
2.0	Temperature	^0C	22 - 30
3.0	Conductivity	µS/cm	1300
4.0	Colour	Hazen Units	Not Available
5.0	Odour		Not Available
6.0	Taste		Not Available
7.0	TDS	ppm	870
8.0	P-Alkalinity as $CaCO_3$	ppm	Nil
9.0	M-Alkalinity as $CaCO_3$	ppm	400
10.0	T – Alkalinity as $CaCO_3$	ppm	400
11.0	Organic Matter as $KMnO_4$	ppm	50
12.0	Iron (as Fe)	ppm	1
13.0	Turbidity (NTU)	ppm	100 during Non – Monsoon Up to 10,000 during Monsoon
14.0	**CATIONS**		
	(a) Ca as $CaCO_3$	ppm	295
	(b) Mg as $CaCO_3$	ppm	77
	(c) Na as $CaCO_3$	ppm	203

SR. NO.	PARAMETERS	UNITS	VALUES
	(d) K as $CaCO_3$	ppm	10
	Total Cation	ppm	**585**
15.0	**ANIONS**		
	(a) HCO_3 as $CaCO_3$	ppm	400
	(b) Chlorides	ppm	149
	(c) SO_4 as $CaCO_3$	ppm	33
	(d) Fluoride as $CaCO_3$	ppm	1
	(e) Nitrate as NO_3	ppm	2
	Total Anion	ppm	**585**
16.0	Ammonia	ppm	Absent - Traces
17.0	Silica Colloidal (as SiO_2)	ppm	< 1 (can be present in summer)
18.0	Silica Non - Colloidal (as SiO_2)	ppm	36
19.0	Free Chlorine	ppm	Nil
20.0	Total Suspended Solids	ppm	Not Available
21.0	Carbonates as $CaCO_3$	ppm	Not Available
22.0	Boron	ppm	Not Available
23.0	Oil & Grease	ppm	Not Available

WATER QUALITY AT CLARIFIER OUTLET

a) Residual Chlorine 0.1 ppm as Cl_2
b) Iron Content < 0.1 ppm as Fe
c) Turbidity < 15NTU

SSF BACK WASH WATER PROPERTIES - TSS of SSF backwash water 4500 ppm

TSS OF DM AND CPU WATER shall be 5000 ppm

FLOOR WASH WATER PROPERTIES
Refer Analysis of Raw Water as below

DRAWINGS

OVERHEAD SERVICE WATER TANK
WATER FROM SERVICE WATER PUMP DISCHARGE HEADER
FLOAT VALVE
CAP.- 10M3 MOC: RCC ABOVE CHEMICAL HOUSE
MAX VENDOR
BHEL PEM

CHEMICAL DOSING SYSTEM FOR CMB
ACID DOSING TANK
ALKALI DOSING TANK
DOSING PUMPS 2NOS.(2X100N) AUTO CONTROLLED DIAPHRAGM TYPE
TRIP SIGNAL
DRAIN
SAMPLING

ALUM DOSING SYSTEM FOR ETP CLARIFIER
ALUM DOSING TANKS 2 NOS.
DOSING PUMPS 3NOS.(2X100N) AUTO CONTROLLED DIAPHRAGM TYPE

LIME DOSING SYSTEM FOR ETP CLARIFIER
LIME SOLUTION SLAKING TANKS HORIZONTAL TYPE NOS.: (2W +1S)
SLAKED LIME TRANSFER PUMPS 2NOS HORIZONTAL TYPE NOS.: (2X50N)
LIME SOLUTION PREPARATION TANK 2 NOS.
LIME SOL. RECIRCULATION CUM DOSING PUMPS 3NOS.(2X100N) HOOZONTAL CENTRIFUGAL
LIME DOSING BOX

CENTRAL MONITORING BASIN(TWO COMPARTMENT)
FROM CT BLOW DOWN — 900 m3/hr Intermittent
FROM DM PLANT NEUTRALISATION EFFLUENT DISPOSAL PUMP — 225 m3/hr Intermittent
FROM N-PH, CPU Regeneration — 225 m3/hr Intermittent

CENTRAL MONITORING BASIN EFFLUENT TRANSFER PUMPS
TYPE : HORIZONTAL
NOS.: (2W +1S)
CAP.-170M3/HR(EACH)
LOCATION - ETP AREA

STILLING CHAMBER
RCC CHANNEL
PARSHALL FLUME
FLASH MIXER
TRASHE LINE
HRSCC
SAMPLING
TURBIDITY

CLARIFLOCCULATOR SLUDGE SUMP
TWO COMPARTMENTS CAP.- 100M3 EACH MOC-RCC (ABOVE GROUND)
CLARIFLOCCULATOR SLUDGE TRANSFER PUMPS
CAP.- 100M3/HR(EACH) TYPE : VERTICAL CENTRIFUGAL (1W+1S) LOCATION - ETP AREA
AIR BLOWERS (1W+1S)
TIMER OPERATED TELESCOPIC TYPE SLUDGE DISPOSAL ARRANGEMENT (TYP.)
NDCT SLUDGE DRAIN — 200NB, — 250 m3/hr Intermittent
TO ASH HEADER SUMP (Pipe length=600 meter)

APH & BG FLOOR WASH AREA
BOILER BLOW DOWN
(Pipe length=500 meter)
RETENTION PIT FOR BOILER BLOW DOWN CAP.-50M3 M.O.C.-RCC (UNDER GROUND)
BOILER BLOW DOWN TRANSFER PUMPS (1W+1S) CAP.-50M3/HR(EACH) TYPE: VERTICAL CENTRIFUGAL

OILY WASTE FROM POWER HOUSE AREA
(Pipe length=450 meter)
POWER HOUSE AREA SERVICE WASTE TRANSFER PUMPS (1W+1S) CAP.- 60M3/HR(EACH) TYPE : VERTICAL SCREW
RETENTION PIT FOR SERVICE OILY WASTE FROM POWER HOUSE AREA CAP.-60M3 M.O.C.-RCC (UNDER GROUND)

OILY WASTE FROM TRANSFORMER YARD AREA
(Pipe length=300 meter)
TRANSFORMER YARD AREA OILY WASTE TRANSFER PUMPS (1W+1S) CAP.- 30M3/HR (EACH) TYPE : VERTICAL SCREW
RETENTION PIT FOR OILY WASTE FROM TRANSFORMER YARD AREA CAP.-90M3 M.O.C.-RCC (UNDER GROUND)

OILY WASTE FROM FUEL OIL STORAGE AREA
(Pipe length=750 meter)
FUEL OIL STORAGE AREA OILY WASTE TRANSFER PUMPS (1W+1S) CAP.- 10 M3/HR(EACH) TYPE : VERTICAL SCREW
RETENTION PIT FOR FUEL OIL STORAGE AREA CAP.-10M3 M.O.C.-RCC (UNDER GROUND)

AC PLANT REJECT TANK AT 54M. ELEVATION (Pipe length=520 meter)
EFFLUENT TRANSFER BY GRAVITY

CLEAR WATER STORAGE TANK CAPACITY:300M3 EACH MOC-RCC (ABOVE GROUND)
CLEAR WATER TRANSFER PUMPS
TYPE : HORIZONTAL
NOS.: (2W +1S)
CAP.-150M3/HR(EACH)
LOCATION - ETP AREA
EGMS
SERVICE WATER
CHP DUST SUPPRESSION
HORTICULTURE/ GARDENING GREEN BELT DEVELOPMENT
ASH WATER SUMP

