THE WEST BENGAL POWER DEVELOPMENT CORPORATION LIMITED

1 X 660 MW SAGARDIGHI TPS UNIT NO. 5 PHASE -III

TECHNICAL SPECIFICATION
FOR
CONDENSATE POLISHING UNIT

TECH. SPECIFICATION NO.: PE-TS-445-155-A001 REV. 01

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

	TITLE: **1 X 660 MW SAGARDIGHI TPS UNIT NO. 5 PHASE III**	SPECIFICATION NO. PE-TS-445-155A-A001	
		SECTION :	
	TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT	**SUB-SECTION:**	
		REV. NO. 01	DATE : 13.07.2021

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PROJECT SYNOPSIS AND GENERAL INFORMATION

1.00.00 INTRODUCTION

The West Bengal Power Development Corporation Limited (WBPDCL) proposes to extend their on-going Phase-II extension project of 2x500 MW at Sagardighi by adding one super critical unit of 660 MW as Phase-III extension unit. Sagardighi TPS is located in the village Manigram in Murshidabad district of West Bengal, India. The West Bengal Power Development Corporation Limited, a Company fully owned by the Government of West Bengal formed in the year 1985, have commissioned 2x300 MW Thermal Power Plant together with all other infrastructure at Sagardighi Thermal Power Project. Presently WBPDCL is also working on their under-construction Phase- II extension project of 2x500 MW at Sagardighi.

The Bidder shall acquaint himself, by visiting the site, with the conditions prevailing at site. The information given here in under is for general guidance only.

2.00.00 APPROACH TO SITE

Sagardighi Super Thermal Power Station site is located at Manigram village, 13 KM north of Sagardighi town by the side of the SMGR (Sagardighi-Manigram-Gankar-Raghunathganj) Road at a distance 20 KM from National Highway 34 in Murshidabad District, West Bengal and around 240 KM from Kolkata, India. The nearest rail station is Manigram adjacent to the site on Bandel - Barhawara branch line and 6.5 KM from Sagardighi Railway Station on Sainthia - Azimgunj line of Eastern Railway. From Sagardighi railway station a railway line will branch off to the site for material unloading and coal marshalling. The equipment will be normally transported by rail only and under exceptional cases by road. The material consignments shall be as per the restrictions of rail and road transportation prevailing in the country.

Nearest Airport – Kolkata.

Nearest Seaport –Haldia.

3.00.00 LAND

The total land available for the Power Station and Plant auxiliaries will be generally as per the Site Location Plan (12A05-DWG-M-002) enclosed and flexibility will remain to make the final equipment layout based on equipment sizes.

All construction material, heavy equipment, over dimensioned consignments (ODC) for the station during construction may be transported through road/rail access. During operation stage, coal would be transported through rail access.

The total land, approximately 706 hectares, has already been acquired for the present and proposed extension. The locations of various facilities and plant auxiliaries for Unit 1 & 2 under Phase-I and Units 3 & 4 in Phase-II and the space provision for extension unit no. 5 (660 MW) will be as per the General Layout enclosed. About 456 acre of land has been kept for disposal of ash. The Bidder shall accommodate equipment offered under this specification generally within the spaces allocated for such equipment in the General Layout. Specific approval from Owner/Consultant shall be taken by the contractor prior to any revision or relocation.

Except where stated otherwise, the plinth levels of all buildings shall be 300 mm above the corresponding developed grade level and the road level shall be 150 mm above the developed grade.

4.00.00 SOURCE OF COAL

The Power plant shall receive coal from ECL mines. Coal is planned to be transported in rake loads through the existing Pakur- Tildanga-Dhulian-Monigram broad gauge line or through Pakur- Nalhati (proposed)–Takipara-Gosaingram-Poradanga-Monigram broad gauge line. The coal would be carried in rake loads of BOBR/BOX-N wagons.

It is considered that coal would be received from the same source as the plant under Phase-I and Phase-II station with similar characteristics and a new mine at Pachwara (north) in Jharkhand being developed by WBPDCL. These sources being connected by B.G. rail track, coal would be transported by rail only. For coal unloading, crushing and storage facility it is proposed that a new Wagon tippler along with crusher houses, conveyors will be installed in addition to existing coal handling plant of Phase-II station with suitable extension from the end of Transfer Point (TP-19).

5.00.00 SOURCE OF WATER

The source of water for this project is the River Bhagirathi (5 km) through the proposed intake pump house under implementation for Phase-II station. The water from the River Bhagirathi will be transferred and stored in the five (5) nos. Plant Raw Water Reservoirs by augmentation of the Intake water transportation system for phase - II for meeting the requirement of Phase-III Sagardighi TPS.

The Power station will operate on semi open recirculating condenser cooling system using cooling towers. In addition all water conservation and recycling measures will be adopted to minimize requirement of make up water. The proposed project will adopt zero effluent discharge philosophy.

6.00.00 ASH DISPOSAL AREA

Bottom Ash (BA) shall be extraction in wet form and conveyed to the disposal area in lean slurry form. Whereas Fly Ash (FA) shall be extracted in dry form and stored in dry form for onward usage. However, arrangement shall be also

made to dispose fly ash in lean slurry form to ash dump yard located within 1 km from Plant boundary under exigency..

7.00.00 DETAILS OF EXISTING FACILITIES OF PHASE-II

INTRODUCTION

The proposed phase-III, Unit No. 5 is an extension project with many auxiliary systems being common and shared with the Phase-II units (Unit Nos. 3 & 4). It is not the intent to describe all systems in details. Facilities being shared by both Phase-II & Phase-III units and which have a common terminating and control philosophy are outlined below:

MAIN & AUXILIARY COOLING WATER SYSTEMS & ACCESSORIES

Condenser cooling water and auxiliary cooling water system of Phase-III will be independent of Phase-II. Separate pump house and pumping system shall be installed for Phase-III. Only CT make-up system of Phase-II will be shared for Phase-III. However, DMCW system of boiler of Phase-II has excess capacity, which can be utilized for phase-III. The detail of excess cooling water capacity is furnished below:

Provision kept of miscellaneous BOP coolers in DMCW (SG) pump capacity of Phase-II:

i) AHP compressor coolers – 2X300 = 600 m^3/hr (for 2X500 MW units)
ii) MRS compressor coolers - 2X30 = 60 m^3/hr (for 2X500 MW units)
iii) Plant air compressor coolers - 2X175 = 350 m^3/hr (for 2X500 MW units)

Cooling water consumption for miscellaneous BOP coolers (both working and standby) of Phase-II:

i) AHP compressor coolers 158 m^3/hr (for 2X500 MW units)
ii) Fluid Coupling of Ash slurry pumps = 40 m^3/hr (for 2X500 MW units)
iii) BA overflow pumps = 30 m^3/hr (for 2X500 MW units)
iv) MRS compressor coolers - 30 m^3/hr (for 2X500 MW units)
v) Plant air compressor coolers - = 185 m^3/hr (for 2X500 MW units)

The following excess capacity of DMCW(SG) system of Phase-II is available, which can be shared by miscellaneous BOP coolers of Phase-III (except BAOF pump and vacuum pumps), by suitable extension of existing supply and return header of Phase-II :

i) AHP system coolers- 372 m^3/hr
ii) MRS compressor coolers - 30 m^3/hr
iii) Plant air compressor coolers - = 165 m^3/hr

Bidder to check and confirm that excess available capacity of DMCW (SG) system of Phase-II would be adequate for satisfactory operation of the above mentioned BOP systems of Phase-III. With this consideration, the capacity of DMCW (SG) can be optimized for Phase-III.

Condensate Storage Tanks & Transfer System:

In addition to two (2) nos. installed Condensate storage tanks of Phase-II, One (1) no. similar capacity Condensate storage tank (CST) of capacity 750 m^3 shall be installed for Phase-III.

Inside CST pumps, the following horizontal centrifugal pumps are installed for Phase-II:

a) Three (3) nos. (2W+1S) cycle make-up (DMSW)pumps of capacity 120 m^3/hr and TDH 50.0 MWC at rated capacity

b) Two (2) nos. (1W+1S) boiler fill(SG Fill) pumps of capacity 190 m^3/hr and TDH 140.0 MWC at rated capacity

c) Two (2) nos. (1W+1S) CPU Regeneration pumps

In addition to these, installed pumps, the CST pump house have the provision for the following pumps of Phase-III:

a) One (1) no cycle make-up pump

b) One (1) no boiler fill pump (though no additional pump is considered for Phase-II, as the capacity of boiler fill pumps of Phase-II is envisaged to be sufficient for requirement of Phase-III).

c) Two (2) nos. (1W+1S) CPU Regeneration pumps

The proposed pumps of Phase-III shall be selected and interconnected such that the aggregate pumping capacity of Phase-II & III can be shared by all the units of both Phase-II & III.

WATER & WASTEWATER TREATMENT SYSTEMS

Pre-Treatment System-.

A Pre-Treatment Plant for Phase-II (Unit Nos. 3 & 4) have been envisaged which shall cater the requirement for Phase-III (Unit 5). As per the WBD developed for 3,4 & 5 the total clarified water requirement works out as 4789 m^3/hr. therefore the requirement of construction of additional PT Plant is not called for. However the detail of the Pre-Treatment System is given below.

Raw water will be taken through a flow control station to Aerator where raw water will be aerated and then led to Stilling Chamber where its turbulence will be broken.

To inhibit incidental growth of organic matters in raw water, pre chlorination of raw water in Stilling Chamber shall be carried out by use of gaseous chlorine.

Water will then flow to three (3) nos. Distribution Chambers through three (3) nos. Parshall Flumes. From Distribution Chambers, water would be directed to three (3) nos. proposed High Rate Solids Contact Clarifiers. Chemicals such as Ferric Chloride, Lime solution & Polyelectrolyte will be added at the inlet of each of the High Rate Solids Contact Clarifiers.

Clarified water from Clarifiers will flow through channel and be stored in a Clarified Water Reservoir for further use.

The sludge generated from Clarifiers as addressed above will be collected in a common Sludge Sump. Sludge will be pumped from Sludge Sump by means of three (3) nos. Sludge transfer Pumps to the Effluent Treatment Plant. An arrangement for sludge recirculation to Clarifiers shall be provided to aid flocculation in case of low turbidity in raw water.

All chemicals required for the entire plant will be stored in the ground floor of a two-storied Chemical House. Chemicals will be unloaded from the trucks and thereafter be stacked in the respective storage space at ground floor by means of an Electrically Operated Monorail Hoist. However, preparation of chemical solution of Ferric Chloride, lime and polyelectrolyte for injection to raw water shall be carried out in the first floor of the Chemical House. Chemicals will be lifted from ground floor to first floor by means of another Electrically Operated Monorail Hoist. The water required for preparation of solutions is supplied from Overhead Clarified Water Tank to be located above Chemical House or directly from the Service Water Line.

The Chlorination System will be complete with Electrically Operated Monorail Hoist, Chlorine Ton Containers, Booster Pumps, Strainers, Pipe Works and Diffuser Systems up to points of injection, Emergency Chlorine Leak Absorption System and all other necessary accessories and auxiliaries.

The Chlorinators will be connected with Chlorine Ton Containers. The water to the Booster Pumps will be supplied from Overhead Clarified Water Tank located above Chemical House. All the necessary equipment (Chlorinators, Chlorine Ton Containers, etc.) will be located indoor at ground floor of the Chemical House as addressed above.

The water to the booster pumps will be supplied from Overhead Clarified Water Tank.

De-mineralization System

A De-mineralization Plant for Phase-II (Unit Nos. 3 & 4) have been envisaged which shall cater the requirement for Phase-III (Unit 5), considering 500 MW sub-critical unit. In view that Unit #5 is now rated to 660 MW super-critical technology, the requirement of DM water has been reduced as evident from attached WBD. Therefore the requirement of construction of additional DM Plant is not called for. However the detail of the De-mineralization System is given below.

Clarified Water will be pumped from Clarified Water Reservoir (located in Raw Water Treatment Plant area) by three (3) nos. DMF Feed Pumps to UF-RO-MB Exchanger Plant.

Clarified Water will enter the Dual Media Filters and suspended solids present in it will be removed.

From the Dual Media Filters, water shall flow to UF Modules through Pre-Filter. The UF Modules shall be backwashed automatically as per the requirement. Permeate from UF Modules shall be stored in 'UF Permeate Water Storage Tank' for further treatment by Reverse Osmosis. Reject from UF Modules shall be collected to Backwash Collection Pit and feed to the Waste Water Treatment System.

Ultrafiltered water from UF Permeate Storage Tank shall be pumped to Cartridge Filter for further filtration, prior to RO Modules.

Required quantity of antiscalant shall be dosed before Cartridge Filters in order to reduce scale formation tendency of feed water on the surface of the RO Membranes. Sodium Bi Sulphite shall be dosed to de-chlorinate the water and acid shall be dosed to maintain the pH.

After Dosing, filtered Water from Cartridge Filter shall be passed through RO High Pressure Pump to deliver water at desired pressure to the inlet on RO Modules.

The entire RO System shall be designed to achieve minimum 85% recovery. Permeate shall be passed through Degasser Tower to reduce the dissolved CO2 content in the water. Water from Degasser Towers shall be collected to the Degassed Water Storage Tank.

Degassified RO Permeate, finally be pumped to MB Exchanger for further reduction of TDS, to get desired quality of Water.

For chemical cleaning of UF System, One (1) no..UF Cleaning Solution tank, two (2) nos. UF Cleaning Chemical Pumps and one (1) no. 5 micron cartridge filter along with necessary piping and instrumentation as addressed in the P&I Diagram shall be provided.

A full-fledged chemical cleaning system comprising One (1) no. chemical cleaning tank, one (1) no. chemical solution circulating pumps and one (1) no. 5 micron cartridge filter along with necessary piping and instrumentation as addressed in the P&I Diagram shall be provided for RO Skid.

The entire UF-RO-MB Exchanger System along with Chemical Dosing / Cleaning Systems shall be located indoor within DM Plant Building.

EFFLUENT TREATMENT SYSTEM

An Effluent Treatment Plant is already under construction for the Treatment of liquid waste to be generated from Unit# 3, 4 & 5. The wastewater streams from different sources of the Power Plant will be collected, treated and then reused to the maximum extent possible within the Plant. Various waste waters are to be handled and treated for reuse.

However few items have been envisaged for Phase-III (Unit 5) which is described below.

One (1) no. Retention pit and two (2) nos. transfer pumps for service oily waste from Power House Area which will pump the effluent from Power House Area to the existing Waste water Treatment Plant.

One (1) no. Retention pit and two (2) nos. transfer pumps oily effluent from Transformer Yard area which will pump the effluent from Transformer Yard area to the existing Waste water Treatment Plant.

COAL HANDLING SYSTEM

The Existing Coal Handling Plant has been designed to cater the requirement for Phase-II & III stations together. One (1) track hopper for Phase-I, one (1) additional track hopper (Capacity: 5100T) and one (1) wagon tippler (Rated capacity 20 Tips/Hour and Design capacity 25 tips/Hour) along with one (1) side arm charger (Rated / Design capacity 29 Loaded wagons of 140 T) in Phase-II are provided. These are adequate for Phase-III extension unit#5 also. Further two (2) nos. of stacker-cum-reclaimers having 2000 / 2200 TPH rated / design capacity for Phase-II station are adequate for both Phase- II & III units. In the existing crushers, coal would be sized to (-) 20 mm. Crushed coal would thereafter be led either to the boiler bunkers or to the stack yard. In the main route, coal will be directly taken to the powerhouse via TP # 19. Existing four (4) nos. in-line magnetic separators, two (2) nos. metal detectors, two (2) nos. suspended magnets, four (4) nos. belt weighers, two (2) nos. coal sampling units will be commonly used for phase-II & phase-III units.

New set of 2000 / 2200 TPH rated / designed capacity twin stream conveyors as per the same for existing CHP would be installed under Phase-III beyond Transfer Point 19 of unit #4 upto unit #5 bunkers.

New set of 1650 / 1500 TPH, 1200 / 1320 TPH (rated / designed) capacity twin stream conveyors considered from New Wagon Tippler to TP-20. This conveyor stream will also feed to conveyor 22A & 22B for Stacking on the Existing Stock Pile.

Existing system facilities to be commonly used for Phase-II & III and new dedicated system facilities for Phase-III

The major equipment for the coal handling plant installed for Phase-II & shall serve Phase III also is listed below :-

1. a) Track Hopper	:	5100T with paddle feeders to twin stream conveyors
b) Wagon Tippler	:	One (1) no (Rated capacity 20 Tips/ Hr and Design capacity 25 ips / hr.).
c) Side Arm Charger	:	One (1) no
2. Conveyors	:	Twin stream conveyor line of 2000 / 2200 TPH rated / design capacity.
3. Crushers	:	**Type:** Ring granulator. **Number:** Four (4) (2 working + 2 standby) **Capacity:** 1200 TPH (Rated) / 1320 TPH (Design) **Input coal size:** (-) 300 mm **Output coal size:** (-) 20 mm
4. Vibrating Screen	:	**Type:** Roller screen type. **Number:** Four (4) (2 working + 2 standby) **Capacity:** 1200 TPH (Rated) / 1320 TPH (Design)
5. Paddle Feeder	:	Capacity 1200 TPH rated / 1320 TPH design x 2 in each stream of conveyors.
6. Stacker-cum-reclaimer	:	**Type:** Hydraulic motor-driven rail-mounted unidirectional having slewing and adequate lifting arrangement. **Stacking Capacity:** 2000 TPH (Rated) / 2200 TPH (Design) **Reclaiming Capacity:** 2000 TPH (Avg.) / 2200 TPH (Peak)

Quantity: Two (2)
Coal size: (-) 20 mm

7. Apron feeder : 2000 / 2200 TPH rated / design capacity

ASH HANDLING SYSTEM

BAHP Water System

Six (6) nos. (4W+2S) BAHP water pumps (Make- Flowmore& Model - 5822 (HS) / 350 X 300) with drive, each of capacity 1000 CMH and discharge pressure of 70 MWC, are already installed in existing ash water sump & pump house (common for Phase-II & III). Space for two (2) nos. BAHP water pumps (one shall cater the HP water requirement of bottom ash system and the other for wet fly ash system) with drive for Unit#5, had been kept in the existing ash water sump & pump house.