OIL WATER SEPARATOR (CORRUGATED PLATE INTERCEPTOR) LOCATION - ETP AREA
SLOP OIL STORAGE TANK
COMMON OILY WASTE TRANSFER PUMPS (1W+1S) CAP.- 50M3/HR(EACH) (HEAD= 14 MWC) TYPE : VERTICAL SCREW
COMMON OILY WASTE RETENTION PIT CAP.-50M3 M.O.C.-RCC (UNDER GROUND) LOCATION - ETP AREA
TO CLARIFLOCCULATOR SLUDGE SUMP (Pipe length=30 meter)
CPI SLUDGE SUMP CAP.- 15M3 M.O.C.-RCC (UNDER GROUND)
CPI SLUDGE SUMP TRANSFER PUMPS CAP.- 15M3/HR EACH (HEAD=28 MWC) TYPE : VERTICAL CENTRIFUGAL LOCATION - ETP AREA
AIR BLOWERS (1W+1S)

OILY WATER SEPARATOR TRANSFER PUMPS (1W+1S) CAP.- 50M3/HR TYPE : SCREW VERTICAL
(Approx pipe length=600 meter)
RETENTION PIT FOR TREATED WATER CAP.-50M3 M.O.C.-RCC (UNDER GROUND)

TO ASH SLUDGE SUMP (Pipe length=800 meter)
BACKWASH WASTE FROM SIDE STREAM FILTERATION PLANT
SSF BACKWASH TANK CAP.-90M3 M.O.C.-RCC (UNDER GROUND)
SSP BACKWASH WASTE WATER TRANSFER PUMPS CAP.- 175M3/HR TYPE : VERTICAL CENTRIFUGAL LOCATION - NEAR COOLING TOWER AREA

PLANT RAINFALL RUNNOFF
RAIN WATER HARVESTING POND - 1
RAIN WATER HARVESTING POND - 2
RAIN WATER HARVESTING POND - 3
RAIN WATER HARVESTING POND - 4
RAIN WATER HARVESTING POND - 5
EFFLUENT DISPOSAL PUMPS (1W + 1S) CAP.20M3/HR TYPE : HORIZONTAL
EFFLUENT DISPOSAL PUMPS (1W + 1S) CAP.20M3/HR
(Pipe length100 meter)
TO HORTICULTURE/ GARDENING GREEN BELT DEVELOPMENT SERVICE WATER

MANUAL VALVE LEGEND–
MOTORIZED VALVE — RELIEF VALVE
NON RETURN VALVE — VALVE WITH LIMIT SWITCH
GATE VALVE
3 WAY GAUGE COCK
PLUG VALVE
BALL VALVE

INSTRUMENT LEGEND–
FIELD INSTRUMENT — DIFFRENTIAL PRESSURE TRANSMITTER
PRESSURE GAUGE — FLOW TOTALISER
FLOW TRANSMITTER — LEVEL GAUGE
DIAPHRAGM SEAL
FLOW INDICATOR — CONDUCTIVITY INDICATOR TRANSMITTER
PRESSURE TRANSMITTER — BOD/COD ANALYSER
LEVEL TRANSMITTER — TSS ANALYSER
pH INDICATOR TRANSMITTER — TEMPERATURE TRANSMITTER
AE ANALYSER ELEMENT — AT ANALYSER TRANSMITTER — FIT FLOW INDICATING
LTL LEVEL TRANSMITTER LOW — INTERLOCK — FQ FLOW TOTALYZER
LSH LEVEL TRANSMITTER HIGH — ALARM — SUCTION FILTER
VERTICAL SCREW PUMP — VERTICAL CENTRIFUGAL PUMP — ISOLATION GATE
'Y' TYPE STRAINER
INPUT FOR ETP
EGMS EFFLUENT QUALITY MONITORING SYSTEM

NOTES:–
1.DESIGN PRESSURE: 10KG/SQ.CM(G) MECH. DESIGN TEMPERATURE: 60 C
2.MINIMUM PRESSURE OF WATER AT ANY SW CONNECTION SHALL BE 1.5KG/SQ.CM EXCEPT WHERE MENTIONED OTHERWISE SPECIFICALLY.
3.MATERIALS OF CONSTRUCTION(PIPEWORK): REFER PE-TS-415-164-A001 VOLUME II SECTION IA FOR MOC OF PIPES AND VALVES
4.EFFLUENT DISPOSAL PUMPS WITH ARRANGEMENT SHALL BE PROVIDED FOR ALL RAIN WATER HARVESTING POND AS INDICATED IN PLOT PLAN DRG NO.; PE-DG-415-100-M001
5.HANDLING ARRANGEMENT FOR INLET OUTLET GATES/PUMPS SHALL BE AS PER PE-TS-415-164-A001
6.DRAIN FROM ACID/ALKALI TANK SHALL BE ROUTED BY PIPE WITH NECESSARY ARRANGEMENT TO CMB BY BIDDER DRAIN FROM ALUM/LIME TANK SHALL BE ROUTED BY PIPE WITH NECESSARY ARRANGEMENT TO HRSCC BY BIDDER
7. ALL INSTRUMENTS AS INDICATED IN P&ID IS BARE MINIMUM IN THE SCOPE OF BIDDERS
8. THE MISCELLANEOUS EFFLUENTS SHALL BE COLLECTED IN THE SUMPS BY BHEL THROUGH GRAVITY UNLESS EXCLUSIVELY MENTIONED.
9. IN CASE OF HORZ. PUMP (USED FOR SUMPS OF RAIN WATER HARVESTING POND) SELF PRIMING ARRANGEMENT & ASSOCIATED TANK, VALVES, PIPING, INSTRUMENTS, FITTINGS AS REQUIRED SHALL BE PART OF BIDDERS SCOPE.
10. PIPING DETAILS OF CLEAR WATER TRANSFER TO VARIOUS LOCATION – REFER PE-TS-415-164-A001 SECTION IA

JOB NO.	: 415
STATUS	: Contract
DISTRIBUTION	:
TO	
No.OF	

REV	DATE	ALTD	CHD	APPD

MAHARASHTRA STATE POWER GENERATION CO. LTD.
1X600 MW, BHUSAWAL T.P.S. UNIT–6
BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NEW DELHI

DEPT	NAME	SIGN	DATE
CODE DRN			
A DESN			
CHD			
APPD			

TITLE
P & I DIAGRAM EFFLUENT TREATMENT PLANT

DEPT.	SCALE NTS	DRAWING NO.
SIGN		PE-DG-415-164-A001
DATE		SHEET 01 OF 01 REV. 0

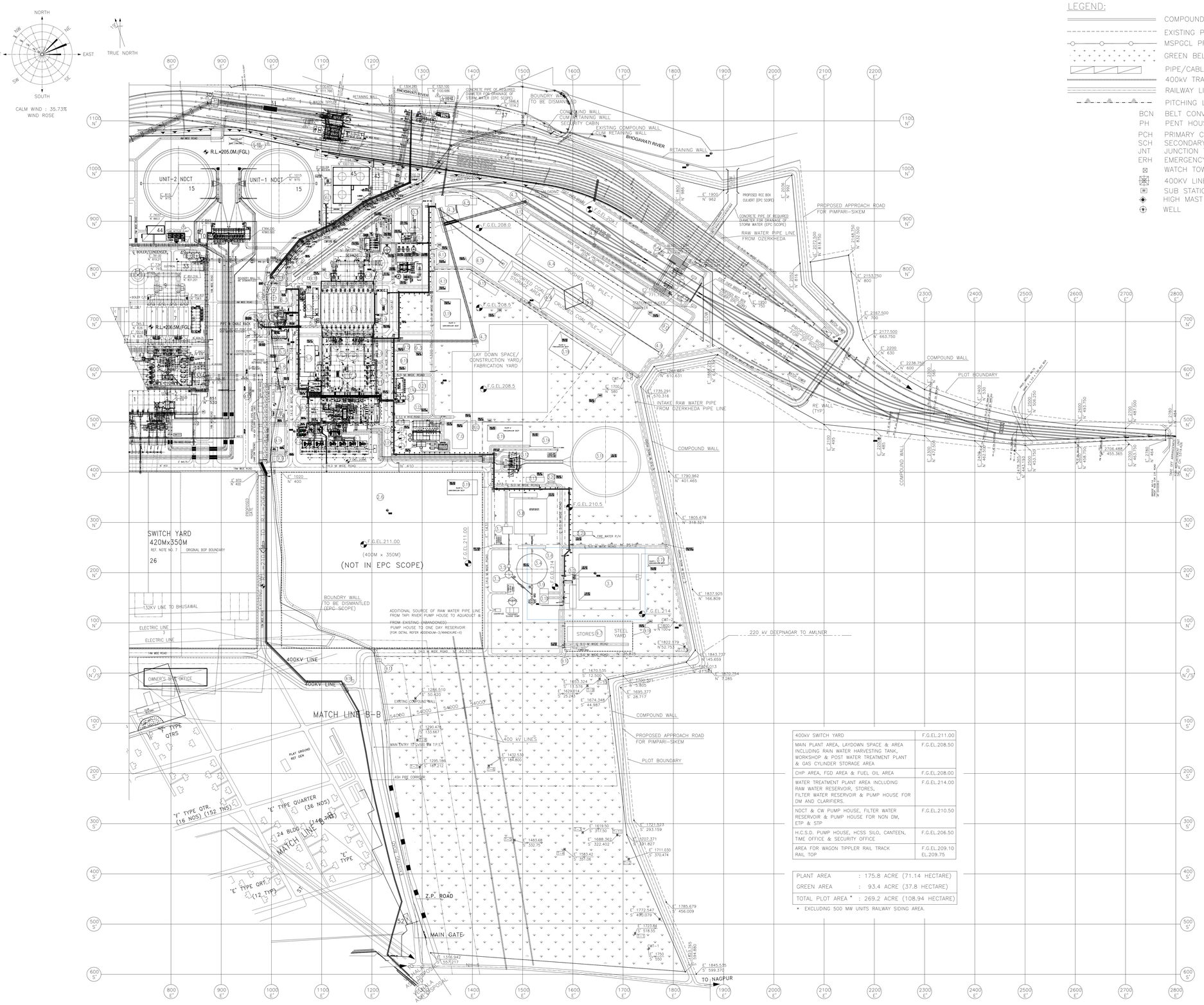
FORMAT SIZE A0

DRAWING No. PE-DG-415-100-M001

CUSTOMERS DRAWING No.

FIRST ANGLE PROJECTION | ALL DIMENSIONS ARE IN MM

COMPUTER FILE NAME : 415_100_M001_R3



LEGEND:

- COMPOUND WALL
- EXISTING PLANT BOUNDARY
- MSPGCL PROPERTY FENCING
- GREEN BELT
- PIPE/CABLE RACK
- 400kv TRANSMISSION LINE
- RAILWAY LINE
- PITCHING LINE FOR LEVEL DIFFRENCE
- BCN BELT CONVEYOR
- PH PENT HOUSE
- PCH PRIMARY CRUSHER HOUSE
- SCH SECONDARY CRUSHER HOUSE
- JNT JUNCTION TOWER
- ERH EMERGENCY RECLAIM HOPPER
- WATCH TOWER
- 400KV LINE TOWER
- SUB STATION FOR CONSTRUCTION POWER.
- HIGH MAST (HM)
- WELL

FACILITY	DESCRIPTION OF FACILITIES	SIZES (M)
1.0	POWER BLOCK AREA	
1.1	TG BUILDING	139.5x48
1.2	TG CONTROL EQUIPMENT ROOM/PCR	21x33.85
1.3	BOILER	82x53
1.4	FD/PA FANS	2 No Each
1.5	MILLS & BUNKERS	8 Bunkers
1.6	ESP	–
1.7	ESP CONTROL ROOM	52.625x20.6
1.8	ID FANS	–
1.9	CHIMNEY	–
1.10	SPACE FOR FGD (REFER FACILITY No. 10)	
1.11	MILL REJECT SILO	7.5x5.0
1.12	AIR COMPRESSOR BUILDING/MILL REJECT COMPRESSOR & CONTROL ROOM	14x48
1.13	CONDENSATE STORAGE TANK	ø10
1.14	CONDENSATE STORAGE TANK PUMP HOUSE	28x17.5
1.15	DG BUILDING/AIR WASHER BLDG.	22x16
2.0	ELECTRICAL FACILITIES	
2.1	GENERATOR TRANSFORMER	–
2.2	STATION TRANSFORMER	–
2.3	UNIT TRANSFORMER	–
2.4	UNIT AUXILIARY TRANSFORMER	–
2.5	STATION AUXILIARY TRANSFORMER	–
2.6	400kV SWITCH YARD (CUSTOMER SCOPE)	400x350
3.0	WATER SYSTEM	
3.1	RAW WATER & FIRE WATER STORAGE TANK	119x92
3.2	RAW WATER PUMP HOUSE	36x6.5
3.2a	FIRE WATER PUMP HOUSE	39x8
3.3	DM WATER CLARIFIER (PT PLANT)	–
3.4	NON-DM WATER CLARIFIER (PT PLANT)	–
3.5	GRAVITY FILTERS(FOR DM WATER) (PT PLANT)	–
3.6	GRAVITY FILTERS(FOR NON DM WATER) (PT PLANT)	–
3.7	FILTER WATER TANK & PUMP HOUSE FOR DM	24x10
3.8	CLARIFIED WATER TANK AND PUMP HOUSE (NON DM)	65x70
3.9	OZONIZATION PLANT(PRE-TREATMENT AREA)	19x16.5
3.10	CHEMICAL HOUSE/ELEC. & CONTROL ROOM	–
3.11	N.D. COOLING TOWER	ø132
3.12	CW/ ACW PUMP HOUSE	13.5x28.5
3.13	OZONIZATION & CW TREATMENT AREA (C.W.SYSTEM)	36x10
3.14	CW SIDE STREAM FILTRATION PLANT	46x30
3.15	DM WATER STORAGE TANKS(2 NOS.)	ø12
3.16	POST WATER TREATMENT PLANT AREA (DM PLANT)	55x35
3.17	NEUTRALISING PIT	12x10
3.18	ACID/ALKALI STORAGE AREA	20x8
3.19	RAIN WATER HARVESTING POND	–
3.20	SULPHURIC ACID STORAGE AREA FOR CW TREATMENT	14x14.5
3.21	CHEMICAL LAB (PCRI-HWR)	30X20
3.22	CPU REGENRATION BUILDING	40x38.5
4.0	COAL HANDLING PLANT (ISG SCOPE)	
4.1	WAGON TIPPLER	–
4.2	CONTROL ROOM FOR WAGON TIPPLER	–
4.3	CRUSHER HOUSE	39x30
4.4	CRUSHED COAL STORAGE AREA	270x50x11(2nos.)
4.5	CHP MCC/CONTROL ROOM	62.5x22
4.6	STACKER RECLAIMER	–
4.7	TRANSFER POINTS	12x12
4.8	PENT HOUSE	–
4.9	DRIVE HOUSE FOR STACKER RECLAIMER	–
4.10	COAL PILE RUN-OFF POND	30x40
4.11	CHP MAINTENANCE BUILDING	25x40
4.12	AREA FOR GROUND UNLOADING OF COAL	650 M^2
4.13	CHP PUMP HOUSE	30x25
4.14	WAGON TIPPLER MCC ROOM	–
5.0	ASH HANDLING PLANT (ISG SCOPE)	
5.1	HCSD SILO	–
5.2	H.C.S.D. PUMP HOUSE & CONTROL ROOM	10x30
5.3	DELETED	–
5.4	MAIN FLY ASH SILO	–
5.5	SILO MCC CUM HCSD BFD ROOM	–
5.6	ASH WATER TANK & ASH SLURRY PUMP HOUSE	35x69
5.7	AHP COMPRESSORS & BLOWERS	15x30
5.8	TUBE SETTLER PLANT	20x35
5.9	FLY ASH COLLECTION SUMP-1&2	15x10
5.10	AHP MCC CUM CONTROL ROOM	45x15
6.0	FUEL OIL SYSTEM	
6.1	FUEL OIL TRANSFER PUMP HOUSE	9x25.5
6.2	HFO & LDO DAY TANK AREA	32x20
6.3	HFO & LDO PRESSURIZING PUMP HOUSE	26x15
6.4	ELECTRICAL ANNEXE FOR FGPH	9X25
7.0	EFFLUENT TREATMENT PLANT	56x30
8.0	SEWAGE TREATMENT PLANT	20x10
9.0	NON-PLANT BUILDING	
9.1	SERVICE BUILDING	12x42
9.2	WORKSHOP-DELETED	65x30
9.3	LUBE OIL STORAGE SHED WITH STORAGE YARD	15x15
9.4	FIRE STATION-DELETED	10x25
9.5	GAS CYLINDER STORAGE AREA	15x25
9.6	FOPH FOAM SHED	11.5x8.3
9.7	STORES	75x30
9.8	CANTEEN	17.5x17.5
9.9	TIME OFFICE & SECURITY OFFICE	25x10
9.10	SECURITY OFFICE FOR STORES	10x5
9.11	SECURITY CABIN	10x5
9.12	COAL SAMPLING & PROCESSING ROOM	15x25
9.13	WEIGH BRIDGE FOR DRY ASH SILO	–
9.14	PARKING SHEDS WITH GATE OFFICE	30x50
9.15	PAY LOADER SHED	12x66
9.16	STEEL YARD INCLUDING STORES & WEIGH BRIDGE	1.35x60
9.17	FIRE WATER BOOSTER PUMP HOUSE	9x6
9.18	AMBIENT AIR QUALITY MONITORING SYSTEM	4x5
9.19	AMMONIA UNLOADING AND STORAGE AREA (FOR SCR)	21x35
10.0	FGD	
10.1	FGD ABSORBER	–
10.2	FGD CONTROL ROOM	–
10.3	GYPSUM STORAGE SHED	–
10.4	GYPSUM DEWATERING BUILDING	–
10.5	WET BALL MILL BUILDING	–