For details and disposition of existing equipments of Phase-II and space provision for proposed equipment of phase-III, please refer layout of ash water sump & pump house (Dwg. No I-5034-M-GA-002).

BALP Water System

Three (3) nos. (2W+1S) BALP water pumps (Make – Flowmore & Model - 5821A / 300 X 250) with drive, each of capacity 757 CMH and discharge pressure of 25 MWC, are already installed in existing ash water sump & pump house. Space for one (1) no BALP water pump with drive for Unit#5, had been kept in the existing ash water sump & pump house.

For details and disposition of existing equipments of Phase-II and space provision for proposed equipment of phase-III, please refer layout of ash water sump & pump house (Dwg No I-5034-M-GA-002).

Eco Water System

Three (3) nos. (2W+1S) Eco water pumps (Make – Flowmore & Model - F5824A / 100 X 75) with drive, each of capacity 48 CMH and discharge pressure of 45 MWC, are already installed in existing Boiler area for Phase-II i.e. Unit #3 & #4. Space for one (1) no eco water pump for Unit # 5, had been kept in the existing Boiler area (Phase-II).

Ash Conditioning Water System

Two (2) nos. (1W+1S) ash conditioning water pumps (Make – Flowmore & Model - F5824 / 100 X 75) with drive, each of capacity 106 CMH and discharge pressure of 50 MWC, are already installed in existing silo utility building. Space for one (1) no ash conditioning water pump for the proposed silo of Unit#5, had been kept in the existing silo utility building.

For details and disposition of existing equipment of Phase-II and space provision for proposed equipment of phase-III, please refer layout of silo utility building (Dwg No I-5034-M-BE-016).

Seal Water System

Two (2) nos. (1W+1S) seal water pumps (Make – Flowmore & Model - M5972 / 150 X 100) with drive, are already installed in existing ash slurry pump house for Phase-II i.e. Unit #3 & #4. Space for Two (2) nos. (1W+1S) seal water pumps for Unit # 5, had been kept in the existing ash slurry pump house.

Civil foundations for the proposed pumps have already been constructed in the existing slurry pump house. The base plate of the proposed pumps shall be matched with the foundation.

For details and disposition of existing equipment of Phase-II and space provision for proposed equipment of phase-III, please refer layout of ash slurry sump & pump house (Dwg No I-5034-M-GA-001).

Ash Slurry Disposal System

Four (4) nos. (2W+2S) ash slurry pump (Make – Indure & Model - A-918-401) chain (each slurry pump chain consists of 2 nos. pumps in series and there is space provision for future series pump also) with drive, each of capacity 1270 CMH, are already installed in existing ash slurry sump & pump house for Phase-II i.e. Unit #3 & #4. Space for one (1) no ash slurry pump chain for Unit # 5, had been kept in the existing ash slurry sump & pump house.

Civil foundations for the proposed pumps have already been constructed in the existing slurry pump house. The base plate of the proposed pumps shall be matched with the foundation.

For details and disposition of existing equipments of Phase-II and space provision for proposed equipment of phase-III, please refer layout of ash slurry sump & pump house (Dwg No I-5034-M-GA-001).

Silo

Three (3) nos silos, each of capacity 2400 Tons, are already installed in existing silo area for Phase-II i.e. Unit #3 & #4. Space for one (1) no silo for Unit # 5, had been kept in the existing silo area.

For details and disposition of existing silos of Phase-II and space provision for proposed silo of phase-III, please refer layout of ash compressor house (Dwg No I-5034-M-GA-015).

Silo Fluidizing Air System

Five (5) nos. (3W+2S) water cooled silo aeration blowers (Make - Swam & Model - RH-250 WC) with drive and heater, each of capacity 1860 CMH and discharge pressure of 10 MWC, are already installed in existing silo utility building for Phase-II i.e. Unit #3 & #4. Space for one (1) no silo aeration blower and heater for Unit # 5, had been kept in the existing silo utility building.

For details and disposition of existing equipment of Phase-II and space provision for proposed equipment of phase-III, please refer layout of silo utility building (Dwg No I-5034-M-BE-016).

Instrument Air System

Four (4) nos. (2W+2S) oil free, water cooled screw compressor (Make - Atlas Copco & Model ZR 110) with drive and heat of compression (HOC) dryer (Make - Atlas Copco), each of capacity 900 CMH (FAD) and discharge pressure of 8 Kg/cm2 (g), are already installed in existing ash compressor house for Phase-II i.e. Unit #3 & #4. Space for one (1) no instrument air compressor & HOC dryer for Unit # 5, had been kept in the existing ash compressor building.

For details and disposition of existing equipment of Phase-II and space provision for proposed equipment of phase-III, please refer layout of ash compressor house (Dwg No I-5034-M-GA-018).

Recycle Water System

Space for two (2) nos. (1W+1S) recycle water pump with drive for phase-III, had been kept in the existing ash clarifier area.

Space for one (1) no ash slurry disposal pipe (450 NB x 9.52 MM Thk.) for Unit # 5, had been kept in the existing slurry piping corridor of Phase-II. Please refer Dwg No I-5034-M-BE-015 & I-5034-M-BE-025 for layout of existing ash slurry disposal piping & ash dyke.

MILL REJECT SYSTEM (COMPRESSED AIR SYSTEM)

Two (2) nos. (1W+1S) oil free, water cooled screw compressor (Make - ELGI and Model No. - EG110 - 5.5 WC) with drive, each of capacity 20 m3/min (FAD) and discharge pressure of 5.0 Bar (g), are already installed in existing Plant Compressor House (Common for Phase-II & III) for Phase-II i.e. Unit #3 & #4. Space for one (1) no conveying air compressor for Unit # 5, had been kept in the existing plant compressor building.

Civil foundation for the proposed MRS Compressor has already been constructed in the existing plant compressor house. The base plate of the proposed compressor shall be matched with the foundation.

For details and disposition of existing equipments of Phase-II and space provision for proposed equipment of phase-III, please refer layout compressor house (Dwg. No.PE-V0-373-160-505).

Cooling water requirements for conveying air compressor shall be met from existing DMCCW system. The supply and return lines shall be connected at the tie in points from the existing DMCCW system.

PLANT COMPRESSED AIR SYSTEM

Plant air compressor house will be common for Phase-II & III. Instrument air and service air compressors, dryer, receivers and interconnecting piping system for phase-II are installed in the compressor house. Provision of one (1) no. Instrument air Compressor and one (1) no. Service air Compressor, with dryer, receivers and interconnecting piping system are kept in the compressor house for Phase-III. The brief details of existing facilities of Phase-II are indicated below:

a) Instrument Air Compressors- Three (3) nos. (2W+1S) Motor driven oil free screw compressors with air dryer, each of capacity 36 Nm^3/min (FAD-46.53 m^3/min) and discharge pressure of 8.0 kg/cm^2(g)at after cooler outlet at rated capacity.

b) Service Air Compressors- Two (2) nos. (2W+0S) Motor driven oil free screw compressors with air dryer, each of capacity 36 Nm^3/min (FAD-46.53 m^3/min) and discharge pressure of 8.0 kg/cm^2(g)at after cooler outlet at rated capacity.

c) Air Receivers- Five (5) nos., each of capacity 10m^3.

For details and disposition of existing equipment of Phase-II and space provision for proposed equipment of phase-III, please refer P&ID & layout Compressor house of Phase-II (Dwg. no. PE-V0-373-555-A002 & PE-V0-373-555-A001 respectively).

The proposed compressors of Phase-III shall be selected and interconnected such that the aggregate compressed air capacity of Phase-II & III can be shared by all the units of both Phase-II & III.

FIRE PROTECTION SYSTEM

Two (02) nos. inter-connections with isolation valves for hydrant system and Two (02) nos. inter-connections with isolation valves for spray system shall be considered at site for proposed integration with the hydrant and spray network of Phase-III with Phase – II. Please refer Composite piping layout of hydrant and spray network of Phase-II (Dwg. no. PE-V0-373-522-A0013) for locations of inter connection points.

LP PIPING (PIPE RACK)

Existing pipe rack of Phase-II shall be utilized to carry pipe lines from new pumps/ compressors of Phase-III to be installed in existing pump/compressors

houses of Phase-II. Suitable augmentation/ modification/strengthening of existing pipe racks of Phase-II shall carried out by the bidder.

FUEL OIL HANDLING SYSTEM

No further extension of unloading and storage capacity is envisaged for installed fuel oil handling system, which is sufficient for requirement of Phase-I, II& III units.

Pressurizing pumps will supply oil from the HFO/LDO storage tanks to the burner. Three (3) nos.HFO (2 W+ 1S) & two (2) nos. LDO (1W +1S) pressurizing pumps (each having capacity equivalent of 2X500 MW units) are installed under Phase-II system.

There is provision for one additional HFO pressuring pump along with HFO Heater to be installed in pressurizing pump house to cater the requirement of Phase-III. Installed LDO forwarding pumps of Phase-II can also cater requirement of Phase-III. HFO & LDO Pressurizing pump discharge lines, which has been extended up to Unit #4 of Phase-II, shall be further extended by bidder to feed Phase-III.

HFO supply and return lines to and from boiler of phase-III to be extended from existing HFO supply and return header respectively (terminated with isolation valve) of Phase-II. Similarly, LDO supply line to boiler of phase-III to be extended from existing LDO supply header (terminated with isolation valve) of phase-II.

The proposed HFO pressurizing pump with heater of Phase-III shall be of identical capacity with the existing equipment to utilize existing equipment foundations at site.

ELECTRICAL EQUIPMENT & ACCESSORIES

Necessary power supply for Phase-III Fuel oil pump will be arranged from existing FO Switchboard. Accordingly existing FO switchboard shall be modified as specified elsewhere.

If the new equipment of Phase-III 400kV air insulated switchyard can be accommodated in the existing switchyard control building, same needs to be modified if required.

For further details regarding the existing facilities of Phase – II, please refer Volume – II F1 and F2: Technical Specifications for Electrical Equipment and accessories.

CONTROL & INSTRUMENTATION

The following are the existing Stage-II facilities which shall be used for Unit #5 C&I works.

	System	Existing Facilities to be used
a)	Fuel Oil Pressurizing & Heating System	Existing spare I/O cards and spare I/O slots of Unit #3 & Unit #4 DCS [Stage-II] shall be used for augmentation of the new Fuel Oil Pressurizing & Heating System of Unit#5 of Stage-III. Relevant control shall be implemented in the existing DCS processors.
b)	Compressed Air System	New Instrument Air Compressor and Service Air Compressor shall share the existing serial network of Compressors of Unit#3 & Unit#4 DCS [Stage-II] for DCS soft communication. The new Instrument Air Compressor shall also be interfaced with the existing electronic sequencer module (ES-6) provided for the existing Instrument Air compressors of Unit#3 & Unit#4 DCS [Stage-II] for group interlocks.
c)	Mill Reject Handling System	The control shall be implemented in the existing MRHS PLC of Unit#3 & Unit#4 [Stage-II], located in the existing CPU regeneration Area control room. The new MRH System shall use the existing processor of the PLC. New IO panel for additional IO cards for the new system shall be installed in the assigned location of the existing control room for Future IO Panel. The UPS for the new MRH system PLC IO Panel shall be derived from the existing UPS ACDB located in the existing CPU Regeneration Building Control Room (Stage-II).
d)	Ash Handling System	The operation and control of new Unit#5 AHP facilities shall be through the existing PLC of Stage-II (located in the Compressor House Control room). Existing PLC processor (PLC-1), shall cater to the control of the common systems including Ash Water & Ash Slurry System, Fly Ash Unloading System, Instrument Air System & various sump draining systems. Additional IO panels shall be installed in the locations assigned for future IO panels in the Compressor House Control Room, Ash Water Pump House RIO Room and Silo Utility Building RIO Room of Stage-II units.

		One new redundant processor shall be installed in the existing Processor Panel located in the Compressor House Control room to cater the new Unit#5 Bottom Ash & Fly Ash Evacuation System. Extended RIO of the new processor shall be procured for the Unit#5 systems. For new PLC CPU/ IO at existing (Stage-II) Compressor House Control Room, existing UPS system in the Existing [Stage-II] Compressor House Control Room shall be considered. New Energy Meter, Numerical Relays, Air Compressor etc. shall share the existing serial network for interface with existing PLC for Unit#3 & Unit#4 [Stage-II].
e)	Coal Handling System	Spare IOs cards at Remote IO Unit of existing Stage-II CHP PLC near TP-17 of Stage-II shall be used for the augmentation of new CHP system of Unit#5 (Stage-III). The control shall be implemented in the existing PLC processor. However, for Wagon Tippler & Crusher separate new PLC based system with connectivity with existing PLC at HMI network level shall be envisaged. Existing “3D Level Mapping Software” loaded in the CHP PLC for Unit#3 & #4 of Stage-II shall be used for the new Unit#5 Bunker Level indication System. The existing Fiber Optic network for CHP PLC interface with Bunker Level indication System of Stage-II shall also be used by the new Bunker Level indication System for CHP PLC interface.
f)	GPS Master Clock System	All the microprocessor based control systems like DCS, PLC based systems, CCTV, TSI & Rotating machine condition monitoring system etc of unit#5 shall be time synchronized with the Existing GPS Master clock of Phase-II.
g)	Fire Alarm System	Existing Fire Alarm Panel at Fire Station of phase II shall be used to display parameters / Alarms of new Fire Alarm System of unit#5. Main FAP of unit#5 shall be connected to the phase II FAP located at existing fire station.

CIVIL, STRUCTURAL AND ARCHITECTURAL WORK (BUILDINGS CONSTRUCTED WITH SPACE FOR PHASE III)

Necessary Walkway connection between operating floors of Power House of Phase – II (Existing) and Phase – III shall be considered by Bidder.

Few civil foundations have already been constructed for future equipment. Such existing foundation details including bolts, inserts etc. to be studied in detail before procurement of specific equipment for respective purposes so that the same can safely be placed over the existing foundations complying all technical compatibility. In case this is not at all possible, new foundations need to be constructed after complete demolition of existing foundations.

For further details regarding the existing facilities of Phase – II, please refer Volume – II G1, G2 and G2: Technical Specifications for Civil, Structural and Architectural..

8.00.00 SALIENT DESIGN DATA

8.01.00 For implementation of the project, the Bidder shall consider the following Site and Meteorological data:-

a)	Location	:	Manigram village, Sagardighi, Raghunathganj sub-division, Murshidabad District, West Bengal.
b)	Latitude and Longitude	:	24^0 22’ 13.7” N, 88^0 6’ 15.8” E (Topo sheet No.78/D/3)
c)	Nearest Towns	:	Ajimganj, Jangipur, Raghunathganj.
d)	District Head Quarters	:	Berhampore - 40 km.
e)	Approach Road	:	20 km from National Highway (NH-34)
f)	Nearest Railhead	:	Manigram railway station on Bandel-Barhawara branch line 1 km from site.
g)	Source of Water	:	Bhagirathi River - 5 km
h)	Source of Coal	:	Pachwara (North) mine block in Jharkhand.
i)	Fuel Transportation	:	By rail in rake loads of BOBR/BOX-N wagons.
j)	Surrounding Habitations	:	Villages - Manigram, Chhamugram, Karaia, Thakurpara on the south; Bhumhar, Khasittor, Ekrakhi on the west;

Dhalo, Bagpara, Santoshpur on the north and Harirampur, Chandparam, Dogachhi on the east.

k)	Level	:	Within 34.5 m contour. Land is above HFL (highest flood level) of the area.
l)	Soil	:	Less fertile alluvial soil.
m)	Land Use	:	Within existing plant boundary of WBPDCL.

Meteorological data of site is given below:

a)	Design ambient dry bulb temperature	:	50 ºC maximum 5 ºC minimum
b)	Highest wet bulb temp	:	26.9 ºC
c)	Maximum relative humidity	:	84%
d)	Average relative humidity	:	73%
e)	Average annual Rainfall	:	1389 mm
f)	Wind load	:	In accordance with IS-875 for a basic wind speed of 47 m/sec, up to a height of 10 metres above mean ground level.
g)	Seismic Zone	:	Zone III as per IS: 1893 latest edition.
h)	Altitude	:	34M above MSL

SECTION – I

SPECIFIC TECHNICAL REQUIREMENTS

SUB-SECTION – IA: Specific Technical Requirements (Mech.)
SUB-SECTION – IB: Specific Technical Requirements (Electrical)
SUB-SECTION – IC: Specific Technical Requirements (C&I)

SECTION – I

SUB-SECTION – IA: SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)

1.0 GENERAL

This specification is intended to cover design, engineering, manufacture, supply, fabrication, assembly, inspection/ testing at vendor's & sub-vendor's works, painting, maintenance/ special tools & tackles, mandatory spares alongwith spares for erection as required, startup and commissioning spares as required, forwarding, proper packing, shipment and delivery at site, unloading, handling, transportation & storage at site, in site transportation, assembly, erection & commissioning, final painting at site, trial run at site, preparation and submission of drawings/ documents including "As Built" drawings and O & M manuals, layout drawings in 2D & 3D (as applicable) and carrying out Performance Guarantee/ Functional/ Demonstration tests at site (as applicable) & equipment/ system guarantee/ aux. guaranteed power consumption etc. inclusive of all prevailing taxes, duties and other levies and handover in flawless condition of the package specified above for above mentioned project to the end customer complete with all accessories for the total scope defined as per BHEL NIT & tender technical specification no. **PE-TS-445-155A-A001** for condensate polishing unit package of **1 X 660 MW SAGARDIGHI TPS UNIT NO. 5 PH III.**

The Condensate Polishing Units (1 set) with external regeneration system (1 set) and associated accessories shall conform to the technical specification **(**PE-TS-445-155A-A001) for **CONDENSATE POLISHING UNIT** of **1 X 660 MW SAGARDIGHI TPS UNIT NO. 5 PH III.**

2.0 DESIGN CONDITIONS FOR CONDENSATE POLISHING UNIT

There shall be three service vessels (3 X 50%) for 660 MW unit each polishing 50% of the maximum condensate flow corresponding to VWO (valve wide open) condition at 1% make up (flow through each service vessel indicated in the data sheet).

There shall be one external regeneration facility shall be provided for this thermal power station. For regeneration, resin from the exhausted Condensate Polisher Mixed Beds will be transferred hydraulically to the external regeneration facility.

The DM water required for resin transfer, regeneration etc. shall be tapped off from condensate storage tank of unit.

CPU regeneration facility shall be located outside of TG hall (identified in enclosed plot plan, BHEL Doc. No. PE-DG-445-100-M001).

GENERAL DESIGN DATA TABLE FOR SERVICE VESSEL AREA		
S. No.	**Description**	**Parameter**
1.	Total Number of Vessels	Three (3 x 50%)
2.	CEP Discharge Pressure (Operating).	36.5 kg/cm^2(g)
3.	CEP Shut off head	47 kg/cm^2(g)
4.	Design Pressure of CPU	47 kg/cm^2(g) + 5% margin.
5.	Condensate Flow (flow at VWO condition at 1% make up)	1280.11 t/ hr.
6.	Condensate Flow (660 MW , 1% MU)	1204.19 t/ hr.
7.	Flow through each polisher vessel.(Design)	640.05 t/ hr.
8.	Condensate Temperature (Operating)	43.1 Deg. C
9.	Condensate Temperature (Process Design)	50 Deg. C
10.	Condensate Temperature (Mechanical Design)	60 Deg. C
11.	Service Run Cycle-Normal Run (Hrs)	240 hrs
12.	Service Run Cycle-Start up condition (Hrs)	48 hrs
13.	Service Run Cycle-Condenser Tube Leakage condition (Hrs)	48 hrs
14.	Average velocity of condensate through service vessels	≤ 105 m/ hour for spherical vessel and ≤ 120 m/ hour for cylindrical service vessels.

3.0 BRIEF DESCRIPTION OF THE SYSTEM

The proposed condensate plant shall treat the entire condensate of the turbine generator of unit of power station. The proposed schematic arrangement of the condensate polishing plant and its regeneration facility shall be as per the enclosed P&I Diagram. Arrangement of piping, valves and instruments shown in the P&ID are bare minimum. The bidder shall include the complete system including regeneration facility as elaborated in this specification meeting the contractual requirements.

The condensate polisher service vessels shall be located in the TG hall of corresponding units. The resins shall be transferred to and from the common regeneration facility by sluicing through a pipeline hydraulically.

The regeneration process offered by the bidder shall be of proven design and shall essentially be the same process by virtue of which the bidder is qualified and shall give resin-separation compatible with the desired effluent quality.

4.0 SCOPE OF SUPPLY (MECHANICAL)

Following are in bidder's scope of supply:

Broad scope of supply (mechanical) for this package is detailed below and as indicated in relevant portion of this specification.

A. SERVICE VESSEL FACILITY

1) Three service vessels (3 X 50%) for 660 MW unit, each polishing 50% of the condensate flow.

2) Each Condensate polisher vessels shall be complete with condensate inlet and outlet connections, connections for resin transfer to and from the vessels, bed support-cum-under drain system, inlet water distributors, air distribution arrangement for resin mixing, all fittings and appurtenances etc. as specified and as required.

3) One no. external resin traps at the condensate & rinse outlet of each of the condensate polisher mixed bed each designed for in-place manual back flushing facility. Total 3 nos. of external resin traps for one TG unit.

4) Condensate inlet and outlet headers for each installation with pipe connections to the condensate polisher vessels for 660 MW TG unit.

5) Resin transfer headers and pipe lines of stainless steel construction connecting the external regeneration facility to all the condensate polisher vessels of each installation (TG units) along with all necessary supports, anchors etc.

6) Rinse water outlet headers from condensate polisher vessels of each installation up to the condenser hot well of respective TG unit. Rinse water outlet headers from condensate-polisher vessels shall be provided with a pressure reducing valve and orifice plate, suitably designed to enable the water entry to the condenser hot well under all operating condition of condenser. The pressure reducing station shall consist of either a pressure reducing valve (reducing the pressure from design pressure of service vessel to condenser vacuum) or a combination of orifice plates to reduce pressure from design pressure of service vessel to 2 kg/ cm^2 and a pressure reducing valve from 2 kg/ cm^2 to condenser vacuum for each 660 MW TG unit.

7) All necessary valves and fittings for the installations with actuators necessary for their remote operation from CP System Control Panel of 660 MW Unit. These shall include suitable fool proof arrangement to prevent accidental over pressurization of the resin transfer pipeline and regeneration facilities connected to it, which are designed for pressure much lower than that of the Condensate Polisher Mixed Beds / Condensate Polisher Service vessels. It shall be PCV (Pressure Control Valve) with pressure controller and operable from DCS and also provided with safety relief mechanism and the same shall be in bidder's scope.

8) A common drain header for the condensate polisher service vessel of unit up to the condenser hot well for 660 MW TG unit. All necessary drains, vents and sampling points, with valves as specified and as required.

9) Gland sealing water piping for the Gland sealing valves in the rinse water line & other lines for 660 MW TG unit.

10) Sample cooling line piping for sample cooling for all analysers for TG units.

11) Two nos. (1W + 1S) per unit oil free type air blowers with electric motor drives for TG unit for supplying air required for mixing the resins in the service vessels. Each blower shall be complete with motor, V-belt drive with belt guard, inlet filter, silencer, flexible couplings and discharge snubber, acoustic hood, relief valve etc. all mounted on a single base. Total service vessel area blowers to be supplied for TG units shall be 2 nos. each of 100% capacity along with the accessories as detailed above shall be supplied by bidder.

12) Complete Instrumentation and Control for automatic operation.

13) Instruments racks & analyser racks for mounting pressure & flow transmitters, pressure switches, conductivity analysers & all other analysers etc. for each of condensate polisher mixed beds. Analysers and pressure transmitters shall be mounted in separate racks. The type of rack (Open or Closed type) shall be selected in line with requirement stipulated elsewhere in the specification. All analytical Instruments shall be located in a separate rack/ panel.

14) Emergency bypass between the condensate influent and effluent headers. Each Condensate polisher service unit shall be provided with an automatic bypass for the condensate polisher on the condensate inlet and outlet headers of the unit with a globe type control valve (of carbon steel construction), along with wafer type butterfly isolation valves (resilient material seated, to ensure bubble tight shut off) on the upstream and downstream side of the control valve. The control valve shall be of 1x100% configuration to achieve proper control under all operating conditions. Isolation valve shall be provided with geared operators for manual operation.

    Complete instrumentation and controls for this emergency by-pass system for TG unit. Further all tubing, wiring air sets and other fittings required to complete the system shall be provided for TG unit.

15) The plant shall include resins for first fill of resins for all condensate polisher mixed beds, Mixed resin storage vessel of TG units i.e. Four (04) complete charges of resin. Further to this, Resin for resin injection hoppers charge (150 litres for resin injection hopper) shall also be provided separately.

    Deration factor of 10% for all resins shall be considered while calculating the quantity of resin to be supplied.

    One resin charge shall be considered as resin required for one service vessel i.e. cation resin, anion resin and inert resin (if any) used for this project.

16) One no. specific conductivity analyser at condensate common inlet header, & one no. specific conductivity analyser at individual outlet of each Condensate Polishing Mixed Beds/ Condensate Polisher Service Vessels of TG unit.

17) One no. cation conductivity analyzer at condensate common outlet header of TG unit & one (1) no. cation conductivity analyzer at individual outlet of each Condensate Polishing Mixed Beds/ Condensate Polisher Service vessels of TG unit.

18) One no. multichannel (five channel) sodium analyser to measure the process value of each service vessel outlet & common condensate outlet header for TG unit.

19) One no. multichannel (five channel) silica analyser to measure the process value of each service vessel outlet & common condensate outlet header for TG unit.

20) Complete instrumentation and controls for this system, including the differential pressure transmitters, panel mounted indicating type controller with provision for remote manual operation, actuator for the control valve with positioner etc. All tubing, wiring, airsets, and other fittings, required to complete the system for TG unit.

21) All the piping, valves, fitting, accessories etc. used in service vessel area shall be 300# class (minimum) and this area shall be considered as high pressure side to complete the system for TG unit shall be in bidder's scope. Further rest shall be considered as low pressure side (regeneration area) and all piping, valves, fitting, accessories etc. used in regeneration area shall be of 150# class (minimum).

22) Minimum instrumentation required shall be as per P&ID included in this tender specification. Further to meet the redundancy criteria as specified in section IC, if any instrument, transmitter & analyzer required shall be included and provided by bidder without any price and delivery implication to BHEL & customer.

23) All butterfly valves MOC used in service vessel area in condensate line shall be (body: WCB Disc: CF8M/SS316) and condensate outlet line will be (Body & Disc both: CF8M/ SS316).

24) All instrument air distribution for SOV shall be through SS-316 manifold with SS-316 isolation and auto drain traps.

25) Solenoid valve shall be kept in pneumatic junction boxes only. Air distribution for SOV's shall be through -316 manifold and SS-316 isolation valves only and SS tubing from SOV to valve shall not be more than 6 meters.

26) Instrument and transmitter provided in Resin line, Resin slurry line (Resin with DM water) and DM waterline shall be of capillary diaphragm type only.

27) All non-stainless steel pipe colour coding shall be provided by bidder during detail engineering.

28) All nuts, bolts etc. in submerged and corrosive application shall be of SS-316.

5.0 REGENERATION SYSTEM

One no. external regeneration facility for regeneration of the resins from all condensate polisher vessels of TG unit shall be provided.

The CPU regeneration system will be located outside TG hall. Regeneration area shall be considered as low pressure area.

The acid and alkali unloading equipment for regeneration of condensate polishing resins shall preferably be mounted on skid. In order to facilitate smooth erection at site chemical dosing preparation equipment shall be mounted on structural steel skids and assembled (including piping) at the manufacturer's shop, to the maximum extent possible, prior to shipping. The number of mechanical connections shall be minimized by the use of pipe headers wherever possible. The bidder may also supply and install this equipment's independently instead of assembling the skids.

The acid and alkali dosing equipment for regeneration of condensate polishing resins shall preferably be mounted on skid and shall be in bidder's scope. All the equipment, piping etc. shall be assembled on two structural steel skids one for acid and one alkali dosing equipment.

Complete regeneration facility (1 set) with interconnection as mentioned below and as indicated in P&ID of CPU shall be in Bidder's scope. The Regeneration System shall consist of following below mentioned items:

1) One (1) no. Resin Separation Vessel complete with all accessories

2) One (1) no. Anion Resin Regeneration Vessel complete with all accessories

3) One (1) no. Cation Resin Regeneration Vessel / Mixed Resin Storage Vessel complete with all accessories.

4) All vessels must be complete with vents, drains, piping & valves for air scrubbing, back-washing & regeneration process etc.

5) All internals, fittings and appurtenances for these vessels (indicated under S. No. 1, 2 & 3 above).

6) One (1) no. common waste effluent header with resin trap in each waste effluent header designed for in place manual backwashing.

7) The vessels indicated above at S. No 1, 2 and 3 are tentative only. However, any other proven alternative scheme of external regeneration as per the standard practice of supplier of CPU System may also be adopted subject to suitability of the same in all respects for satisfactory operation and performance of Condensate Polisher Mixed Beds. However, design requirement shall be as per tender specification only.

8) Resin make up/ injection hopper complete with water ejector system for resin make up. Resin make up / injection hopper shall be sized to handle up to minimum 150 liters of as received new resins per single injection or maximum attrition loss whichever is higher.

9) Two (2) nos. (1W+1S) oil free type air blowers with electric motor drives, for supplying the process air required for

regeneration of resins. Each blower shall be complete with motor, V-belt drive with belt guard, inlet filter, silencer, flexible couplings and discharge snubber, acoustic hood, relief valve, anti-vibration pads etc.as required and shall be mounted on a single base.

10) Two (2) nos. CPU Regeneration cum Resin Transfer Pumps (located in CST pump house) each with electric drive motor drives, one normally operating and the other standby, supplying water for chemical preparation / dosing, dilution and transfer of resin from service vessel to regeneration vessels & vice-versa, backwash & rinse activities shall be provided. These CPU Regeneration cum Resin Transfer Pumps will take suction from condensate storage tanks (Condensate Storage Tanks are not in bidder's scope).

11) One (1) no. resin trap at common discharge header line of CPU regeneration facility, designed for in-place manual backwash.

12) Two (2) numbers (2 X 100%) simplex hydraulically operated diaphragm type, positive displacement acid dosing pumps, each complete with electric motor drive, pulsation dampener & safety relief valve at the outlet header of each pump along with all other required accessories for acid dosing.

13) One (1) no. (1 X 100%) acid measuring tank for regeneration complete with fume absorbers, overflow seal pot, integral pipe works, valves, instrumentation and all other accessories required. Tank capacity shall be adequate to hold the acid required for one regeneration plus 20% margin.

14) One (1) no. activated carbon filter for alkali, complete with internals, integral pipe works, valves, instrumentation, manhole, hand hole etc. and all other accessories as required. One (1) no. Activated Carbon Filter for alkali rated flow of each filter shall not be less than the design capacity of the alkali unloading pump/ alkali transfer cum recirculation pump (as applicable), and the maximum velocity through each activate carbon filter for this flow shall not exceed 15 meters/ hour. Depth of the filter materials shall not be less than 1.2 meter in activated carbon filter.

15) One number carbon trap shall be provided at the outlet line of activated carbon filter (ACF). This carbon trap shall have screen opening of 60 mesh.

16) Two (02) numbers (2X100%) simplex hydraulically operated diaphragm type, positive displacement alkali dosing pumps for regeneration, each complete with electric motor drive, pulsation dampener & safety relief valve at the outlet header of each pump along with all other required accessories for alkali dosing.

17) One (1) no. (1X100%) alkali measuring cum preparation tank for regeneration complete with slow speed agitator driven by motor complete with carbon dioxide absorber, overflow seal pot, dissolving basket, integral pipe works, valves, instrumentation and all other accessories required. The tank capacity shall be equal to 120% of regeneration requirement of one regeneration of a service vessel.

18) One (1) no. (1 X 100%) hot water tank for heating of alkali diluent water for anion resins with (2 X 50%) electric heating coil, adequately insulated of carbon steel rubber lined construction (suitable for temp. of 70 deg. C) (8 mm in 6 layers) shall be provided complete with integral pipe works, valves, instrumentation and all other accessories required shall be provided. The tank shall be vertical cylindrical type with dished ends. The effective capacity of the hot water tank is suitable to meet the requirements for alkali injection and alkali displacement in course of single regeneration of a Condensate Polisher Mixed Bed, plus 20% margin. This tank shall be provided with burn out protection, pressure relief valve, level transmitter, level gauges, temperature indicator etc. The heaters shall be sized for heating the water from a temperature of 15 to 50 deg. C in 5 hours at the outlet of ejector.

19) Diluent water supply separately, for acid and alkali, each provided with an automatic on-off valve, a throttling valve for setting of flow, a local flow indicator with flow transmitter and a mixing tee where the chemicals get injected into the water stream.

20) 2 nos. concentration analyser for measuring density of diluted acid & alkali shall be provided, one (1) in acid dilution line and one (1) in alkali dilution line. This concentration analyser shall be provided in addition to mechanical density indicator in each line.

21) All the equipment, piping etc. shall be assembled on two structural steel skids one for acid and one for alkali dosing equipment. The bidder shall supply all anchor bolts, foundation plates, sleeves, nuts, inserts etc. to be embedded in concrete for these equipment skids. The length of the foundation bolts shall be liberally sized to reach below the reinforcement level. Each equipment skid shall be provided with suitable lighting lugs, eye bolts etc. to facilitate erection and maintenance.

22) One (1) no. hose Station for transfer of Hydrochloric Acid (30-33% HCl). The hose station shall consist of two (2) sets of rubber hoses each of size 80 mm/ NB @ 20 meter length, provided along with coupling & diaphragm type isolation valves.

23) Two (2) nos. (2X100%) Hydrochloric acid unloading/ transfer pumps each complete with electrical drive motor, necessary valves & instrumentation and all other accessories as required. These pumps shall take suction from the unloading tankers.

24) One (1) no. bulk acid storage tank complete with integral pipe works, valves, radar type level transmitters, level gauges, fume absorber cum overflow seal pot, instrumentation, manhole, ladder and platform and all other accessories required. Capacity of tank shall adequate to hold the quantity of commercial Acid (30-33% HCl) required for thirty (30) days of operation.

25) One (1) no. hose Station for Transfer of Alkali (48% NaOH). The hose station shall consist of two (2) sets of rubber hoses each of size 80 mm /NB @ 20 meter length, provided along with coupling & diaphragm type isolation valves.

26) Two (2) nos. Alkali unloading/ transfer pumps, each complete with electrical drive motor, necessary valves & instrumentation and all other accessories as required. These pumps shall take suction from the unloading tankers.

27) One (1) no. bulk alkali storage tank complete with integral pipe works, valves, ultrasonic type level transmitters, level gauges, CO_2 absorber, over flow seal pot, instrumentation, manhole, ladder and platform and all other accessories required. Capacity of tank together shall adequate to hold the quantity of commercial Alkali (48% NaOH) required for thirty (30) days of operation.

28) All integral pipe works, valves, internals, fittings, hangers, supports and appurtenances etc. for these vessels, atmospheric tanks & dosing pumps as well as unloading and transfer pumps. All necessary suction and discharge piping for these pumps including all strainers, valves and fittings as required, up to the mixing tee with the diluent water. Further flushing connections to all dosing, unloading and transfer pumps shall be provided with service water along with an isolation valves for individual pumps and for drain arrangement shall be provided with an isolation valves for individual pumps as shown in P&ID of CPU.

29) All interconnecting piping, valves and fittings & instrumentation as required shall be in bidder's scope.