400kV SWITCH YARD	F.G.EL.211.00
MAIN PLANT AREA, LAYDOWN SPACE & AREA INCLUDING RAIN WATER HARVESTING TANK, WORKSHOP & POST WATER TREATMENT PLANT & GAS CYLINDER STORAGE AREA	F.G.EL.208.50
CHP AREA, FGD AREA & FUEL OIL AREA	F.G.EL.208.00
WATER TREATMENT PLANT AREA INCLUDING RAW WATER RESERVOIR, STORES, FILTER WATER RESERVOIR & PUMP HOUSE FOR DM AND CLARIFIERS.	F.G.EL.214.00
NDCT & CW PUMP HOUSE, FILTER WATER RESERVOIR & PUMP HOUSE FOR NON DM, ETP & STP	F.G.EL.210.50
H.C.S.D. PUMP HOUSE, HCSS SILO, CANTEEN, TIME OFFICE & SECURITY OFFICE	F.G.EL.206.50
AREA FOR WAGON TIPPLER RAIL TRACK RAIL TOP	F.G.EL.209.10 EL.209.75

PLANT AREA	:	175.8 ACRE (71.14 HECTARE)
GREEN AREA	:	93.4 ACRE (37.8 HECTARE)
TOTAL PLOT AREA *	:	269.2 ACRE (108.94 HECTARE)

* EXCLUDING 500 MW UNITS RAILWAY SIDING AREA.

NOTES:

1. ALL DIMENSIONS ARE IN MM AND ALL ELEVATIONS ARE IN METERS. THE GRIDS AND CO-ORDINATES ARE SHOWN IN METERS.
2. BUILDINGS OUTER LINES SHOWN ARE COLUMNS GRID LINES.
3. ALL ELEVATIONS ARE REFERRED TO POWER HOUSE FINISHED GROUND FLOOR
4. ELEVATION ± 0.00M WHICH CORRESPONDS TO RL.(+)209.0M.
5. HIGH FLOOD LEVEL RL.198.20M
6. PROPOSED RCC BOX CULVERTS SHALL BE AS PER INDIAN RAILWAY STANDARD.
7. RAILWAY LAYOUT IS INDICATIVE AND THE SAME SHALL BE PROVIDED AS PER RAILWAY'S APPROVAL.
8. EXISTING FIRE STATION OF 2x500MW UNITS SHALL BE USED FOR 1x660MW. (CO-ORDINATES OF EXISTING FIRE STATION E'517.0 & N'352.6, SIZE 20.5Mx10M)
9. LAYOUT/SIZE OF VARIOUS EQUIPMENTS/FACILITIES IS TENTATIVE ONLY AND SHALL BE FINALIZED DURING DETAIL ENGINEERING.

REFERENCE DRAWINGS:

1. CUSTOMER PLOT PLAN (GENERAL LAYOUT)	PE-189-GA-101-REV.09
2. PLOT PLAN BOUNDARY MARKING	DG/253-NEW-001/REV.0 (189-MAHAGENCO-05/R0)

REV	DATE	ALTD	CHD	APPD
03	16.11.19	BS	AMT	PM

1. PLOT PLAN REVISED AS PER CUSTOMER COMMENTS DTD. 04.09.18.
2. DRAWING IS UPDATED IN GENERAL.

REV	DATE	ALTD	CHD	APPD
02	24.07.18	AK -sd/	AMT-sd/	PM -sd/

PLOT PLAN REVISED AS PER CUSTOMER OBSERVATION VIDE MAIL DTD:21.06.2018

REV	DATE	ALTD	CHD	APPD
01	18.04.18	AK -sd/	AMT-sd/	RP -sd/

PLOT PLAN REVISED AS PER CUSTOMER OBSERVATION VIDE MAIL DTD:17.03.2018

JOB No. 415
STATUS CONTRACT
DISTRIBUTION
TO
No.OF

OWNER: MAHAGENCO — MAHARASHTRA STATE POWER GENERATION CO. LTD.

CONSULTANT: DEVELOPMENT CONSULTANTS PVT. LTD.
CONSULTING ENGINEERS
VASHI, NAVI MUMBAI

PROJECT: 1x660 MW BHUSAWAL TPS UNIT-6

CONTRACTOR: BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

DEPT CODE		NAME	SIGN	DATE
–	DRN	AK	–sd/	19.02.2018
	DESN	AMT	–sd/	19.02.2018
	CHD	RP	–sd/	19.02.2018
	APPD	JJ	–sd/	19.02.2018

TITLE: PLOT PLAN

CUSTOMER PACKAGE CODE: –
SCALE 1:2750
DRAWING No. PE-DG-415-100-M001
DISCIPLINE: M C E I L
SHEET 01 OF 01 REV 03

SIZE-A0

DATASHEET-A

(EFFLUENT TREATMENT PLANT)