30) One (1) no. Neutralization Pit of RCC construction inside lined with PVC sheet of 3 mm thick (civil work not in bidder's scope) with two (2) compartments with PVC lining along with 2 nos. isolation gates for each compartment shall be provided in the CPU regeneration area. The regeneration waste shall be led to the N- pit through drain. Each section/ compartment shall have capacity to hold 120% of waste water generated from CPU in one regeneration. 2 nos. isolation gates for each compartment/ section of each N-pit shall be provided by bidder. Each section of Neutralization Pit to have Level Transmitter and pH at common discharge header for remote monitoring and control purpose. Dosing of acid and alkali shall also be provided to neutralize effluents of CPU regeneration waste before disposal. Necessary air grid arrangement of polypropylene construction shall be provided in each compartment for effective neutralization of the waste effluent.

31) One (1) no. (1 x 100%) Acid Measuring Tank for Neutralization- pit complete with fume absorbers, over flow seal pot, flanges, integral pipe works, pneumatic valves & instruments all other fitting and accessories as required. Capacity of the AMT for N-pit shall be adequate to hold the quantity of acid required for neutralization of excess alkali in waste effluent due to one regeneration of a Condensate Polisher Mixed Bed with 20% overall margin.

32) One (1) no. (1 X 100%) Alkali Measuring Tank for neutralization-pit along with slow speed agitator driven by motor and complete with CO2 absorbers, over flow seal pot, dissolving basket, flanges, integral pipe works, pneumatic valves & instruments all other fitting and accessories as required. Capacity of the ALMT for N-pit shall be adequate to hold the quantity of alkali required for neutralization of excess acid in waste effluent due to one regeneration of a Condensate Polisher Mixed Bed with 20% overall margin.

33) Two (2) nos. (2 X 100%) capacity Neutralized Waste Transfer cum Recirculation Pumps of horizontal centrifugal type, each complete with electrical drive motor along with necessary valves, instrumentation, piping, flanges, fittings and accessories as required. These pumps shall be supplied for waste recirculation and disposal to ash water sump of Stage - II. The pump shall be designed to pump the total volume of one section/ compartment of the neutralization pit in 4 hours or 50 m3/ hr (whichever is higher). Proven agitation system like air agitation, venture mixing etc. shall be provided in addition to recirculation from pumps.

34) One no. pH analyser at effluent discharge header, shall be in the scope of bidder.

35) All interconnecting piping, valves, instrumentation and fittings as required for the N-pit and N-pit disposal system.

36) Further all interconnecting piping, valves, instrumentation and fittings as required for the complete CPU regeneration system shall be in bidder's scope.

37) One (1) no. personnel water drench shower/ safety shower and eye bath with necessary accessories in regeneration area shall be provided by the bidder.

38) All the pressure vessels (except service vessels) shall be designed for a pressure that is maximum expected pressure to which the vessel may be subjected plus 5% extra margin. Maximum expected pressure for vessels placed in the discharge line of pumps shall be based on the shut-off head of the pumps plus static head at pump suction or 10 kg/ cm2 (g) whichever is higher.

39) Further all measuring tanks and storage tanks shall be designed for atmospheric pressure.

40) One (1) set of safety equipment comprising PVC protection suits with hoods, rubber boots, face visors and thick PVC gauntlets shall also be provided by bidder.

41) Bidder to include one no. toilet block having facilities for Ladies & Gents as per the space available for CPU Regeneration area.

42) Solenoid valves shall be kept in pneumatic junction boxes only. Air distribution for SOV's shall be through SS-316 manifold and SS-316 isolation valves only and SS tubing from SOV to valve shall not be more than 6 meters.

43) Instruments and transmitters provided in Resin line, Resin slurry line (Resin with DM water) and DM waterline shall be of capillary diaphragm type only.

44) All non-stainless steel pipe colour coding shall be as per approved painting schedule, during detail engineering.

45) All nuts, bolts etc. in submerged and corrosive application shall be of SS-316.

B. PIPING

All the piping as listed below shall be in bidder's scope. The below indicated pipes shall be designed, supplied, erected, laid and tested by the bidder. Elbows, tees, flanges, counter flanges, hangers and supports, embedment plates with lugs etc. required for the below given piping shall also be provided by the bidder.

1) Service vessel inlet header shall be SA 106 Gr. C (OD 355.6 X 9.53 mm thick) as indicated in CPU P&ID.

2) Service vessel outlet header shall be SA 106 Gr. C RL (OD 355.6 X 9.53 mm thick) as indicated in CPU P&ID.

3) Individual service vessel inlet and outlet line shall be of SA 106 Gr. C [273 mm x 9.27 mm thick (min.)] & SA 106 Gr. C RL [273 mm x 9.27 mm thick (min.)] respectively.

4) Service vessel by pass line piping shall be SA 106 Gr. C (OD 355.6 X 9.53 mm thick).

5) Rinse water outlet piping shall be SA 106 Gr. C (OD 168.3 x 7.11 mm). The distance between CPU service vessel to condenser hot well shall be considered as 100 meter.

6) Resin transfer piping shall be minimum 80 NB and of ASTM A 312 Gr. TP 304 (SS 304) Sch. 10S (minimum). One-way distance for resin transfer piping between service vessel of TG unit and regeneration system located in regeneration area shall be minimum 175 m. The fittings shall be of forged stainless steel to ASME SA 182 F304 with SW ends to ANSI B 16.11.

7) Piping handling DM water shall be ASTM A 312 Gr. TP 304 (SS 304) Sch. 10S (minimum). One-way distance for DM water piping between farthest service vessel of TG unit and regeneration system located in regeneration area shall be minimum 175 m.

8) Distance between CPU regeneration area and CPU regeneration & transfer pumps shall be approx. 350 meters.

9) For sizes equal to and below 50 NB, SS piping to ASTM A 312 TP 304 Sch. 40S shall be provided and SS

304 Sch. 10S shall be provided for sizes equal to & more than 65 NB.

10) Interconnection piping along with isolation valves, tee, bends, flanges along with instruments between resin transfer lines & DM water lines of CPU regeneration area & service vessel area shall be in bidder's scope.

11) N-Pit effluent common discharge piping from N-Pit effluent transfer pumps to ash water sump of Stage - II shall be minimum 150 NB size or as per velocity criterion for sizing given in technical specification whichever is higher of MOC CSRL conform to IS 1239 (heavy)/ IS 3589 or equivalent shall be in bidder's scope. The distance between N-Pit of regeneration system and ash water sump of Stage - II shall be 500 m and this piping shall be in bidder's scope. Complete N-pit effluent discharge piping of CPU regeneration system shall be in bidder's scope.

12) Piping used for handling alkali (concentrated) and alkali solution shall be CPVC Sch. 80 minimum for complete CPU regeneration area. The complete piping and distribution of the same inside the CPU regeneration area shall be in bidder's scope.

13) Piping handling acid service shall be CPVC Sch. 80 minimum for complete CPU regeneration area. The complete piping and distribution of the same inside the CPU regeneration area shall be in bidder's scope.

14) Piping for the instrument & service air confirming to SS 304 Sch. 40S for size equal to & less than 50 NB and SS 304 Sch 10S for size equal to & more than 65 NB. The distribution of the same inside the CPU regeneration area and CPU service vessel area shall be in bidder's scope.

15) DM water piping from condensate storage tanks common outlet header to CPU REGENERATION CUM RESIN TRANSFER PUMPS (located in CST pump house) suction lines along with their isolation valves, tee, bends, piping, flanges etc. shall be in bidder's scope. Distance shall be approximately 25 meter.

16) DM water piping from each CPU REGENERATION CUM RESIN TRANSFER PUMPS (located in CST pump house) discharge recirculation line to common recirculation header (of condensate storage tank) along with their isolation valves, tee, bends, piping, flanges etc. shall be in bidder's scope. Distance shall be approximately 30 meter.

17) Further DM water piping from each CPU REGENERATION CUM RESIN TRANSFER PUMPS to service vessel area of TG units and regeneration area all equipments shall be in bidder's scope.

18) Service water piping (used for cooling of condensate sample & other activities in regeneration area), piping for gland sealed valve cooling, instrument air piping and service air piping, potable water piping for eye wash & other applications etc. shall be in bidder's scope.

19) All piping between the external regeneration facility, skids for chemical dosing and acid/alkali preparation, and acid & alkali storage shall also be designed, supplied, erected and tested by the bidder. These shall include demineralized water piping to the chemical dosing, acid / alkali piping from external bulk storage tanks to respective preparation skids, the alkali preparation skids from the external regeneration facility, alkali solution from its preparation facility to the alkali dosing skid, dilute chemical solution piping for acid and alkali from the dosing skids to the external regeneration facility, piping to the preparation/ dosing facilities, instrument air piping and power supply for immersion heaters of the diluent water tank from the regeneration facility and all instrumentation and control wiring between these skids, etc.

20) In addition, any additional piping and associated accessories required to complete the system shall be in bidder's scope.

C. ADDITIONAL REQUIREMENT

1) Operating platforms, ladders, supports and other structural works for each vessel to facilitate accessibility for operation and maintenance for all the condensate polisher mixed beds, regeneration vessels, storage tanks, alkali and acid measuring tanks & preparation tanks and other equipment's etc. shall also be in bidder's scope.

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) Start-up and commissioning spares are in bidder's scope of supply.

5) Start-up and Commissioning spares are those which would be required during equipment or system testing, start-up and commissioning. All spares used until the plant is finally handed over by the bidder to the customer come under this category. All start-up and commissioning spares as required shall be provided by the bidder without any additional cost to the BHEL and customer. Bidder to provide spares as per their system requirement without any commercial and delivery implication to BHEL/ Customer during detailed engineering. List of spares shall be furnished by BIDDER along with the offer.

   Bidder shall be responsible for the ready and timely availability for all the startup and commissioning spares as required during various stages of testing, cleaning and commissioning up to handing over of each unit of the total plant.

   An adequate stock of start-up spares shall be available at the site such that the start-up and commissioning of the equipment/systems, Performance guarantee test and handing over the equipment/ systems to the customer will be carried out without hindrance and delay. All start-up spares which remain unused after the taking over of the plant shall remain the property of the customer.

6) All required elbow, tee, pipe fittings etc. required for erection of the complete system including piping shall be in bidder's scope. Bidder to provide the detailed BOQ during detail engineering. Bidder to consider 10% margin over and above the BOQ requirement of all the fittings, tees, elbows etc.

7) 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 buried pipes as per IS 10221 or AWWA C 203-93 shall be in bidder's scope of work.

8) Bidder shall consider 12 m static head + 10% margin in addition to the losses in straight pipes and bend in pipes, tees, reducer, expander and valves etc. (in yard piping) while selection of pump head during detailed engineering.

9) The Bidder's scope includes all the first fill and one year's topping, requirements of consumables such as greases, oils, lubricants, servo fluids/ control fluids, gases, reagents, standard reference chemical solutions etc. which will be required to put the equipment covered under the scope of specifications. Consumption of all these consumables during the initial operation or PG test of bidder's supplied equipment (whichever is later) and final filling after the initial operation OR PG test of bidder's supplied equipment (whichever is later) shall also be included in the scope of the Bidder. Bidder shall also supply a quantity not less than 10% of the full charge of each variety of lubricants, servo fluids, gases, chemicals etc. used which is expected to be utilised during the first year of operation. This additional quantity shall be supplied in separate containers. Suitable standard lubricants as available in India are desired. The variety of lubricants shall be kept to a minimum possible.

10) On completion of erection, a complete list of bearings/ equipment giving their location and identification marks shall be furnished to the Owner along with lubrication requirements.

11) MCC, DDCMIS based control room & battery room shall be located in CPU regeneration area building. All regeneration vessels and chemical dosing facilities shall be located in CPU regeneration building. Bulk chemical storage tanks, unloading and transfer pumps shall be located open to sky. Further N-pit shall be located in open area near CPU regeneration area. CPU regeneration cum resin transfer pumps shall be located near condensate water Storage tanks and shall have been provided with localised KNOPY arrangement on pump & motor and the same shall be in bidder's scope. Further, Bidder to also provide the localized KNOPY arrangement on all pumps & motors which are open to sky.

12) 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.

13) 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.

14) 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.

15) 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.

16) 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.

17) 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 successful bidder for concurrence. 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.

18) Necessary approach (platform) shall be provided for all the Pneumatic Valves & Flow Orifice Plates. Necessary drawing/ documents, indicating the same, shall be provided by successful bidder during contract stage.

19) AII the transmitters (Pressure, Temperature, Flow, Level, Differential Pressure etc.) & analysers which are used in system for interlock & protection shall be redundant. For redundancy please refer the C&I portion of this specification, Section I-C. The same shall be indicated in P&ID by successful bidder after award of contract.

20) Instruments, analyzers etc. used in system should sustain operating & design parameters of system. In case operating & design parameters of instruments, analysers are less than system's parameters, then necessary arrangement/ accessories shall be provided by bidder for safe & reliable operation.

21) Embedment plates with lugs shall also be provided by bidder as per system requirement.

22) All channels & brackets, mounting plates as required for mounting of motors, pumps, stirrers, tank etc. shall be in bidder's scope.

23) Mandatory spares as per attached Annexure-VI of Sub-Section IA to this technical specification.

24) All necessary structural steel for pipe supporting structure, platforms, walkways/ pathways and access stairs, mechanical plant and equipment, mechanical services and pipe work associated with CPU Plant.

25) All Motorized valves with integral starter as per requirement and as indicated in the P&ID.

26) All handrails shall be of 32 mm nominal bore MS pipes (medium class) as per IS: 1161 galvanized using 750 gm/sq. m of zinc. Hand railing shall be a two-rail system with the top rail 1000 mm above the walkway surface and the intermediate rail 450 mm below the top rail. Handrail post spacing shall be limited to 1500 mm as far as possible but can be proportioned to the length of the opening. In such a case spacing shall not exceed 1850 mm centre to centre of posts. Hand railing shall be shop fabricated for specific locations and field welded or bolted to the erected structural steel. Railings shall be provided with 100 mm wide and 8 mm thick MS strip at bottom as toe guard all along the length of railing in horizontal plane. For RCC stairs, hand railing with 20 mm square MS bar balustrade with suitable MS flat and Aluminium/ Teakwood handrail shall be provided, unless specifically mentioned otherwise.

27) Instrument hook up material shall be in bidder's scope.

28) Permanent ladder (not rungs) for approaching the top of tanks, valves for all steel inserts 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 being supplied under this specification for opening/ maintenance purpose.

29) Any item/ work either supplies of equipment or erection material which have not been specifically mentioned in but are necessary to complete the woks for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification and shall be in bidder's scope without any commercial, technical and delivery implication to BHEL.

30) If service air is required by the bidder in the service vessel area (for hydro-pneumatic resin transfer operation etc.) then bidder to provide necessary compressors, valves, piping, fittings, flanges, instruments etc. to meet the system requirement.

31) If service air is required by the bidder in the CPU regeneration area (for hydro-pneumatic resin transfer operation etc.) then bidder to provide necessary compressors, valves, piping, fittings, flanges, instruments etc. to meet the system requirement.

32) All other items as specified in other part of the specification are also included in scope of supply.

33) Space available for CPU Regeneration area is 32 m x 14 m. Bidder to accommodate their equipment within the space provided.

34) Bidder to submit BBU during detailed engineering after approval of Basic documents. BBU shall be equal to BOQ for the package and there shall be no price and delivery implication to BHEL/ customer for the same. None of the items supplied for the project as non-billable. Incomplete BBU shall not be reviewed by BHEL.

35) 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 suitable number of pumps for cooling for each location of 2 X 100% configuration for CPU package.

36) Any statutory requirement/ clearance required for the packages from government/ local body shall be in bidder's scope.

37) KKS codes for all drives and instruments for the project have to be followed.

38) KKS numbering shall be followed for all instruments/ equipment's/ tanks/ valves/ pipe etc. for maintaining plant quality standard. KKS numbering to be done by Bidder.

39) The suction & discharge valves of pumps shall be provided with open & close limit switches for auto operation. All discharge valves placed at the outlet of the pumps shall be auto valves for auto operation of the plant.

40) Bidder to use analysis given in Sub-Section –IA ANNEXURE –VIII of this technical specification under SALIENT DESIGN INPUTS/ CRITERIA for NORMAL RUN & START-UP OR CONDENSER LEAK CONDITION for design of condensate polishing plant.

41) Bidder shall perform the guarantee parameters as per specification requirement to the satisfaction of owner. The exact modalities of verifying guarantee for the parameters indicated in the specification shall be finally as agreed with the owner during detailed engineering & mutually agreed.

42) Hoist shall also be provided by the bidder for Condensate Polishing Unit meeting the specific and general technical requirements specified in Section- II/ Sub-section IIA of this technical specification.

43) Seal pots, fume absorbers, carbon dioxide absorbers of adequate capacities are to be provided for acid and alkali storage tanks & day/ measuring/ preparation tanks as applicable. Sizing calculation for these items shall be furnished by the bidder for BHEL's clearance/ acceptance.

44) The sub systems/ modules/ items/ components used in assembling of the complete equipment(s)/ system(s) shall be sourced from reputed manufacturers having proven experience with such similar products.

6.0 SCOPE OF SUPPLY (ELECTRICAL)

Complete electrical as per specification/ details indicated in Sub-Section IB (Specific Technical Requirement Electrical) and IIB (General Technical Requirement Electrical).

7.0 SCOPE OF SUPPLY (C&I)

Complete C&I as per specification/ details indicated in Sub-Section IC (Specific Technical Requirement C&I) and IIC (General Technical Requirement C&I).

8.0 SCOPE OF SUPPLY (CIVIL)

Total Civil is in BHEL's scope of work, however complete grouting for equipments, fixing and any concreting inside the vessels, puddle pipe inside civil structure, nozzles, supporting plate/ structures & lining shall be in bidder's scope. Also detailed Civil Input drawing shall be provided by bidder. Successful bidder shall furnish civil assignment drawings. The corresponding CIVIL drawing prepared by BHEL / CIVIL agency, based on civil assignment drawing of bidder and shall be furnished to the successful bidder for concurrence. 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".

9.0 SCOPE OF SERVICES

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

a) Erection and commissioning, unloading, storage and handling at site.

b) 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.

c) 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.

d) Arrangement of all instruments, equipment, lab facilities, monitoring gadgets for monitoring, pre-commissioning, carrying out trial run, commissioning, PG test & till plant hand over.

e) Monitoring gadgets, instruments and equipments required for maintenance.

f) During Logic preparation, FAT & commissioning of DDCMIS, bidder shall arrange his concerned personnel at PEM office, BHEL –EDN office & for commissioning of DDCMIS at site, as and when required by customer / BHEL without any delay as per clause specified under Sub -section-IC (C&I).

g) Complete grouting for equipment, fixing and any concreting inside the vessels and lining.

h) All personnel required during maintenance, Commissioning, trial run and PG test.

i) Trial run for requisite period.

j) Performance Guarantee testing.

k) Training of plant Owner's personnel, O&M operators' personnel on plant operation and maintenance.

l) All other facilities/ services as described in section on site services in specification and related to CPU Plant scope of work.

m) Relevant requirements as per GTR, GCC, ECC & SCC.

n) All the Piping, Valves and Equipment's of this system shall be protected against external corrosion by providing suitable painting. The surfaces of stainless steel, Gunmetal, brass, bronze and non-metallic components shall not be applied with any painting. The condensate pipelines and valves near the condensate polisher vessels shall be painted as per Sub-Section IA ANNEXURE V of this Technical Specification.

o) Painting shall be as specified Sub-Section IA ANNEXURE V of this technical specification. However, any variation in the painting schedule as finally approved by BHEL / Customer shall be taken care by the bidder without any commercial and delivery implication to BHEL / Customer. Colour coding scheme shall be intimated to vendor during detail engineering.

p) Final touch up paint at Project Site.

10.0 TERMINAL POINTS

10.1 CONDENSATE POLISHING PLANT - SERVICE VESSEL AREA

a) Service vessel inlet - (OD 355.6 X 9.53 mm thick, SA 106 Gr. C) - single piping connection near service vessel area in BC bay for unit as per attached Composite Piping Layout Plan below Mezzanine Floor Dwg. No. PE-DG-445-100-M032.

b) Service vessel outlet - (OD 355.6 X 9.53 mm thick, SA 106 Gr. C) - single piping connection near service vessel area in BC bay for unit as per attached Composite Piping Layout Plan below Mezzanine Floor Dwg. No. PE-DG-445-100-M032.

c) Rinse water outlet - Rinse water outlet piping (OD 168.3 x 7.11 mm, SA 106 Gr. C) from the service vessel outlet up to condenser hot well for TG unit.

d) The DM water used for resin transfer operations from the Regeneration building to the Condensate Polisher vessels shall be terminated by the bidder to the nearest drain trench through drain channel.

e) 25 NB connection of Instrument air supply at 5 to 7 kg/cm2 (g) – At 5-meter distance from service vessel area. However, distribution and piping inside TG hall service vessel area shall be in bidder's scope.

f) Gland sealing valves cooling water supply & analysers rack cooling water supply piping – service water connection (25 NB) at 5-meter distance from service vessel area for each TG unit. Piping inside service vessel area for each TG unit for mentioned services will be in bidder's scope.

10.2 EXTERNAL REGENERATION AREA

a) DM Water Supply – DM water piping terminal point shall be common outlet header from condensate storage tanks (Condensate storage tanks not in bidder's scope) & for recirculation line terminal point shall be up to common DM/ condensate water recirculation line to condensate storage tanks.

b) 50 NB Instrument air supply at 5 to 7 kg/cm2 (g) – At 5-meter distance from the CPU regeneration building. However, distribution and piping inside reg. area shall be in bidder's scope.

c) Service water (50 NB) - At 5-meter distance from the CPU regeneration building. However, distribution and piping inside CPU regeneration area will be in bidder's scope.

d) Drinking/ potable water (50NB) - At 5-meter distance from the CPU regeneration building. However, distribution and piping inside CPU regeneration area will be in bidder's scope.

e) N-Pit effluent piping from N Pit up to ash water sump of Stage - II shall be in bidder's scope. The piping distance to be considered from regeneration system N-pit to ash water sump shall be approximately 500 m.

f) In addition to this, detailed terminal points shall be as per the P&ID for CPU plant (BHEL Drg. No.:PE-DG-445-155A-A001) enclosed with the technical specification.

11.0 EXCLUSIONS

a) All civil works including foundation of equipment. However complete grouting for equipment, fixing and any concreting inside vessels and lining shall be in the scope of the bidder. But civil works including operating / maintenance platforms and interconnection platforms (if any) with ladders / stairs & handrails,

structural supports and hangers for pipes / cables / ducts, crane rails, all embedments and inserts with lugs including anchor fasteners, bolts etc., dressing of foundations, grouting of pockets and underpinning of base plates for equipment / structures and fixing supports, filling and finishing of openings in walls, floors, cladding, roof and trenches shall be in Bidder's scope.

b) Main pipe trestles interconnecting CPU regeneration building and Service Vessel Pipe trestle. However, auxiliary structure, hanger/ support components for all the piping (CPU regeneration area, in acid/ alkali handling area, interconnecting acid/ alkali storage area, CPU service vessels, DM water piping, resin transfer piping, instrument air piping, service water piping, potable water piping and effluent disposal piping etc.) are in bidder's scope.

c) Instrument air up to terminal points.

d) All chemicals except reagents, monitoring gadgets required for pre- commissioning, commissioning, trial run and PG test.

e) Air conditioning, ventilation & firefighting facilities.

f) Supply of ISMB monorail.

g) Other exclusions as mentioned in the Electrical & C&I parts of this specification.

h) Service water, Drinking/ potable water & DM water up to terminal points.

12.0 QP AND SUB VENDOR APPROVAL

12.1 Minimum QP requirements are specified as Sub-Section IA ANNEXURE I. BHEL & customer reserves the right for inspection of imported items by BHEL/customer officials (if felt necessary). The same shall be decided during detail engineering during approval of QP's.

12.2 However, any additional comments as given by BHEL/ customer on quality plan shall be adhered by the bidder without any commercial & delivery implication to BHEL.

12.3 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.

12.4 List of make sub vendor items is enclosed as Sub-Section IA ANNEXURE-II is indicative only and is subject to BHEL and Customer approval during detailed engineering stage without any commercial & delivery implication to BHEL. Any additional sub vendor shall be subject to BHEL and Customer approval during detailed engineering stage without any commercial & delivery implication to BHEL.

12.5 Bidder to propose sub vendor list with following back up documents within 4 weeks of placement of LOI/ LOA. Thereafter no request for additional sub-vendor shall be entertained. The sub vendor list shall subject to BHEL and Customer approval during detailed engineering stage without any commercial & delivery implication to BHEL.

12.6 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.

13.0 FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES

Functional Guarantees and liquidated damages shall be as per enclosed Sub-Section IA ANNEXURE III**.**

14.0 DESIGN/ CONSTRUCTION

In addition to the requirements of Sub-Section IIB, IIC the following shall also be complied under scope of this specification.

The P&ID diagram 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.

15.0 DRAWING/ DOCUMENTS REQUIREMENT

After award of LOI, following minimum drawing/documents shall be submitted by the bidder for BHEL/ 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 number of drawing/ documents to be submitted by the bidder shall be as per enclosed Sub-Section IA ANNEXURE IV. The submission of soft copy or hard copy of the document whichever is later will be considered as final date of submission of the document. 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.

For the drawings/ documents distribution Procedure, please refer attached Sub-Section IA/ Annexure-IV. 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. The numbers of soft copies & hard copies of drawing/documents to be submitted by the bidder shall be as per enclosed Sub-Section IA Annexure-IV.

After award of LOI/ LOA, drawing/documents to be submitted by the bidder for BHEL/Customer approval has been indicated in Sub-Section IA Annexure VII. However, any additional drawing /document if found necessary for completion of the engineering, the same shall be submitted by bidder without any technical, commercial & delivery implication to BHEL. Bidder confirmed drawings submission schedule as follows:

- Drawing/ documents submission schedule: 1st submission of basic drawings/ documents – (please refer MDL for list of basic drawing/documents & submission schedule).

- Every revised document shall be submitted by bidder incorporating BHEL/ customer comments – within 10 days.

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

Bidder to note that the successful bidder, during detail engineering, will submit the drawing/ doc through web based Document Management System in addition to hard copies to be submitted as per the Section IA Annexure VII of this specification. Bidder would be provided access to the DMS for drawing/ doc 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

16.0 SPARES

The Bidder shall include in his scope of supply all the necessary Mandatory spares, start up and commissioning spares as indicated in the relevant sections of specifications. The general requirements pertaining to the supply of these spares is given below: -

16.1 RECOMMENDED SPARES:

The bidder shall also furnish list of recommended spares parts for three (3) years normal operation with unit prices. These recommended spares shall be those considered necessary by the bidder on a stand-alone basis. The BHEL reserves the right to buy any of the recommended spare parts as considered necessary by him.

The recommended spares shall be delivered at project site at least two months before the scheduled date of initial operation of first unit. However, the spares shall not be dispatched before the dispatch of the main equipment. The price of these spars will remain valid upto 6 months after placement of Notification of Award for the main equipment. However, the Bidder shall be liable to provide necessary justification for the quoted prices for these spares as desired by the BHEL/ Customer.

16.2 MANDATORY SPARES:

All Mandatory spares listed in Sub-Section IA Annexure VI of this specification are in bidder's scope of supply.

All the Mandatory spares for the equipment under the contract provided by the vendor will strictly conform to the specifications and documents and will be identical to the corresponding main Equipment/components supplied under the contract.

Whenever the quantity is mentioned in "sets" the bidder has to give the item details and prices of each item.

All mandatory spares shall be delivered at site at least two months before scheduled date of initial Operation of the first unit. However, spares shall not be dispatched before dispatch of corresponding main equipment.

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

Inspection of mandatory spares shall be in line with the approved quality plans for the respective Items/ equipment. The inspection categorisation of mandatory spares shall also be in line with the approved categorisation plan for the respective items/ equipment.

16.3 START-UP & COMMISSIONING SPARES

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

Notes: -

- The Bidder shall indicate the service expectancy period for the spares parts (mandatory) under normal operating conditions before replacement is necessary.

- That all spares supplied will be new and in accordance with the contract document and will be free from defects in design, material and workmanship and shall further guarantee as under.

- In case of any failure in the original component/ equipment's due to faulty designs, materials and workmanship, the corresponding spare parts if any, supplied will be replaced without any extra cost to the BHEL and customer unless a joint examination and analysis by BHEL and/or customer of such spare parts prove that the defect found in the original part that failed can safely be assured not to be present in spare parts.

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

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

- Each spares part shall be clearly marked or labelled on the outside of the packing with its description. When more than one spares part is packed in a single case, a general description of the content shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purposes of identification.

- All cases, containers or other packages are to be opened for such examination as may be considered necessary by BHEL / Customer.

- The Bidder will provide the BHEL/ Customer with all the addresses and particulars of his sub suppliers while placing the order on vendors for items/components/equipments covered under the contract and will further ensure with his vendors that the BHEL/Customer, if so desires, will have the right to place order for spares directly on them on mutually agreed terms based on offers of such vendors.

- The Bidder shall warrant that all spares supplied will be new and in accordance with the contract documents and will be free from defects in design, material and workmanship.

- The bidder to provide datasheets/assembly drawings of the manufacturer/ any other relevant document showing Bill of Material(s), Make, Model Number, Part Number etc. through which the mandatory spares to be supplied can be uniquely identified.

- The bidder shall guarantee the long term availability of spares to the BHEL/ Customer for the full life of the equipment covered under the contract. The Bidder shall guarantee that before going out of production of spares parts of the equipment covered under the Contract, He shall give the BHEL/ Customer at least 2 years advance notice so that the latter may order his bulk requirement of spares, if he so desires. The same provision will also be applicable to sub-vendors. Further, in case of discontinuance of manufacture of any spares by the Bidder and/or his sub-vendors, bidder will provide the BHEL/Customer, two years in advance, with full manufacturing drawings, material specifications and technical information including information on alternative equivalent makes required by BHEL /Customer for the purpose of procurement of such items.

- Further in case of discontinuance of supply of spares by the vendors or his sub-vendors, the vendor will provide the BHEL and the customer with full information for replacement of such spares with other equivalent makes, if so required by the BHEL and the customer.

- Notwithstanding the above, the vendor shall be responsible for supply of spares for the lifetime of the package at reasonable prices. The prices of all future requirements of spares shall be derived from the corresponding ex-works price at which the orders for such spares have been placed by the BHEL and the customer as a part of the mandatory or long term or any other kind of spares. The base indices for calculating ex-works price shall be commissioning of last equipment under main contract

- Wherever quantity has been specified as percentage (%), it shall mean percentage (%) of the total population of the item as defined elsewhere in this specification, unless specified otherwise and the fraction will be rounded off to the next higher whole number.

- Wherever the quantities have been indicated for each type, size, thickness, material, radius, range etc. these shall cover all the items supplied and installed and the break up for these shall be furnished.

- In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities.

- The Bidder will indicate the delivery period of the spares, which the BHEL and the customer may procure in accordance with this clause.

- In case of emergency requirements of spares, the vendor would make every effort to expedite the manufacture and delivery of such spares on the basis of mutually agreed time schedule.

- In case the vendor fails to supply the mandatory or long term or any other kind of spares on the terms stipulated above, the BHEL and the customer shall be entitled to purchase the same from the alternate sources at the risk and the cost of the vendor and recover from the vendor, the excess amount paid by the BHEL and the customer over the rates as per the contract. In the event of such risk purchase by the BHEL or the customer, the purchases will be as per the works and procurement policy of the BHEL and the customer prevalent at the time of such purchases and BHEL & the customer at his option may include a representative from the vendor in finalizing the purchases.

- It is expressly understood that the final settlement between the parties in terms of relevant clauses of the tender document shall not relieve the vendor of any of his obligations under the provision of long term availability of spares and such provisions shall continue to be enforced till the expiry of 30 (thirty) years period reckoned from the scheduled date of completion of trial operation of the last equipment unless otherwise discharged expressly in writing by the BHEL or the customer.

17.0 MISCELLENEOUS REQUIREMENT

- 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.

- 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 CPU plant (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.

- 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.

- The requirements mentioned in Section – I shall prevail and govern in case of conflict between requirements mentioned in section I & section –II for any item or equipment or system. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with, without any implication to BHEL & Customer.

- Latest version of all codes and standards to be followed.

- CPU regeneration facilities (except bulk acid & alkali storage and Neutralisation pit which area kept in open) shall be housed in RCC Building. Control room, battery room & MCC room for CPU plant shall be shall be housed shall be located in RCC building. RCC building shall have toilet blocks for ladies and gents.

- Any statutory requirement / clearance required for the package from government/ local body shall be in bidder's scope.

- All interconnecting piping, valves, fittings including dosing piping, drain piping from tanks to nearby drain, flushing lines from nearest available water source, valves, fittings and accessories is also in bidder's scope.

- All the vertical pumps shall be self-lubricating type.

- 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 shall be taken from BHEL. 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.

- KKS numbering if required, as per BHEL/Customer requirement shall be provided by the Bidder during detailed engineering stage without any commercial/delivery implication to BHEL.

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

- Buried piping shall be protected as under (as per IS-10221). Surface cleaning by wire brush, power tool cleaning etc. Apply one coat of coal tar/ primer/ enamel. Apply one layer of tape comprising of coaltar. Application of tape shall conform to AWWA C- 203/ IS 10221 (Appendix-B) with Minimum thickness of tape as 4MM +10%

- All drawings/ documents shall be approved by BHEL/ Customer during detailed engineering stage. Successful Bidder shall comply with the comment of the customer/BHEL without price & delivery implication.

- 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.

- 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.

- 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 successful bidder for concurrence. In case any modification is required in the civil work already carried out based on final civil inputs given by bidder, BHEL reserves the right to debit cost of such rework to bidder.

- 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.

- 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.

- 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 & sub -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 SECTION -III of the specification. In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser / Customer shall prevail and shall be complied by the bidder without any commercial 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 Purchaser/ Customer as and when brought to their notice either by the bidder or by purchaser/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication to BHEL / Customer.

- The bidder 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. 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. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve the vendor from the responsibility of providing such facilities to complete the supply and erection & commissioning of condensate polishing unit.

- 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.

- 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.

- The general term 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 in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.

- Deviations along with cost of withdrawal (positive or negative), if any, should be very clearly brought out clause by clause in the enclosed schedule; otherwise, it will be presumed that the vendor's offer is strictly in line with tender specification & there is no deviation. (Price to be given in sealed envelope only.)

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

- 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 THE WEST BENGAL POWER DEVELOPMENT CORPORATION LIMITED (WBPDCL) and/ or customer's assigned consultant.

- The equipment covered under this specification shall not dispatch unless the same have been finally inspected, accepted and shipping release issue by BHEL/ Customer.

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

18.0 BIDDER TO FURNISH 4 SETS OF TECHNO-COMMERCIAL BID INCLUDING FOLLOWING DOCUMENTS/INFORMATION (FOR ELECTRICAL AND C&I PLEASE REFER THE RESPECTIVE SECTION OF THE SPECIFICATION).

- Deviation if any in the enclosed Schedule of deviation with cost of withdrawal only with mention of specification clause for which deviation is being asked. (Stamped & Signed)

- Compliance certificate. (Stamped & Signed)
- Schedule of Declaration. (Stamped & Signed)
- Unpriced Price Schedule duly filled as “Quoted” (Stamped & Signed).

Any other documents submitted by bidder except as asked in the bid’s specification shall not be evaluated & considered as null & void.

19.0 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.

20.0 APPROVED SUPPLIERS FOR CPU

Following CPU suppliers are already approved by the customer, need not to submit any PQR credentials and they are considered to be technically pre-qualified.

1. BGR Energy Systems Limited.
2. DRIPLEX Water Engineering International Private Limited, Haridwar.
3. Ion Exchange (India) Ltd.
4. THERMAX Limited, Pune.
5. VA Tech WABAG Ltd.