DATA SHEET – A

S. No.	Description	Units	Parameter
1.00.00	**OIL HANDLING AREA EFFLUENT**		
1.01.01	**Power House Area Oily Waste Sump**		
i)	Numbers Required	Nos.	1
ii)	Type		Underground rectangular with flat bottom
iii)	Effective capacity	M3	60
iv)	Material of Const.		RCC
1.01.02	**Power House Area Oily Waste Transfer Pumps**		
i)	Numbers Required	Nos.	2
ii)	Type		Screw Type
iii)	Location		Outdoor
iv)	Type of Fluid		Oily Waste Water
v)	Rated Flow	M3/hr	60
vi)	Head	MWC	As per process requirements
vii)	Service		Intermittent
viii)	Pump Speed	RPM	1500
ix)	Material of Construction		
	Casing		2% Ni - CI to IS 210 FG 260
	Rotor		SS-316
	Stator		Nitrile/EPDM
	Shaft		SS-316
1.02.01	**Transformer Yard Area Oily Waste Sump**		
	Numbers Required	Nos.	1
	Type		Underground rectangular with flat bottom
	Effective capacity	M3	60
	Material of Const.		RCC
1.02.02	**Transformer Yard Area Oily Waste Transfer Pumps**		
i)	Numbers Required	Nos.	2
ii)	Type		Screw Type
iii)	Location		Outdoor
iv)	Type of Fluid		Transformer area oily waste water
v)	Rated Flow	M3/hr	30
vi)	Head		As per process requirements
vii)	Service		Intermittent
viii)	Pump Speed	RPM	1500
ix)	Material of Construction		
	Casing		2% Ni - CI to IS 210 FG 260
	Rotor		SS-316
	Stator		Nitrile/ EPDM
	Shaft		SS-316
1.03.01	**Fuel Oil Storage Area Oily Waste Sump**		
	Numbers Required	Nos.	1
	Type		Underground rectangular with flat bottom
	Effective capacity	M3	150
	Material of Const.		RCC
1.03.02	**Fuel Oil Storage Area Oily Waste Transfer Pumps**		
i)	Numbers Required	Nos.	2
ii)	Type		Screw Type
iii)	Location		Outdoor
iv)	Type of Fluid		Oily waste from Fuel Oil Storage area.
v)	Rated Flow	M3/hr	150
vi)	Head		As per process requirements
vii)	Service		Intermittent
viii)	Pump Speed	RPM	1500
ix)	Material of Construction		

	Casing		2% Ni - CI to IS 210 FG 260
	Rotor		SS-316
	Stator		Nitrile/ EPDM
	Shaft		SS-316
1.04.01	**Common Oily Waste Retention Pit**		
i)	Numbers Required	Nos.	1
ii)	Type		Underground rectangular with flat bottom
iii)	Effective capacity	M3	50
iv)	Material of Const.		RCC
1.04.02	**Common Oily Waste Water Transfer Pumps**		
i)	Numbers Required	Nos.	2
ii)	Type		Screw Type
iii)	Location		Outdoor
iv)	Type of Fluid		Oily Waste from Common Oily Retention Pit
v)	Rated Flow	M3/hr	50
vi)	Head	MLC	As per process requirements
vii)	Pump Speed	RPM	1500
viii)	Material of Construction		
	Casing		2% Ni-CI to IS 210 FG 260
	Rotor		SS-316
	Stator		Nitrile/ EPDM
	Shaft		SS-316
1.05.01	**Oil Water Separators**		
i)	Numbers Required	Nos.	1
ii)	Type		Plate or tube with counter/ cross flow
iii)	Effective capacity	M3/hr	50
iv)	Treated Water Quality		Free Oil content not to exceed 10 ppm for free oil concentration 1000 ppm maximum in feed waste to the Separator. Suspended Solids not to exceed 20 ppm for Suspended Solids 300 ppm maximum in feed waste to the Separator.
v)	Design Criteria Angle of inclination Rise Rate		60 Degree Suitable to provide efficient coalescence and removal of oil from waste water to maintain oil concentration 10 ppm maximum in treated water.
vi)	Material of Construction		
	Body		RCC
	Plates or tubes		UV inhibited virgin FRP or GRP or PVC
	Oil skimmer System		To be provided
	Sludge disposal System		By gravity along with all accessories
1.06.02	**Slop Oil Storage Tank**		
i)	Numbers Required	Nos.	1
ii)	Type		Vertical Cylindrical
iii)	Type of Fluid to be Handled		Slop Oil
iv)	Effective capacity	M3/hr	3
v)	Material of Construction		Carbon Steel
1.07.01	**Retention Pit for Treated Water**		
i)	Numbers Required	Nos.	1
ii)	Type		Underground rectangular with flat bottom
iii)	Effective capacity	M3	50
iv)	Material of Const.		RCC
1.07.02	**Oil Water Separator Transfer Pumps**		
i)	Number of pumps	Nos.	2
ii)	Type of Pumps		Screw Type
iii)	Location		Outdoor
iv)	Fluid to be Handled		Treated water from OWS
v)	Capacity of each pump	M3/hr	50
vi)	Duty		Intermittent
vii)	Head	MWC	As per Process Requirements

viii)	Pump Speed	RPM	1500
ix)	Material of Construction		
	Casing		2.5% Ni-CI , IS 210 FG 260
	Rotor		SS-316
	Stator		Nitrile/ EPDM
	Shaft		SS-316
1.08.01	**CPI Sludge Sump**		
i)	Numbers Required	Nos.	1
ii)	Type		Rectangular with flat bottom
iii)	Effective capacity	M3	15
iv)	Material of Const.		RCC
v)	Internal		Epoxy painted
1.08.02	**CPI Sludge Sump Transfer Pump**		
i)	Numbers Required	Nos.	2
ii)	Type		Vertical Centrifugal Type
iii)	Location		Outdoor
iv)	Type of Fluid		CPI Sludge
v)	Rated Flow	M3/hr	15
vi)	Head		As per process requirements
vii)	Service		Intermittent
viii)	Pump Speed	RPM	1500
ix)	Material of Construction		
	Casing		2% Ni - CI to IS 210 FG 260
	Impeller		Stainless Steel – Gr. 316
	Shaft		Stainless Steel – Gr. 410
1.08.03	**CPI Sludge Pit Blower**		
i)	Numbers Required	Nos.	2
ii)	Type		Rotary, Twin lobe
iii)	Location		Outdoor
iv)	Type of Fluid		Ambient air
v)	Rated Capacity		Suitable to meet 100% of System Requirements.
vi)	Head		As per process requirements
vii)	Service/ Duty		Sludge Mixing/ Intermittent
viii)	Material of Construction		
	Casing		CI to IS 210 FG 260
	Lobes		CS to BS 970, EN9 Forged
	Shaft		CS to BS 970, EN9 Forged
2.00.00	**Boiler Area Wash Effluent**		
2.01.01	**Boiler Area Waste Sump**		
i)	Numbers Required	Nos.	1
ii)	Type		Underground
iii)	Effective capacity	M3	50
iv)	Material of Const.		RCC
2.01.02	**Boiler Area Wash Water Transfer Pumps**		
i)	Number of pumps	Nos.	2
ii)	Type of Pumps		Vertical Centrifugal Type
iii)	Location		Outdoor
iv)	Type of Fluid		Boiler Drain waste water
v)	Rated Flow	M3/hr	30
vi)	Head		As per process requirements
vii)	Service		Continuous
viii)	Pump Speed		1500
ix)	Material of Construction		
	Casing		2% Ni - CI to IS 210 FG 260
	Rotor		Stainless Steel – Gr. 316
	Shaft		Stainless Steel – Gr. 410
4.00.00	**Back Wash Waste from SSF**		
4.01.01	**Back Wash Waste Sump**		