TECHNICAL DETAILS OF CONDENSATE POLISHING PLANT

1.00.00 INTRODUCTION

For maintaining the feed water purity condensate polishing plant will be provided in the feed water cycle at the downstream of condensate extraction pumps. The function of the CPU will be to purify the condensate effluent from the condenser by removing solids and dissolved salts with the intent of reducing corrosion and depositions in the steam-water cycle. The proposed Condensate Polishing Unit (CPU) shall treat the condensate of the Turbine-Generator (TG) Units of the power station, using deep Mixed Bed Ion Exchange Polisher vessels and an external regeneration system. One (1) number of Condensate Polishing Plants (CPP), for each TG (Turbine-Generator) unit, along with one set of common external regeneration system shall be provided alongwith instrumentations, valves and piping, controls etc.

2.00.00 SYSTEM DESCRIPTION (GENERAL)

A. The proposed Condensate Polishing Plant (CPP) shall treat the condensate of the respective Turbine-Generator (TG) Unit of the power station. The system shall be as per tender drawing titled P&ID of Condensate polishing Plant.

B. The proposed schematic arrangement of the Condensate Polishing Plant has been shown in the relevant Tender Drawing (P&ID). Arrangement of piping and valves shown in them are bare minimum only. The Contractor shall propose the complete system including regeneration facilities as per their standard & proven design and as elaborated in this specifications meeting the basic functional requirements.

C. The system should be capable of producing the output characteristics which will be better than or equal to the specified conditions as prescribed by the Boiler Manufacturer or as specified elsewhere in this document whichever is more stringent. The system should be also capable of monitoring and maintaining the characteristics during unit start up, load variations and condenser tube leakage.

D. The regeneration process offered by the bidder, shall be of proven design and shall essentially be the same process by virtue of which the bidder is qualified and shall give resin-separation compatible with the desired effluent quality. Documentary evidence shall be submitted by the bidder to the Customer/ BHEL to establish this requirement during detailed engineering stage if required.

E. The bidder shall include inert resin in the system if they feel that it helps in better resin separation.

F. In case, after separation of resins, there are undesired contaminant resins, the bidder shall provide a system either to eliminate this cross contamination of resins or to nullify the detrimental effect of entrapped resins to the effluent quality.

G. The guaranteed chemical consumption figures must be supported by relevant published data such as performance of the resin system, statistical data on resin losses and actual field performances of Systems using a similar technique, indicating the quantity of chemicals required for regeneration, in particular, besides other parameters. The data on the chemical consumption figures and the calculations furnished by the Bidder shall be the primary basis of checking the guaranteed parameters. The operating exchange capacity and regeneration levels shall be vetted by resin manufacturer and the Bidder must furnish the resin performance curves especially applicable for this project.

H. The Condensate polishing Plant shall consist of one set of Condensate polishing Units (CPU) for each TG unit inside TG Building and a common external regeneration system for TG unit. There shall be three service vessels (3X50%) for each 660 MW unit each polishing 50% of the condensate flow corresponding to VWO (valve wide open) condition at 1% make up (Flow through each service vessel indicated in the data sheet) condition.

I. The regeneration system shall be external. For regeneration, resin from the exhausted exchanger vessel will be transferred hydraulically to this facility. The exhausted resin charge will be cleaned, separated, regenerated, mixed and rinsed before being stored for the next use.

J. The common influent and effluent headers of each CPU, will be connected to an automatic bypass line(s) to be provided by Bidder. On high pressure signal across the service vessel, the automatic control valve(s) in the

bypass line(s) shall open, bypassing the service vessel(s).

K. In the event of a tube failure in the condenser, circulating water will enter the condensate system and will contaminate it. Typical composition for the "START-UP OR CONDENSER LEAK CONDITION" is exhibited elsewhere in the technical specification and the condensate polishing plant shall be designed for such tube leakage condition as mentioned.

L. For arriving water analysis under condenser tube leakage condition. The analysis of the clarified water is exhibited in the Sub-Section IA Annexure VIII of tender specification shall be multiplied with 5 COC to derive the circulating water analysis.

M. Polisher mixed bed/ service vessels of each 660 MW Unit shall be located in respective TG hall unit. However, the regeneration system shall be external consisting of 1 sets of external regeneration facility and in building (except bulk acid & alkali storage facility & N-pit which is in open area). The CPU regeneration system will be located outside TG Hall (kindly refer enclosed plot plan for the same).

N. The equipment kept in open area (pumps, blowers, motors, tanks, instruments, analysers etc.) shall have localized shade provisions which is in bidder's scope. All the instruments associated with condensate polishing plant shall be provided with proper enclosures by Bidder. All vessels, pumps & blowers and their drives and other electrical and C&I equipment/ accessories of regeneration system shall be suitable for outdoor duty and enclosures class of all the equipments shall be suitably selected by the bidder meeting contract specification requirement as minimum.

3.00.00 SALIENT DESIGN DATA

I. There shall be three service vessels (3X50%) for 660 MW unit each polishing 50% of the condensate flow corresponding to VWO (valve wide open) condition at 1% make up condition (Flow through each service vessel indicated in the data sheet).

II. The following dissolved solids concentration and conditions shall be used as a basis of design for the condensate polishing system.

(a) ANALYSIS OF TREATED CONDENSATE UNDER NORMAL AND START UP CONDITION

The following concentration and conditions shall be used as a basis of design for the condensate polishing system:

CONTAMINANT	UNIT	EFFLUENT UNDER NORMAL CONDITION	EFFLUENT UNDER START UP CONDITION	TUBE LEAKAGE CONDITION
Total dissolved solids (TDS)	ppb	< 25	< 50	
Silica (as SiO2)	ppb	< 5 (Refer note # 1)	< 20 (Refer note # 1)	
Iron (dissolved)	ppb	< 2	< 10	
Chloride (as Cl)	ppb	< 2	< 10	
pH (polisher runs at 25^{O}C with H/OH mode)		6.5-7.5	6.5-7.5	
Electric Conductivity after cation column (25 Deg. C)	Micro S/cm	< 0.1	< 0.2	
Sodium (as Na)	ppb	< 2	< 5	< 20
Crud (mostly black oxide of iron)	ppb	< 5	< 100	

Note-1: For temperature 50˚C and above the silica value in the effluent shall be based on the resin supplier's recommendations.

Under the Normal Condition, each Condensate Polisher Mixed Bed shall be designed to operate in hydrogen cycle for not less than 240 hours of continuous operation, while maintaining the above treated condensate quality.

Useful service run under startup condition & Condenser Tube leakage condition shall be 48 hours before regeneration.

In addition to the dissolved solids, the influent condensate shall also contain some quantities of suspended solids (crud) derived from the corrosion of water and steam carrying pipelines, turbine condenser and steam side of the feed water heater. Normally this concentration will not exceed about 50 ppb and the polisher beds shall provide sufficient filtering action to restrict the effluent crud content to less than 5 ppb & same shall be guaranteed.

(b) INFLUENT CONDITION:

Following influent quality shall be considered for designing CP system:

CONTAMINANT	UNIT	NORMAL CONDITION	START UP CONDITION	TUBE LEAKAGE CONDITION
Ammonia	Ppb	250	1500	
Total dissolved solids (TDS, ammonia and silica excluded)	Ppb	100	650	
Silica (as SiO2)	Ppb	30	500	
Iron (dissolved)	Ppb	50	1000	
Chloride (as Cl)	Ppb	20	100	
pH (polisher runs at 25^{O}C with H/OH mode)		8.5-9.0	9.0-9.6	
Conductivity (25 Deg. C)	Micro S/cm	0.5	2	
Sodium (as Na)	Ppb	10	20	< 20
Crud (mostly black oxide of iron)	Ppb	50	1000	

Under condenser tube leak condition, the CP System shall be designed for ingress of 2000 ppb TDS in addition to the influent contaminants under Design Condition as stated above.

III. Influent water quality as indicated in the above clauses is minimum only. Bidder to check the same and higher values, if felt by them, shall be considered in the design so as to meet the specified effluent quality.

IV. The bed cross section in the service vessels shall be such that the average velocity of condensate through it shall not exceed 120 m^3/ hr./ m^2 for cylindrical service vessels & 105 m^3/ hr./ m^2 for spherical vessels, at the design flow rate. Internal diameter of the service vessels (excluding the rubber lining) of spherical type shall be selected meeting the mentioned velocity criteria. The effective depth of mixed bed in condensate polisher service vessel shall be not less than 1100 mm.

V. At the design flow rate, the pressure drop between inlet and outlet flanges of the polisher Condensate Polisher Mixed Beds with clean resin bed shall not exceed 2.0 bar (g). This pressure drop shall include losses due to entrance and exit nozzles, distributors, under drains, resins and the effluent resin traps. Maximum pressure drop under dirty conditions shall be restricted to about 3.5 bar (g) including the pressure drop across effluent resin traps.

VI. Cation resins shall be regenerated by technical grade hydrochloric acid to IS: 265 (concentration 30-33% by volume) and anion resins by sodium hydroxide, rayon grade to IS: 252 available as 48% lye. For calculations regeneration temperature should be taken as 25°C. In no case, the regeneration levels cannot be lower than the valves indicated below:

a) Cation resin: 125 kg of 100% HCl per cubic meter of resin.

b) Anion resin: 160 kg of 100% NaOH per cubic meter of resin.

VII. Rinse water outlet headers from condensate-polisher vessels shall be provided with a pressure reducing valve and orifice plate, suitably designed to enable the water entry to the condenser hot well under all operating condition of condenser. The pressure reducing station shall consist of both a pressure reducing valve from design pressure of service vessel to condenser vacuum or a combination of orifice plates to reduce pressure from design pressure of service vessel to 2 kg/cm^2 and a pressure reducing valve from 2 kg/cm^2 to condenser vacuum.

VIII. While calculating pump head, 10% margin (minimum) shall be considered of the value of friction losses. Pipe friction loss shall be calculated as per Willam-Hazen formula and "C" value to be adopted shall be as below: -

a)	Carbon Steel pipe	:	100
b)	CI pipe/ ductile Iron	:	100
c)	Rubber lines steel pipe	:	120
d)	Stainless steel pipe	:	100
e)	CPVC/ HDPE pipe	:	140

For pumps whose discharge pipes shall be running on pipe trestle/ pipe rack and traveling from one area to another area bidder to select 12 m static head while selecting the pump head. Pump recirculation with a regulating valve shall be provided for all the pumping system.

4.00.00 GUARANTEES

All the design parameters at clause no 3.00.00 of this chapter (technical details of condensate polishing plant), i.e. the effluent quality, the design flow, design service length and Pressure drop across the resin bed in clean and dirty condition at rated design flow shall be guaranteed by the Bidder. In addition to that Bidder to refer detail chapter of guarantees as specified in Sub-Section-IA, Annexure -III of this specification for the same.

5.00.00 SYSTEM REQUIREMENT

I. The regeneration process offered by the bidder, shall be of proven design and shall essentially be the same process by virtue of which the bidder is qualified and shall give resin-separation compatible with the desired effluent quality. Documentary evidence shall be submitted by the bidder to the Customer/ BHEL to establish this requirement during detailed engineering stage if required.

II. The bidder shall include inert resin in the system if they feel that it helps in better resin separation.

III. In case, after separation of resins, there are undesired contaminant resins, the bidder shall provide a system either to eliminate this cross contamination of resins or to nullify the detrimental effect of entrapped resins to the effluent quality.

IV. CP System shall operate in hydrogen cycle. The volume ratio of cation resin to anion resin shall be 2:1. A minimum total bed depth of 1100 mm for resins is envisaged for each Condensate Polisher Vessel.

V. EXCHANGE RESINS

A. The plant shall include resins for each condensate polisher service vessel & one resin charge for mixed resin storage vessel i.e. four (4) complete charges of resin. In addition to the 4 resin charges, Resin for resin injection hopper shall also be provided.by the bidder.

B. Cation-anion resin ratio shall be 2.0 parts Cation to 1.0 part anion by volume. In case the process requires any non-ionic resin the same shall represent at least 10% of the bed volume, but not less than 15 cm of the bed depth in the resin separation/ cation regeneration tank of the external regeneration facility.

C. After Separation anion resin in the cation resin shall be less than 0.1% and cation resin in the anion resin shall be less than 0.1%.

D. Deration factor of 10% for all resins shall be considered while calculating the quantity of resin to be supplied.

E. The resins used for the Condensate Polishing Unit shall be in the form of spherical beads. Cation resins shall be supplied in hydrogen form and Anion resins shall be supplied in hydroxide form. Base of the ion-exchange resins shall be a copolymer of styrene and divinyl benzene forming a macro porous or macrorecticular structure. Other details are as follows:

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F. The Cation resin shall be strong acid, with sulfonic acid functional group to be regenerated with Hydrochloric Acid. The Anion resin shall be strong base, with quaternary ammonium (Type-I) functional group to be regenerated with Sodium Hydroxide. Inert resin, if used, shall be non-ionic compatible with the above resin.

G. The resin strength and other physical properties shall be suitable to withstand the design pressures in the system. The CPU Grade resin shall be of uniform particle size quality.

H. Total wet volume ion-exchange capacities in equivalents/liter shall be based on resin supplier recommendation and shall be preferably the following:

Cation in hydrogen form: 1.7
Anion in hydroxide form: 0.8

I. The resins shall contain a minimum of metallic and organic impurities consistent with good processing. The processing procedure will include rinsing the resins with demineralized water before packing, so that further rinsing will not be required before use. Foreign objects in the resins shall constitute a basis for its rejection.

J. The resin charge shall consist of material properly selected, washed, processed and graded to provide the guaranteed capacity and life. The resin shall have adequate abrasion resistance during its guaranteed life.

K. Manufacturer: The resins selected must have been in use in Condensate Polishing Systems capable of producing water as specified or better, for a period of not less than three (3) years.

L. The resin shall be suitable for the condensate temperature that may be achieved in all operating regimes of TG cycle. However, the anion resin shall be suitable for a minimum temperature of 60 deg.C.

VI. CONDENSATE POLISHING UNITS

A. Operating pressure for service vessels shall be normal operating pressure of condensate extraction pump. Service vessel design pressure shall be equal to shut off pressure of condensate extractions pump plus 5% margin or as specified in data sheet (A) of this technical specification, whichever is higher.

B. Design temperature of the service vessel shall take care of all operating regimes including HP-LP bypass operation of TG cycle. Maximum temp. expected during all loads at CEP discharge is 60 Deg. C.

C. EMERGENCY BYPASS SYSTEM:

- Condensate polisher service unit shall be provided with an automatic bypass system for the condensate polisher on the condensate inlet and outlet headers of the unit with a set of control valve (Globe type) (1X100%) and with its isolation valves (resilient material seated, to ensure bubble-tight shut off) on the upstream and downstream sides of the control valve.

- The common inlet and outlet headers of each Polisher Vessel shall be connected to an emergency automatic bypass line. This bypass line shall include redundant differential pressure transmitters, which on a high signal shall operate an automatic valve to open, bypassing the service vessels. Automatic bypass line shall be provided with globe type control valve (of carbon steel construction with internals of SS316) and wafer type butterfly isolation valves (resilient material seated, to ensure bubble-tight shut off) on the upstream and downstream sides of the control valve. In the event of excessive pressure differential between the condensate inlet and outlet header, this control valve shall open automatically to bypass requisite quantity of condensate to prevent this pressure differential from exceeding a present limit when both vessels / one vessel / no vessel is in operation).

- In the event of pressure differential 0.35 MPa between the condensate inlet and outlet headers, the control valve will open automatically to bypass requisite quantity of condensate to prevent this pressure differential from exceeding a preset limit when two vessels, one vessel or no vessel is in operation.

- When condensate temperature exceeds 50 deg C or bypass pressure difference reaches 0.35 MPa, the bypass valve shall be 100 % opened automatically and the inlet/ outlet of the Condensate Polisher Mixed Beds shall be closed to protect elements and resins inside the polisher.

- Bidder to provide 1 x 100% control valve to achieve proper control under all operating conditions.

- The control system shall be so designed that the control valve is able to bypass 50% of rated flow when any of the service vessel is out of service & 100% when both the service vessels are out of service.

- The isolation valves shall be provided with geared operators for manual operation. The entire system shall be designed for an internal pressure of at least the design pressure of service vessels and for a maximum condensate flow of not less than total design flow of all the working service vessels.

- Complete instrumentation and controls for this system, including the differential pressure transmitters, panel mounted indicating type controller with provision for remote manual operation, actuator for the control valve with position indicator shall be provided by the bidder as part of this package. All tubing, wiring, air sets, and other fittings, required to complete the system shall also be installed by bidder.

VII. EXTERNAL REGENERATION FACILITY (REGENERATION PLANT)

The pressure vessels in the common external regeneration facility shall be provided with adequate freeboards over the top of the settled resins, to minimize resin loss during their use. Minimum freeboards to be are as follows:

- Mixed resin storage vessel : not less than 50%
- Resin separation vessel and anion resin reg. vessel : not less than 100%
- Cation regeneration vessels : not less than 100%

However, if a vessel is used for more than one service, then the vessel design shall be based on the service which gives maximum freeboard.

VIII. All equipment for dosing of acid and alkali solutions shall be rated to provide a maximum dosing rate at least 20% in excess of that required from process calculation.

IX. Mill tolerances 0.3 mm shall be considered for determining the thickness of the shells and dished ends of pressure vessels. A minimum thinning allowance of 2 mm shall be considered for the dished ends of pressure vessels. Corrosion allowance for non-rubber lined vessels shall be minimum 2 mm.

X. HOT WATER TANK (FOR ALKALI)

One (1) no. hot water tank shall be provided for regeneration system. Hot water tank for heating of alkali diluent water with (2 X 50%) electric heating coil, adequately insulated of mild steel rubber lined (suitable for temp. of 70 deg. C) (8 mm thick in 6 layers) construction shall be provided complete with integral pipe works, valves, instrumentation and all other accessories required shall be provided. The tank shall be vertical cylindrical type with dished ends and capacity of hot water tank shall be minimum 20% higher than the maximum water demand. This tank shall be provided with burn out protection, pressure relief valve, level transmitter, temperature indicator etc. The heaters shall be sized for heating the water from a temperature of 15 to 50 deg. C in 5 hours at the outlet of ejector.

XI. ACTIVATED CARBON FILTER (FOR ALKALI):

Rated flow of the filter shall not be less than the design capacity of the alkali transfer-cum recirculation pump, and the maximum velocity through the filter for this flow shall not exceed 15 meters/ hour. Depth of the filter material shall be as specified in DATASHEET –A of this specification.

The filtering medium shall be granulated activated carbon, meeting following minimum requirements.

- Total Surface area : Not less than 850 sq.m/gm.
- Bulk density : Not less than 400 kg/cu.m.

- Iodine number : 850 minimum
- Carbon content : Not less than 90%
- Moisture content : 5% (max)
- Uniformity coefficient : 1.5-1.6
- Effective Size mm : 0.8-0.9 mm
- Particle density wetted in water : 1.3-1.4 gm/cc
- Abrasion number : 70 minimum
- Ash Content : 8% maximum

Mean particle diameter shall be about 1.2-1.4 mm with following size distribution:

- On 20 mesh : Less than 3%
- Through 40 mesh : Less than 10%
- Through 50 mesh : Less than 1%

The filter shall be provided with all necessary valves and connections for manual backwashing and rinsing with demineralized water. Rate set valves shall be provided with adjustable limit stops for setting backwash and rinse rates.

XII. CONDENSATE STORAGE TANKS (NOT IN BIDDER' SCOPE) FOR CONDENSATE POLISHING PLANT

DM water required for CPU regeneration as well as resin transfer operations shall be drawn from Condensate Storage Tanks (not in bidder's scope). Bidder to consider the piping from common suction line terminal point to CPU regeneration cum resin transfer pumps and recirculation line piping from the outlet discharge line of these pumps to common recirculation line along with pneumatic/ electric actuated on –off valves, required flanges, counter flanges, fittings to regeneration cum resin transfer pumps and the same shall be in bidder's scope. Further Bidder to consider interlock (trip) of these pumps from the Pressure transmitters provided by bidder in the common suction line of CPU regeneration cum resin transfer pumps. These signals shall be also brought by Bidder to CPU DDCMIS (not in bidder's scope) for tripping and auto operation of the CPU regeneration cum resin transfer pumps for both stage regeneration systems. The arrangement shall be as per Tender P&ID of CPU and same shall be in scope of bidder.

XIII. RESIN INJECTION HOPPER

One no. resin injection hopper shall be provided by bidder. The bidder shall provide a hopper type tank for resin make-up, using water slurry, to the condensate polishing systems. This make-up system will constitute a portion of the condensate polishing external regeneration system. The resin hopper shall have a conical bottom and a flat top. The top shall have a piano type hinged port, having a lifting handle, of sufficient size for easy resin loading. The resin shall discharge through a bottom connection to a water ejector for transport. Water shall be added to the hopper to assist in the resin transfer. The ejector discharge shall be to the resin separation-cation regeneration vessel. Demineralized water shall be used throughout for the resin transfer. Piping of the resin make-up system shall be the responsibility of the Bidder as a part of the external resin regeneration system.

a) **Capacity**: The resin make-up hopper tank shall be sized to handle up to 150 liters of as received new resin per single injection.

b) **Material:** The resin make-up hopper tank shall be fabricated of mild carbon steel having a minimum thickness of 6 mm and lined.

XIV. PIPING

a) Bidder shall design, supply and erect the piping between the service units and the common external regeneration facility, for transferring the exhausted and regenerated resins as required.

b) All piping shall be laid above ground and generally laid in pipe trestles including crossing of road/ pipe/ cable trenches if any. Piping of between chemical tanks area and regeneration area etc. may be laid on pedestals if layout permits.

c) Complete supporting system for the pipeline shall be designed, fabricated and supplied by the Bidder. Inside the building, the overhead portion of the pipeline may be supported from the building structures. In outdoors, the pipeline may run on steel posts. Crossing of the roads shall be on a pipe bridge with a clear height of at least 6.1 meters over the road surface. All the steel structures of the pipe bridge and the supporting posts along with all necessary hanger, clamps, connecting steel, fixing bolts, nuts, etc. shall be supplied and erected by the bidder.

d) Routing of this pipe line shall be developed by the bidder and shall be finalized in coordination with the BHEL/Customer, based on the space available and the final layout.

e) The resin transfer pipeline arrangement shall avoid any sharp bends which cause segregation of the mixed resins, and pockets where the resins can get trapped. Suitable observation ports shall be provided in all critical areas to enable the operator to monitor completeness of the resin transfer operations. All necessary arrangements for venting and draining of the pipeline shall be provided.

f) The resin transfer pipeline shall be sized for a flow velocity of between 2.3 and 3.0 meters/ sec.

g) The condensate pipeline shall be sized for a flow velocity between 3 and 5 m/ sec.

h) Remotely operated valves suitably interlocked with the plant operation, shall ensure that the resins get transferred to and from only the particular service vessel which has been selected by the operator.

i) All lined vessel connections and connections in unlined vessels (25 Nb and larger) shall be flanged to ANSI 150 lb class (min.) except the polisher service vessels which shall be ANSI 300 lb class (minimum): flat face flanges shall be used throughout. Nozzle material shall be ASTM-106 Gr. B. Sch.80 pipe for all vessels. All flanged connections shall be supplied complete with matching counter flanges, nuts, bolts and full face gaskets. All the pipeline in service vessels area where pressure may attain same as service vessel shall be designed for 300 lb class (minimum).

j) Bidder to also the refer the detailed specification for low pressure piping for piping inside regeneration area & power cycle piping for piping inside service vessel area which is enclosed elsewhere in this specification.

XV. VALVES

a) All valves shall be designed as per applicable AWWA/IS/BS or equivalent international standard / codes.

b) The isolation valves on the resin transfer line shall be of eccentric plug type/ ball valve (full bore type) of stainless steel construction.

c) Emergency bypass control valve shall be of double flanged globe type (of carbon steel construction with internals of SS 316). Lugged wafer type butterfly manual isolation valves (resilient material seated, to ensure bubble-tight shut off) shall be provided on the upstream and downstream sides of the control valve. Isolation valve shall be provided with geared operators for manual operation.

d) Isolation valves handling Acid, Alkali, Ammonia etc. shall be diaphragm type and MOC & pressure rating shall be as per Data Sheet – A/ details indicated elsewhere in this specification.

e) Isolation Valves handling DM water shall be butterfly or gate or globe type and shall be SS316 construction. Isolation valves handling DM water can also be of diaphragm type MOC and pressure rating shall be as per the Data Sheet – A/ details indicated elsewhere in this specification.

f) Non-return valves for DM Water shall be of SS316 construction and for acid & alkali, non-return valve

shall be of CPVC PN10/ 150 class (min).

g) All valves in service vessels area where pressure may attain same as service vessel shall be designed for 300 lb class (minimum).

h) MOC of butterfly valve at inlet of service vessel Body- CS, Disc/ internals- SS-316 and outlet of service vessel Body – SS-316, disc- SS-316. Rinse recirculation and Rinse line valve will be of MOC: Body – SS-316, disc/ internals- SS-316.

i) MOC of globe type control valve in the bypass line, Body- CS, Internals- SS-316.

XVI. PRESSURE VESSELS, ATMOSPHERIC TANKS & MISCELLANEOUS ITEMS

a) Design pressure of the condensate Polisher Service Vessels shall be as indicated in the data sheet. For all other pressure vessels, unless otherwise mentioned design pressure shall be the maximum expected pressure to which the vessel may be subjected plus 5% extra margin. Maximum expected pressure for vessels placed in the discharge line of pumps shall be based on the shut-off head of the pumps plus static head at pump suction or 10 kg/cm2 (g) whichever is maximum).

b) All pressure vessels shall be designed and constructed in strictly in accordance with the ASME code Section VIII Div.-I /IS-2825 or acceptable equivalent international standard.

c) All pressure vessels shall be fabricated from carbon steel plates as per SA-515 Gr. 60/ 70 or SA-516 Gr. 60/ 70 and lined internally.

d) Lining used shall be natural rubber having a shore durometer reading of 65 ± 5 Shore ‘A’ as per IS 4682 Part I.

e) The lining shall be applied in three layers, resulting in a total thickness of not less than 4.5 mm anywhere on the internal surfaces of the vessels. The lining shall extend over the full face of all flanged connections and shall have a minimum thickness of 3 mm in all such external areas.

f) Design of all vertical cylindrical atmospheric storage tanks containing water, acid, alkali and other chemicals shall conform to IS: 803.

g) Design of all horizontal cylindrical storage tanks containing water, acid, alkali and other chemicals shall conform to BS EN12285-2:2005.

h) Unless otherwise mentioned design temperature of all pressure vessels and storage tanks shall be 10 deg.C higher than the maximum temperature that any part of the vessel/tank is likely to attain during operation.

i) In case, tank is subjected to vacuum, the same shall be taken care in designing the tank.

j) The design of Demineralized water storage tanks (Vertical type) shall conform to IS: 803. Supporting frame where required shall be in accordance with IS: 800. The tank shall be ‘‘Non-pressure’’ fixed roof type with atmospheric vents.

k) CPU service vessels of spherical shape is acceptable only.

l) All vessels/ tanks without inside rubber lining shall have a corrosion allowance of minimum 2 mm and mill allowance (minimum 0.3 mm) for shell and dished ends. Thinning allowance of 2 mm (minimum) shall be considered for dished end of all type.

m) All the atmospheric tanks shall have sufficient free board above the ''Level High / Normal Level'' as the case may be. The overflow level shall be kept at least 30 cm or 10% of vessel height above the ''Level High /Normal Level'' for all the tank. Further, a minimum 100 mm free board shall be provided above the top of overflow level to the top of tank.

XVII. MATERIAL

- All pressure vessels shall be designed and constructed in strict accordance with the ASME code Section VIII or acceptable equivalent international standard. Suitable mill tolerances shall be considered for determining the thickness of the shells and dished ends. A minimum thinning allowance of 2 mm shall be considered for the dished ends of torishpherical type.

- Pressure vessel ends shall be of dished design and constructed by forging, pressing or spinning process. Spherical vessels for CPU service vessels are acceptable. Conical or flat ends shall not be accepted. All the atmospheric vessels shall be at least 6 mm thickness.

- All pressure vessels shall be fabricated from carbon steel plates as specified in DATASHEET-A and lined internally. The lining shall be of rubber having a hardness of 65 plus/minus 5 shore -A meeting the requirements of IS: 4682, Part-I. The lining shall be applied in three layers, resulting in a total thickness of not less than 4.5 mm anywhere on the internal surfaces of the vessels. The lining shall extend over the full face of all flanged connections and shall have a minimum thickness of 3 mm in all such external areas.

XVIII. VESSEL INTERNALS REQUIREMENTS:

Vessel internal shall meet the following requirements:

- Inlet water and under drains distributor: - Hub and internals diffuser splash plate or header and perforated laterals. Material of construction shall be SS-316 except for acid service which will be of suitable material as per process requirement and proven practice.

- Under drains: The under drain system shall be provided with screened laterals with internal perforated pipes and rubber lined flat bottom. For resin separation/regeneration/mixed resin vessels, it may have fully screened bottom (NEVA - clog type with pora-septanurese screen, fully supported by subway grid or equal) /Fasteners.

- All internal fasteners shall be of SS-316 and heavy duty locknuts shall be used throughout.

XIX. RESIN TRAP & CARBON TRAP:

Resin Traps: Outlet of each condensate polisher vessel, activated carbon filter and waste effluent header of the common regeneration shall be provided with a resin trap. Pressure drop at design flow through a clean resin trap shall not exceed 0.35 kg/ sq.cm. Resin trap housing shall be of rubber lined steel construction for regeneration area & Housing MOC shall be SS316 provided at the outlet of each condensate polisher vessel and for internals (cord & screen) shall be of JOHNSON SCREENS IRELAND or equivalent (SS-316) construction. Resin traps of process effluent line shall have screen opening not exceeding 120 percent of associated process vessel under drain screen opening. Other resin traps shall have screen opening of 60 mesh. In place manual back flushing shall be provided for all resin traps.

Carbon Trap (for ACF): Outlet of each Activated Carbon filler on Carbon trap (media trap) shall be provided. MOC of carbon trap Housing shall be SS316 and for internals (cord & screen) MOC shall be SS-316.

6.00.00 OPERATION & CONTROL PHILOSOPHY OF CPU PLANT

The control & operation for the Condensate Polishing Unit shall be through DDCMIS.

The CP System, shall be operated from OWS placed in Service Area Remote IO panel room, which is to be located indoor in the vicinity of Condensate Polisher Vessels. The control of the CP System i.e. service and standby status of Polisher Vessels as well as Resin Transfer from Condensate Polisher Mixed Beds to Regeneration Area and vice versa will be achieved through service vessel OWS. From OWS, the operation of

CP SYSTEM in either AUTO MODE or REMOTE MANUAL MODE shall be possible. Operation from this OWS can only be undertaken under authorization from Regeneration Area Control room.

Service vessel OWS shall show the operating mode of each Condensate Polisher Mixed Bed (in service, on standby, resin transfer, rinsing down etc.), the position of all automatic valves, operating parameters (such as flow conductivity, silica levels, differential pressure etc.) and alarm conditions. A soft mimic diagram shall be implemented on OWS. Status of various valves shall also be indicated on this OWS.

Facility to control the CP System from the Regeneration Area Control room shall also be provided.

The regeneration of ion-exchange resins of CP System shall be carried out from Regeneration Area - remote node of Unit DCS to be located in the Unit#5 Regeneration Control Room. From Regeneration Area – DCS node, the regeneration of CP SYSTEM in either AUTO MODE or REMOTE MANUAL MODE shall be possible.

The control for the external regeneration system shall be from the DCS node based OWS located in a separate Control Room at Regeneration Area. This OWS shall clearly show the status of each concerned Condensate Polisher Mixed Bed. This DCS mode shall be interlocked with the local control panel of Condensate Polisher Mixed Beds [Service Area-RIO panel]. This OWS will provide a manually initiated automatic sequence for physical cleaning and chemical regeneration of the resins and show the status of the cycle at all times. This OWS shall also contain all controls and accessories for the acid and alkali solution preparation and dosing system. The regeneration OWS shall also control the sequences of Resin Transfer - i.e. to transfer resin from the Condensate Polisher Mixed Bed to the external regeneration facility and to receive freshly regenerated resin from the regeneration facility - this involves depressurization of the Condensate Polisher Mixed Bed, water sluicing of exhausted resins to the regeneration system, draining the Condensate Polisher Mixed Bed to the condenser Hotwell, receiving a water slurry of fresh resin from the regeneration system and finally completely filling the vessel with condensate.

One remote node of Unit DCS shall be located in the regeneration area, with PC based workstation. Remote I/O unit interfaced with the remote DCS node at regeneration area shall be provided in the Service Area for control operation of the Condensate Polisher Mixed Beds.

I. CONDENSATE POLISHER MIXED BED OPERATION

Service flow rate for each Condensate Polisher Mixed Bed shall be monitored by flow transmitters. During periods of low condensate flow the operator may select to remove one of the vessels from service by a manually initiated automatic sequence. Redundant differential pressure transmitters installed between the influent and effluent headers will on a high signal cause an annunciator alarm. By observing the individual vessel flow indicators, or conductivity at vessel outlet the operator can determine which vessel is contributing most to the pressure drop and is in need of resin cleaning/ regeneration.

A manually initiated automatic sequence for physical cleaning and chemical regeneration of the resins shall be provided.

The common inlet and outlet headers of each Polisher Vessel shall be connected to an emergency automatic bypass line. This bypass line shall include redundant differential pressure transmitters, which on a high signal shall operate an automatic valve to open, bypassing the service vessels. In the event of excessive pressure differential between the condensate inlet and outlet header, this control valve shall open automatically to bypass requisite quantity of condensate to prevent this pressure differential from exceeding a pre-set limit when both vessels/ one vessel/ no vessel is in operation.

Rack mounted conductivity indicators shall monitor the polishing system influent and effluent streams as well as the discharge of each Condensate Polisher Mixed Bed. A high influent conductivity annunciator alarm will alert the plant operator that a problem condition such as air or condenser cooling water leakage has occurred. This conductivity analyser shall also provide contacts for an alarm at the power station main control room. A high

conductivity annunciator alarm on outlet of each Condensate Polisher Mixed Bed will alert the operator to the need for regeneration of a Condensate Polisher Mixed Bed.

Condensate Polisher Mixed Bed shall be automatically placed in service following initiation from OWS. The automatic sequence shall include steps for pressurization of the Condensate Polisher Mixed Bed, a pre-service rinse and placing in service.

The pre-service rinse shall be time controlled. If the conductivity of the Condensate Polisher Mixed Bed effluent is not acceptable at the end of the pre-service rinse, a rinse overtime alarm shall be sounded and the pre-service rinse continued for a second timed period. If an acceptable Condensate Polisher Mixed Bed effluent is not reached by the end of the second pre-service rinse, a pre-service rinse failure alarm shall be sounded and the vessel shall be automatically returned to standby. If acceptable conductivity at outlet of Condensate Polisher Mixed Bed is attained at the end of the first rinse or during the second rinse, the vessel shall automatically be placed in service. Interlocks shall be provided to prevent placing a vessel into the service mode while resin is being transferred.

The rinse recycle shall be manually initiated full automatic sequence. This sequence shall include a rinse down step using condensate at a rate of 0.4 to 0.6 m3/min/m2 until effluent quality is acceptable for boiler feed water. The effluent quality shall be determined by conductivity monitoring of the rinse water outlet, which is for recycle. A panel mounted conductivity indicator shall be interlocked to prevent advancing of the automatic sequence until the rinse down is complete.

Exhaustion of a Condensate Polisher Mixed Bed shall be annunciated by any of the following:

a) High differential pressure across the polisher vessel/ Vessels.
b) High effluent conductivity from an operating vessel.
c) High effluent silica from an operating vessel.
d) Pre-set volume of condensate treated in an operating vessel.

When the differential pressure across the Condensate Polisher Mixed Bed header reaches the high set point level an alarm shall sound and by pass valve shall be automatically opened by a signal from the control system.

The alarms for a Condensate Polisher Mixed Bed shall be disabled when the Condensate Polisher Mixed Bed is not in service or pre-service rinse.