i)	Numbers Required	Nos.	1
ii)	Type		Underground
iii)	Effective capacity	M3	300
iv)	Material of Const.		RCC
4.01.02	**Back Wash Waste Water Transfer Pumps**		
i)	Number of pumps	Nos.	2
ii)	Type of Pumps		Vertical Centrifugal Type
iii)	Location		Outdoor
iv)	Type of Fluid		Backwash waste from SSF
v)	Rated Flow	M3/hr	175
vi)	Head		As per process requirements
vii)	Service		Intermittent
viii)	Pump Speed		1500
ix)	Material of Construction		
	Casing		2% Ni - CI to IS 210 FG 260
	Rotor		Stainless Steel – Gr. 316
	Shaft		Stainless Steel – Gr. 410
5.00.00	**Central Monitoring Basin**		
i)	Numbers	Nos.	1 in two compartments
ii)	Type		Underground
iii)	MOC		Earthen
iv)	Minimum Effective capacity (Each Compartment)	M3	Effective capacity of each compartment shall have at least 8hrs detention time
v)	Inlet Arrangement		Inlet Chamber with Gate
5.01.00	**CMB Effluent Transfer Pumps**		
i)	Number of pumps	Nos.	Two (3) Numbers (2W+1S)
ii)	Type of Pumps		Horizontal Centrifugal Type
iii)	Capacity of each pump	M3/hr	170
iv)	Head	MWC	As per process requirements
v)	Material of Construction		
	Casing		CI IS-210,FG 260
	Impeller		CI IS-210,FG 260
	Shaft		Bronze IS 318,GR. LTB2 CS to BS 970,EN 8
vi)	Speed of Pump		1500
vii)	Location		Indoor
viii)	Duty		Continuous
5.02.00	**Acid Dosing Tank**		
i)	Numbers Required	Nos.	1
ii)	Type		Vertical rectangular with flat bottom
iii)	Effective capacity	M3	Suitable to meet 100% of system requirements
iv)	Material of Const.		RCC
v)	Location		CMB Pump House
vi)	Protection		Internal – Acid Proof tile lining
vii)	Agitator		
	Numbers Required	Nos	1
	MOC		All wetted parts – epoxy painted carbon steel
5.02.01	**Acid Dosing Pump**		
i)	Number of pumps	Nos	2
ii)	Type of Pumps		Metering Pumps, Simplex, Mechanically actuated (hydraulically operated) diaphragm type
iii)	Location		CMB Pump House
iv)	Type of Fluid		Acid Solution
v)	Rated Flow		Suitable to meet 100% of system requirements
vi)	Head		As per process requirements
vii)	Pump Speed		1500
viii)	Material of Construction		
	All wetted parts		SS-316
	Diaphragm		PTFE

5.03.00	**Alkali Dosing Tank**		
i)	Numbers Required	Nos.	1
ii)	Type		Vertical rectangular with flat bottom
iii)	Effective capacity	M3	Suitable to meet 100% of system requirements
iv)	Material of Const.		RCC
v)	Location		CMB Pump House
vi)	Protection		Internal – Epoxy Painted
vii)	Agitator		
	Numbers Required	Nos	1
	MOC		All wetted parts – epoxy painted carbon steel
5.03.01	**Alkali Dosing Pump**		
i)	Number of pumps	Nos	2
ii)	Type of Pumps		Metering Pumps, Simplex, Mechanically actuated (hydraulically operated) diaphragm type
iii)	Location		CMB Pump House
iv)	Type of Fluid		Alkali Solution
v)	Rated Flow		Suitable to meet 100% of system requirements
vi)	Head		As per process requirements
vii)	Pump Speed		1500
viii)	Material of Construction		
	All wetted parts		SS-316
	Diaphragm		PTFE
5.04.01	**Stilling Chamber**		
i)	Numbers Required	Nos.	1
ii)	Type		Stilling Chamber provided with baffle wall inside
iii)	Effective Capacity	M3/Hr	Suitable to handle the flow rate of waste water as much as required at upstream of one (1) nos. Clariflocculators, each set at rated capacity to produce 300 m3/ hr (indicative) + water loss for sludge disposal through each Clariflocculator
iv)	MOC		RCC
v)	Accessories		Suitable draining arrangement shall be provided for the stilling chamber and drain line shall be extended up to the sludge pocket for final disposal to common sludge sump.
5.05.01	**PARSHALL FLUME**		
i)	Numbers Required	Nos.	1
ii)	Type		Rectangular in cross-section
iii)	Effective Capacity	M3/Hr	Suitable to handle the flow fa te of waste water as much as required at upstream of one (1) nos. Clariflocculators, each set at rated capacity to produce 300 m3/ hr (indicative) + water loss for sludge disposal through each Clariflocculator.
iv)	MOC		RCC
v)	Minimum Free Board/ Design Temperature		300mm/ 60deg C
v)	Special Features		Both local mounted Rate of Flow Indicator as well as panel mounted Rate of Flow Indicator- Integrator - Recorder for each Inlet Channel. The primary flow element shall be Parshall flume type. Each Integrator shall be electronic and have LED digital display (6 digits) along with manual reset facility. Primary transmitter shall be at Parshall flume in a float chamber. Flushing and draining provision of each float chamber shall be provided. Multipoint Recorder shall be one (1) in no. There shall be one Integrator to indicate totalized water flow through all the Inlet Channels.
5.06.01	**Flash Mixer**		

i)	Numbers Required	Nos.	1
ii)	Agitator		Turbine Type AC electric motor operated through reduction gear, MOC-SS 316 or Criss-Cross flow design as per IS:7090
iii)	Construction		Radial, RCC
iv)	Detention time (approx.)		60sec
v)	Protective cover of GI construction for motors and gear drives.		Required - protection for motors - IPW-55 (outdoor duty)
5.07.01	**Clariflocculator**		
i)	Numbers Required	Nos.	1
ii)	Type		Solid Contact Type Clariflocculator
iii)	Output Capacity	M3/Hr	300
iv)	MOC		RCC
v)	Flocculators		
	Numbers Required	Nos	1
	MOC		SS316
vi)	Rake Mechanism		
	Numbers Required	Nos	1
	MOC		Epoxy Painted carbon steel complete rubber squeezers
vii)	Sludge Disposal Arrangement		Continuous – By Gravity Through telescopic standpipe Intermittent – Main Sludge disposal line shall consist of manual adjustable timer operated blow-off valve with manual over riding facilities
viii)	Accessories & Instruments		As per P&ID
ix)	Painting		As per relevant sub section
x)	Walkway		To be provided with handrails around launder periphery of each clarifloccualtor. Width of the walkway shall not be less than 1200mm.
xi)	Residence time in Draft Tube		1 minimum
xii)	Residence time in Flocculation zone		15 minimum
xiii)	Residence time in clarification zone		100minimum
xiv)	Surface flow rate in Clarification zone		Not to exceed 2.5 m3/ hr / m2
xv)	Suspended Solid of treated water at rated condition	ppm	<15
5.08.01	**Clariflocculator Sludge Sump**		
i)	Numbers Required	Nos.	1
ii)	Type		Rectangular with two compartments and flat bottom
iii)	MOC		RCC
iv)	Effective capacity of each compartment m3/ hr		Suitable to hold sludge gene rated from one (1) no. Clariflocculator at rated condition for 1 hr. Continuous operation or 100 m3 of each compartment which ever shall be greater
v)	Painting		Epoxy painted as per sub section
vi)	Minimum free board	mm	500
vii)	Sludge Flushing Arrangement		Required through high pressure water and nozzles to ensure no deposition/ setling of sludge as per the Tender P&ID Water shall be taken from service water pump discharge header. Booster Pump if required, for producing high pressure water, shall be Bidder's scope.
5.08.02	**Clariflocculator Sludge Sump Transfer Pump**		
i)	Numbers Required	Nos.	2
ii)	Type		Vertical Centrifugal Non Clog Type
iii)	Location		Outdoor
iv)	Fluid to be Handled		Sludge-Water slurry

v)	Type of Impeller		Open
vi)	Rated Capacity	M3/Hr	100
vii)	Pump Speed	RPM	1500
viii)	Material of Construction		
	Casing		Ni Hard C.I as per ASTM 532
	Impeller		Ni Hard C.I as per ASTM
	Shaft		EN-8 as per BS-970
	Nuts and Bolts		SS-316 (under wetted condition) and MS Cadmium plated (in other places)
ix)	Design Temperature, Duty		60deg C, Intermittent/ suitable for parallel operation
x)	Suction Condition		Flooded.
5.09.01	**Alum Solution Preparation Tank**		
i)	Numbers Required	Nos.	2
ii)	Type		Vertical rectangular with flat bottom
iii)	MOC		RCC
iv)	Protection		Internal – Acid Proof Tile Lining
v)	Agitator along with drive motor and all other accessories		
	Number Required	Nos	1 (Per tank)
	MOC		SS 316
vi)	Dissolving Basket		
	Number Required	Nos	1 (Per tank)
	MOC		SS 316
vii)	Free Board, Design Temperature		300mm, 60deg C
viii)	Effective capacity of each tank	m3/hr	Adequate to hold the quantity required for twelve (12) hours of Clariflocculator operation at rated capacity plus water loss for sludge disposal through Clariflocculator. [dosing rate of alum solution is 40ppm]
5.09.02	**Alum Solution Injection Pump**		
i)	Numbers Required	Nos.	2
ii)	Type		Positive displacement and hydraulic diaphragm type with stroke adjustment
iii)	Location		Indoor
iv)	Fluid to be Handled		10% w/w Alum Solution
v)	Rated Capacity	M3/Hr	To be supplied by the Supplier to meet the requirement in order to produce 375 m3/hr water + water loss through sludge disposal from Clariflocculator [dosing rate of alum solution is 40 ppm].
vi)	Pump Speed	RPM	1500
vii)	Material of Construction		
	All wetted parts		SS-316
	Diaphragm		PTFE
vii)	Type of Drive		Electric Motor
viii)	Design Temperature		60deg C
5.10.01	**Lime Slaking Tanks**		
i)	Numbers Required	Nos.	2
ii)	Type		Vertical rectangular with flat bottom
iii)	MOC		RCC
iv)	Protection		Internal – Epoxy painted as per painting sub-section
v)	Agitator along with drive motor and all other accessories		
	Number Required	Nos	1 (Per tank)
	MOC		SS 316
vi)	Dissolving Basket		
	Number Required	Nos	1 (Per tank)
	MOC		SS 316
vii)	Free Board, Design Temperature		300mm, 60deg C
viii)	Effective capacity of each tank	m3/hr	Adequate to hold the quantity required for twelve (12) hours of Clariflocculator operation at rated capacity

			plus water loss for sludge disposal through Clariflocculator. [dosing rate of alum solution is 40ppm]
5.10.02	**Slaked Lime Transfer Pump**		
i)	Numbers Required	Nos.	2
ii)	Type		Horizontal Centrifugal
iii)	Location		Indoor
iv)	Fluid to be Handled		10% w/w Lime Solution
v)	Rated Capacity	M3/Hr	To be supplied by the Supplier to meet the requirement in order to produce 300 m3/hr water + water loss through sludge disposal from Clariflocculator
vi)	Pump Speed	RPM	1500
vii)	Material of Construction		
	All wetted parts		SS-316
vii)	Type of Drive		Electric Motor
viii)	Design Temperature		60deg C
5.11.01	**Lime Solution Preparation Tank**		
i)	Numbers Required	Nos.	2
ii)	Type		Vertical rectangular with Flat bottom
iii)	MOC		RCC
iv)	Protection		Internal – Epoxy painted as per painting sub-section
v)	Agitator along with drive motor and all other accessories		
	Number Required	Nos	1 (Per tank)
	MOC		SS 316
vi)	Dissolving Basket		
	Number Required	Nos	1 (Per tank)
	MOC		SS 316
viii)	Effective capacity of each tank	m3/hr	Adequate to hold the quantity required for twelve (12) hours of Clariflocculator operation at rated capacity plus water loss for sludge disposal through Clariflocculator. [dosing rate of alum solution is 40ppm]
5.11.02	**Lime Solution Recirculation cum dosing pump**		
i)	Numbers Required	Nos.	2
ii)	Type		Horizontal Centrifugal
iii)	Location		Indoor
iv)	Fluid to be Handled		6% w/w Lime Solution
v)	Rated Capacity	M3/Hr	To be supplied by the Supplier to meet the requirement in order to produce 300 m3/hr water + water loss through sludge disposal from Clariflocculator
vi)	Pump Speed	RPM	1500
vii)	Material of Construction		
	All wetted parts		Cast iron to IS 210 FG 260
vii)	Type of Drive		Electric Motor
viii)	Design Temperature		60deg C
5.11.03	**Air Blower for Clariflocculator Sludge Pit**		
i)	Numbers Required	Nos.	2
ii)	Type		Rotary, Twin lobe
iii)	Location		Outdoor
iv)	Fluid to be Handled		Ambient Air
v)	Rated Capacity		Suitable to meet 100% of system requirements
vi)	Material of Construction		
	Casing		CI to IS 210 FG 260
	Lobes		CS to BS 970, EN9 Forged
	Shaft		CS to BS 970, EN9 Forged
5.12.00	**Clear Water Transfer Pump**		
i)	Number of pumps	Nos.	Two (3) Numbers (2W+1S)
ii)	Type of Pumps		Horizontal Centrifugal Type
iii)	Capacity of each pump	M3/hr	150
iv)	Head	MWC	As per process requirements

v)	Material of Construction		
	Casing		CI IS-210,FG 260
	Impeller		CI IS-210,FG 260
	Shaft		Bronze IS 318,GR. LTB2 CS to BS 970,EN 8
vi)	Speed of Pump		1500
6.01.00	**Rain Water Harvesting Pump**		
i)	Number of pumps	Nos.	Ten (10) Numbers (5W+5S)
ii)	Type of Pumps		Horizontal Centrifugal Type
iii)	Capacity of each pump	M3/hr	20
iv)	Head	MWC	As per process requirements
v)	Material of Construction		
	Casing		CI IS-210,FG 260
	Impeller		CI IS-210,FG 260
	Shaft		Bronze IS 318,GR. LTB2 CS to BS 970,EN 8
vi)	Speed of Pump		1500

(SPECIFIC TECHNICAL REQUIRMENT-ELECTRICAL)

TITLE: ELECTRICAL EQUIPMENT SPECIFICATION FOR ETP PLANT	SPECIFICATION NO.
	VOLUME NO. : **II-B**
	SECTION: **C**
	REV NO. : **00** DATE: 25/11/2019
	SHEET: 1 OF 1

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 ETP PLANT 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 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical/quality assurance requirements stipulated. In line with this, the bidder shall furnish two signed and stamped copies of the following:

a) A copy of this sheet "Electrical Equipment Specification for ETP Plant Package and sheet Electrical scope between BHEL and Vendor" with bidder's signature and company stamp.

b) Electrical load requirement in the load data format.

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) Technical specification for motors DG/BSL U-6/2011/T-1
c) Datasheets along with Annexure-I
d) Conduit & Pipes specification & constructional details of cables.
e) Quality plan for motors.
f) Electrical Load data format (Annexure –II)
g) BHEL cable listing format (Annexure –III)

REV: 0 DATE: 25.11.19

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGE: ETP PLANT
SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT
PROJECT: 1 X 660MW BHUSAWAL TPP

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	BHEL	BHEL	1. 415 V AC (3 Phase, 4 Wire) /240 V AC 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. Interposing relays (RE 302 of Jyoti make or equivalent), if required for PLC and microprocessor based systems, shall be provided by BHEL in MCCs. Requirement of these relays shall be furnished by vendor during detailed engineering stage.
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, fibre optical 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 equipments 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	

REV: 0 DATE: 25.11.19

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGE: ETP PLANT
SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT
PROJECT: 1 X 660MW BHUSAWAL TPP

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
10	Equipment grounding & lightning protection	BHEL	BHEL	Refer note no. 4 for electronic earthing
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 but not specified above (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 (excluding power cables) in enclosed excel format shall be submitted by vendor during detailed engineering stage.
17	Electrical Equipment & cable tray layout drawings	Vendor	-	For ensuring cabling requirements are met, vendor shall furnish Electrical equipment layout & cable tray layout drawings (both in print form as well as in AUTOCAD) of the complete plant (including electrical area) indicating location and identification of all equipment requiring cabling, and shall incorporate cable trays routing details marked on the drawing as per PEM interface comments. Cabling arrangement of the same (wherever overhead cable trays, trenches, cable ducts, conduits etc.) shall be decided during contract stage. Electrical equipment layout & cable tray layout drawing shall be subjected to BHEL/ customer approval without any commercial implications to BHEL.
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.

(SPECIFIC TECHNICAL REQUIRMENT-C&I)

GENERAL & SPECIFIC TECHNICAL REQUIREMENT

GENERAL REQUIREMENT

1.0 Bidder shall provide complete and independent control & instrumentation system with all accessories, auxiliaries and associated equipment for the safe, efficient and reliable operation of auxiliary systems.

2.0. The quantity of instruments for auxiliary system shall be as per tender P &ID, wherever provided, for the respective system as a minimum for bidding purpose. However, Bidder shall also include in his proposal all the instruments and devices that are needed for the completeness of the plant auxiliary system/ equipment supplied by the bidder, even if the same is not specifically appearing in the P&ID. During detail engineering if any additional instruments are required for safe &reliable operation of plant, bidder shall supply the same without any price implication.

3.0 Measuring instruments/equipment and subsystems offered by the bidder shall be from reputed experienced manufacturers of specified type and range of equipment, whose guaranteed and trouble free operation has been proven. Further all the instruments shall be of proven reliability, accuracy, and acceptable international standards and shall be subject to employer's approval. All instrumentation equipment and accessories under this specification shall be furnished as per technical specification, ranges, makes/ numbers as approved by the employer' during detail engineering.

4.0 The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifold and all the other accessories required for mounting/ erection of these local instruments shall be furnished, even if not specifically asked for, on as required basis. The contacts of equipment mounted instruments; sensors, switches etc. for external connection including spare contacts shall be wired out to suitably located junction boxes.

5.0 In case of any contradiction most stringent clause/condition shall prevail.

SPECIFIC TECHNICAL REQUIREMENTS (C&I):

1) The control of ETP shall be through DCS based control system (in BHEL scope). The operation and control philosophy of ETP has been elaborated in separate section in the specification. The DCS panel along with OWS, EWS, printers (in BHEL scope) shall be located in Local Control Room.

2) Bidder shall provide Local control panel(9 nos.) at different locations for above said system. This local panel shall comprise of lamps, ‘START’ push button, 'STOP' push button along with ‘ON/OFF/TRIP’ indication, local/ remote indication & Local annunciation for local operation. The pumps, motorized valves, control valves etc. shall be operated from Lamp /Pushbuttons, selector switches etc. located on the Local Control panel. Integral type hardware annunciation system shall be provided at the top of the panel for alarm monitoring. Bidder to provide oil tank, pump, Sump etc. level, pressure, temperature indications on the Local Control Panel.

3) All electrical actuators shall be integral type.

4) The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No commercial implication in this regard shall be acceptable. In case of any conflict and repetition of clauses in the specification, the more stringent requirements (to be decided by BHEL/customer) among them are to be complied with.

5) The solenoid valves shall have limit switches for open/close feedback.

6) Interface of MCC, HT SWGR, Actuators, solenoid drives, control valves etc. with DCS based control system shall be as per Drive Control Philosophy attached in the specification.

7) All the instruments/drives shall be terminated on JBs/Panels in field. JBs/Panels shall be in Bidder's scope. No. of junction boxes shall be sufficient and positioned in the field to minimize (max 12-15 meter) local cabling and trunk cable.

8) RTD’s shall be of duplex type. Both the elements of duplex temperature sensors shall be terminated to junction boxes. Temperature measurement shall have upscale / down scale drive to protect from process upset in case of sensor failure.

9) Each pneumatic device requiring air supply and intended for field mounting shall include a filter regulator air set with gauge, to owner's approval.

10) Primary sensor redundancy for Control/measurement shall be decided as per following general criteria:
    - Critical controls and respective measurements- Triple redundant.
    - Non-critical but important control & measurements- Dual redundant.
    - Only measurement- No redundancy.

11) Scope of Instrumentation cables (Screened Control Cables), Fibre Optic cable & Control cables shall be as per Electrical Cable scope matrix in Electrical portion of specification. Any cable in Bidder's scope shall be as per specification.

12) Redundant 230 VAC UPS feeders shall be provided by BHEL at a single point. Further distribution to various instruments/analyzers/local panel etc. shall be in Bidder's scope. Bidder to include necessary power distribution board (ACDB) (as per details attached elsewhere in this specification) in his scope. Any power supply other than the above, if required by any instrument/device, has to be derived by the Bidder from the above supply and all necessary hardware for the same shall be in bidder's scope. Bidder to furnish UPS power requirement along with the bid.

13) Bidder to furnish electrical load/UPS load data during detailed engineering

14) All cables terminated in the terminal block, power distribution scheme instruments shall be ferruled. Ferruling shall be double cross ferruling (i.e.) source and destination addresses shall be marked on both sides of the tube ferruling

15) Bidder to comply with codes and standards as mentioned in the specification.

16) Instrument installation shall be as per the attached "Standard Hook-up diagram of instrument."

17) Bidder shall provide erection hardware as per installation drawings.

18) Bidder to provide mandatory spares as per mandatory spares list attached elsewhere in specification.

19) Bidder to perform tests of C&I items/instruments/systems as per Quality plans/type test attached in the specification.

20) All local gauges, transmitters and switches shall be mounted on suitable enclosures, racks subject to owner's approval. All transmitters shall be HART compatible.

21) All weather canopy is to be provided for instruments in open to protect the instrument/electronics from rain/ sunlight etc.

22) All field instruments enclosure shall be IP65 local panel/cabinet enclosure shall be IP 55, unless otherwise specified.

23) Diaphragm seal shall be provided with Instruments having contact with corrosive media.

24) Analysers such as Sodium Analyser and Silica Analyser, etc if applicable, shall be Multi Channel Type.

25) Bidder to delegate /depute their persons/experts as per BHEL/owner/consultants' requirement without any additional cost at site during commissioning.

26) Bidder must offer general tools and tackles and special calibration instruments required during start-up, trial run, operation and maintenance of the system.

27) The above given scope is indicative & minimum. Any item/ equipment not indicated above however required for the completeness of the system is to be supplied by bidder without any technical, commercial and delivery implication to BHEL.

28) Any part/module of the C&I system which are not listed under recommended spares shall be deemed as having life expectancy not less than the expected life of the plant i.e. 30 years.

29) Instrument ranges shall be selected to have the normal reading, preferably between 50% and 70% of full scale for linear parameters and 70% to 80% for flow measurements. Deviation indicators shall have the null position at mid-scale. The normal operating parameter shall be identified with a clear green mark.

30) Important signals to be identified during detailed engineering and same shall be hardwired to DM plant control room.

31) Bidder's presence is required for 3 Man days (Excluding travel time) at EDN Bangalore during FAT of DDCMIS for certifying correctness & completeness of implementation of Control logic. Intimation to attained

FAT shall be informed in 2 days' advance. All the expenses like boarding, lodging and travel, Air fare etc. shall be in bidder's scope.

32) The above given scope is indicative & minimum. Any item/ equipment not indicated above however required for the completeness of the system is to be supplied by bidder without any technical, commercial and delivery implication to BHEL.