II. RESIN TRANSFER MODE

The sequence for resin Transfer from Condensate Polisher Mixed Bed to Regeneration Vessel and Resin Transfer from Regeneration Vessel to Condensate Polisher Mixed Bed shall be initiated from service vessel area OWS but shall be controlled by Remote processing unit of DCS in the Regeneration Control panel.

Manually initiated automatic sequences shall be provided for transferring resin from a Condensate Polisher Mixed Bed to the remote regeneration facility for physical cleaning and chemical regeneration and for returning fresh resin to that Condensate Polisher Mixed Bed.

The transfer of resin from the Condensate Polisher Mixed Bed shall include isolation of the Condensate Polisher Mixed Bed, hydraulic transfer of the resin to the external regeneration.

The return of fresh resin to the empty Condensate Polisher Mixed Bed shall include the hydraulic transfer from the resin storage vessel of the external regeneration system using demineralized water. After receiving fresh resin, the Condensate Polisher Mixed Bed will remain in the 'Off' position until returned to service by the operator.

Resin transfer from a Condensate Polisher Mixed Bed to the regeneration vessel shall be automatic following initiation from OWS of service vessel area.

The resin transfer sequence shall be interlocked to prevent resin transfer in any of the following situations:

a) Unsuccessful completion of a previous chemical regeneration of physical cleaning sequence in the external regeneration system.
b) The Condensate Polisher Mixed Bed condensate inlet and outlet valves not closed.
c) High pressure in the polisher Condensate Polisher Mixed Bed.

Note: Bidder to note that for complete control & operation of the CPU plant bidder to also refer the respective Control & Instrumentation (Sub -Section IC & IIC) & Electrical (Sub-Section IB & IIB).

ANNEXURE - I

QUALITY PLANS

SECTION-VIII

QUALITY ASSURANCE REQUIREMENTS

1.00.00 **QUALITY ASSURANCE PROGRAMME**

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

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

b) Documentation control system.

c) Qualification data for Bidder's key personnel.

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

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

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

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

h) Control of calibration and testing of measuring and testing equipments.

i) System for quality audit.

j) System for indication and appraisal of inspection status.

k) System for authorising release of manufactured product to the Owner.

l) System for handling storage and delivery.

m) System for maintenance of records.

n) 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 as per format enclosed at Annexure-A to this section.

2.00.00 **GENERAL REQUIREMENTS - QUALITY ASSURANCE**

2.01.00 All materials, components and equipment covered under this specification shall be procured, manufactured and tested at all the stages, as well as Services provided for erection, commissioning and testing shall be as per a comprehensive Quality Assurance Programme. An indicative programme of inspection/tests to be carried out by the Bidder 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 Bidder's responsibility to draw up and implement such programme and reviewed by by the Owner/Consultant. The detailed Quality Plans for manufacturing and field activities should be drawn up by the Bidder, separately in the format attached at Annexure-I and will be submitted to Owner/Owner’s representative for review. Schedule of finalisation of such quality plans will be finalised before award.

2.02.00 Manufacturing Quality Plan will 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 Bidder'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.

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

2.04.00 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. will be subject to Consultant's approval without which manufacture shall not proceed. In these approved quality plans, Owner/Authorised representative/Consultant shall identify Customer Hold Points (CHP), test/checks which shall be carried out in presence of the Owner/Consultant/Owners Owner’s Engineer or his Authorised Representative and beyond which the work will not proceed without consent of Owner/Authorised representative/Consultant in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Owner/Authorised Representative/Consultant for acceptance and dispositioning.

2.05.00 The Bidder shall provide adequate notice to the Owner for inspection before the material is dispatched as per the provisions of the Contract. No material shall be despatched from the manufacturer's works before the same is accepted subsequent to pre-despatch final inspection including verification of records of

all previous tests/inspections by Owner's Owner's Engineer/Authorised representative, and duly authorised for despatch issuance of Material Despatch Clearance Certificate (MDCC).

2.06.00 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.

2.07.00 All the individual and assembled rotating parts shall be statically and dynamically balanced in the works.

Where accurate alignment is necessary for component parts of machinery normally assembled on site, the Bidder shall allow for trial assembly prior to despatch from place of manufacture.

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

2.09.00 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 Bidder's/Sub-Vendor'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.

Under no circumstances any repair or welding of castings be carried out without the consent of the Owner. Proof of the effectiveness of each repair by radiographic and/or other non-destructive testing technique, shall be provided to the Owner.

All pressure parts shall be subjected to hydraulic testing as per the requirements of IBR. Other parts shall be tested for one and half times the maximum operating pressure, for a period not less than thirty (30) minutes.

2.10.00 All non-destructive examination (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). Results of NDT shall be properly recorded and submitted for acceptance.

All welding procedures adopted for performing welding work shall be qualified in accordance with the requirements of Section-IX of ASME code or IBR as applicable. All welded joints for pressure parts shall be tested by liquid

penetrant examination according to the method outlined in ASME Boiler and Pressure Vessel code. Radiography, magnetic particle examination and ultrasonic testing shall be employed wherever necessary/ recommended by the applicable code. At least 10% of all major butt welding joints shall be radiographed. Statutory payments in respect of IBR approvals including inspection shall be made by Bidder. Bidder's scope and responsibility shall also include preparation and submission of all necessary documents in the specific formats and manner stipulated by the statutory bodies, coordination and follow up for above approvals.

2.11.00 All the Sub-Vendors proposed by the Bidder for procurement of major bought out items including castings, forgings, semi-finished and finished components/equipment list of which shall be drawn up by the Bidder and finalised with the Owner shall be subject to Owner's review. Quality Plans of the successful Sub-Vendors shall be discussed, finalised and accepted by the Owner/Authorised representative and form part of the Purchase Order between the Bidder and the Sub-Vendor.

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

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

Quality audit/acceptance 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 Bidder in earning satisfactory performance of equipment as per specification.

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

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

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

3.00.00 QUALITY ASSURANCE DOCUMENTS

3.01.00 The Bidder shall be required to submit two (2) copies and two (2) sets of microfilms of the following Quality Assurance documents within three (3) weeks after despatch of the equipment:

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

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

c) Non-destructive examination results /reports including radiography interpretation reports.

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

e) Welder identification list listing welder's and welding operator's qualification procedure and welding identification symbols.

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

g) Stress relief time temperature charts.

h) Inspection reports duly signed by QA personnel of the Owner and Bidder for the agreed inspection hold points. During the course of inspection, the following will also be recorded :

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

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

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

4.00.00 **INSPECTION, TESTING AND INSPECTION CERTIFICATES**

4.01.00 The Successful Bidder shall give the Owner’s Engineer/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Successful Bidder's account except for the expenses of the Inspector. The Owner’s Engineer/Inspector, unless the witnessing of the tests is virtually waived, will attend such tests within fifteen (15) days of the date on which the equipment is notified as being ready for test/inspection failing which the Successful Bidder may proceed with test which shall be deemed to have been made in the Inspector's presence and he shall forthwith forward to the Inspector duly certified copies of test reports in six (6) copies.

4.02.00 The Owner’s Engineer or Inspector shall within fifteen (15) days from the date of Inspection as defined herein give notice in writing to the Successful Bidder, or any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Successful Bidder shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall confirm in writing to the Owner’s Engineer/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.

4.03.00 When the factory tests have been completed at the Bidder's or sub-Vendor's works, the Owner/Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests but if the tests are not witnessed by the Owner/ Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Bidder's test certificate by the Owner/Inspector. Failure of the Owner/Inspector to issue such a certificate shall not prevent the Bidder from proceeding with the works. The completion of these tests, or the issue of the certificates shall not bind the Owner to accept the equipment should it, on further tests after erection be found not to comply with the contract.

4.04.00 The Bidder shall furnish quarterly inspection programme indicating schedule dates of inspection at customer hold point and final inspection stages. Updated quarterly inspection plans will be made for each three consecutive months and shall be furnished before beginning of each calendar month.

FORMAT OF QUALITY ASSURANCE PROGRAMME

Name of Company / Successful Bidder	NAME OF CONTRACT PACKAGE			QUALITY PLAN FOR						
	Package No. : _____ Contractorr : _____			QP No. : _____ Date _____ Rev.No.: _____ Date _____						
Sl. No.	Component & Operation	Characteristics	Class	Type of Check	Quantum of Check	Reference Document	Acceptance Norm	Format of Record	Agency	Remarks

TITLE: 1 X 660 MW SAGARDIGHI TPS UNIT NO.5 PHASE III	SPECIFICATION NO. PE-TS-445-155A-A001	
	SECTION : I	
TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT	**SUB-SECTION: IA**	
	REV. NO. 01	DATE : 13.07.2021

CONDENSATE POLISHING UNITS

Items / Components \ Tests/Check		Material Test	WPS/PQR/Welder Qualification	DPT/MPI	Assembly Fit up	Dimension	RT	Hydraulic #/ Water Fill	Performance Test	Test as per relevant Standard/ Approved Data Sheets	Other Tests
1.	**HORIZONTAL CENTRIFUGAL PUMPS**				Y	Y			Y^1	Y	
1.1.	Casing	Y^a		Y^b				Y			
1.2.	Impeller	Y^a		Y^b							Y^d
1.3.	Shaft	Y^a		Y						Y^c	
2.	**VERTICAL PUMPS**				Y	Y			Y^1	Y	
2.1.	Casing	Y^a		Y^b				Y			
2.2.	Impeller	Y^a		Y^b							Y^d
2.3.	Shaft	Y^a		Y						Y^c	
2.4.	Fabricated Parts	Y^a	Y	Y^b			Y^2	Y			
3.	**DOSING/ METERING PUMPS**	Y^a						Y	Y^1	Y	
4.	**GATE/ GLOBE/ CHECK VALVES**	Y^a		Y^b		Y		Y	Y	Y	Y^b
5.	**DIAPHRAGM VALVES**	Y^a				Y		Y^3		Y	Y^a
6.	**BUTTERFLY VALVES (LOW PR.)**				Y	Y		Y^3	Y		
6.1	Body (Cast)	Y^a		Y^b							
6.2	Disc (Cast)	Y^a		Y^b							
6.3	Shaft	Y^a		Y^b							Y^c
7.	**PLUG/ BALL VALVES (LOW PR.)**	Y^a		Y^b	Y	Y		Y	Y	Y	
8.	**BLOWERS**	Y^a		Y^b	Y	Y		Y	Y	Y	Y^{dc}
9.	**ATMOSPHERIC STORAGE TANKS/ PRESURE VESSELS**	Y^a	Y	Y^b	Y	Y	Y^5	Y		Y^c	Y^7

LEGENDS:

Y	As Applicable
Y^a	One per Heat/Heat Treatment batch./Lot
Y^b	On machined surfaces only. Also 100% on Butt Welds & 10% on Fillet Welds.
Y^c	UT shall be done for shafts with Diameter 50 mm or above & Plates of Thickness 20 mm or above.
Y^d	Dynamic Balancing per ISO: 1940, Grade 6.3 minimum.
Y^1	As per HIS, USA. / API 598 (In case of Metering Pump)
Y^2	10% RT to be conducted on butt welds for plate Thickness ≥10 mm.
Y^3	Seat Leakage Test for actuator operated valves shall be done by closing the valve with job actuator.
Y^4	Tests on Rubber Diaphragms per batch of Rubber mix such as Tensile, Elongation, Hardness, Thickness, Bleed Resistance, Flex Test for 1500 cycles etc. shall be conducted. In addition, Type Test for 50,000 cycles for each type of diaphragm shall also be conducted, if not carried out earlier.
Y^6	Blue Matching, Wear Travel for Gate Valves, reduced pressure test for check valves shall be conducted per relevant standards.

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	TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT	**SUB-SECTION: IA**	
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Items / Components \ Tests/Check		Material Test	WPS/PQR/Welder Qualification	DPT/MPI	Assembly Fit up	Dimension	RT	Hydraulic / Water Fill	Performance Test	Test as per relevant Standard/ Approved Data Sheets	Other Tests	Remarks	
10.	**RUBBER LINING**	Y[a]				Y				Y	Y[10]	Y[7]	Heat Treatment of the Tank/Vessel shall be done per fabrication code requirement. Dished ends shall be stress relieved.
11.	**BUTTERFLY VALVES (HP)**	Y[a]			Y	Y		Y	Y				
12.	**BALL VALVES (HP)**	Y[a]			Y	Y		Y	Y				
13.	**RESINS/ ACTIVATED CARBON**	Y[a]				Y				Y		Y[8]	RT as per fabrication code requirements. Dished end, if fabricated by butt welding of two plates or more then that butt weld joint(s) shall be subjected to 100% RT.
14.	**AGITATORS**	Y[a]	Y	Y[b]	Y	Y			Y		Y[11]		
15.	**PIPING**	Y[a]	Y	Y[b]	Y	Y		Y[12]		Y			
16.	**VENTILLATION/ EXHAUST FAN**	Y[a]		Y[b]	Y	Y			Y[13]	Y	Y[d], Y[c]	Y[9]	100% RT shall be carried out on butt weld joints coming under tension load and 25% RT shall be carried out on butt weld joints coming under compression load. In case rope drum & brake drum are fabricated then 100% RT shall be carried out on longitudinal & circumferential weld joints.
17.	**DUAL PLATE CHECK VALVE**	Y[a]		Y[b]		Y		Y	Y	Y	Y[14]		
18.	**HOISTS & CRANES**	Y[a]	Y	Y[b]	Y	Y	Y[g]		Y	Y			

Y[10]	Rubber Lining Mix shall be subjected to Bleed Resistance Test on moulded sample. Adhesion, Spark and Hardness Test for the Rubber lined jobs shall also be conducted.
Y[11]	Gear Boxes shall be checked for smooth No Load Operation at shop to verify noise and vibration levels. Gear Ratio and Kerosene Leak Test shall also be conducted.
Y[12]	After erection, the complete Piping system alongwith valves & fittings shall be hydrostatically tested at 1.5 times the design pressure or 2 times the working pressure which ever is higher.
Y[13]	One Fan of each type & size shall be routine performance tested as per corresponding code fir air flow, static pressure, total pressure, speed, efficiency, power consumption, noise & temperature rise. Also all Fans shall be subjected to run test of 4 hours during which noise, vibration, temperature rise and current drawn shall be measured.
Y[14]	Blue Matching for metal to metal contact, reduced pressure test for check valves shall be conducted per relevant standards. Dry cycle test on valve spring for 1, 00,000 cycles shall be carried out as type test, if not carried out earlier, for the similar MOC, size and type of spring.
#	For valves, Hydraulic test includes body and seat leakage, back seat test, disc strength test etc. as per applicable code.

Notes:

1) Inspection/ test/ check requirements for pressure vessels other than service vessel are same as for inspection/ test/ check requirements for service vessel as indicated in table given above.

	TITLE: **1 X 660 MW SAGARDIGHI TPS UNIT NO.5 PHASE III**	SPECIFICATION NO. PE-TS-445-155A-A001	
		SECTION : I	
	TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT	**SUB-SECTION: IA**	
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2) 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.

	TITLE: **1 X 660 MW SAGARDIGHI TPS UNIT NO. 5 PHASE III**	SPECIFICATION NO. PE-TS-445-155A-A001	
		SECTION : I	
	TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT	**SUB-SECTION: IA**	
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QAP FOR LOW PRESSURE PIPING (LP PIPING)

	TITLE: 1 X 660 MW SAGARDIGHI TPS UNIT NO. 5 PHASE III	SPECIFICATION NO. PE-TS-445-155A-A001	
		SECTION : I	
	TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT	**SUB-SECTION: IA**	
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CLAUSE NO.	QUALITY ASSURANCE

L P PIPING

PIPES, FITTINGS, BENDS, VALVES, COATING-WRAPPING, STRAINERS EXPANSION, JOINTS, TANKS, HANGERS & SUPPORTS, FASTENERS, LINING ETC.

	Tests/Check / Items / Components	Material Test	DPT/MPI / RT	Ultrasonic Test	WPS/ WQS/PQR	Hydraulic / Water Fill Test	Pneumatic Test	Assembly Fit up	Dimensions	Functional/operational Test	Other Tests	All Tests as per relevant Std	REMARKS
1	Pipes & Fittings and Mitre Bends	Y[a]	Y[b]		Y	Y			Y		Y[15]		
2	Diaphragm Valves	Y[a]				Y[5]			Y		Y[6]		
3A	Cast Butterfly Valves (Low Pressure)					Y		Y	Y	Y	Y[7]		
	Body	Y[a]	Y[b]										
	Disc	Y[a]	Y[b]										
	Shaft	Y[a]	Y	Y[c]									
3B	Fabricated Butterfly Valves	REFER NOTE 14											
4	Gate/ Globe/Swing Check / Ball Valves	Y[a]	Y[b]	Y[c]		Y[5]	Y	Y	Y	Y	Y[8]		
5	Dual Plate Check Valves	Y[a]	Y[b]	Y[c]		Y	Y	Y	Y	Y	Y[4]		
6	Rolled & Welded Pipes	Y[a]	Y[3]		Y[3]	Y[1]			Y		Y[3]		
7	Coating & Wrapping of Pipes	Y[2]									Y[2]		
8	Tanks & Vessels	Y[a]	Y[b]		Y	Y			Y		Y[16]		
9	Strainers	Y[a]	Y[b]		Y#	Y					Y[11]		#For Fabricated Strainer
10	Rubber Expansion Joints	Y[a]				Y[12]		Y	Y		Y[13]		
11	Internal Lining of Pipes	Y[a]							Y		Y[9]		
12	Hangers & Supports	Y[a]							Y				
13	Site Welding		Y[10]		Y	Y							

	NOTES (MEANING OF SUPERSCRIPTS)
a	One per heat/heat treatment batch/lot.
b	On machined surfaces only for castings and on butt welds.
c	For shaft/spindles > or = 50 mm
1	Weld Joints not subjected to hydraulic test shall be subjected to 100% RT.
2	Spark Test, Adhesion Test and Material Test for primer and enameled & Coal Tar Tapes as per AWWA-C-203-91/ IS-10221/IS 15337 as applicable.
3	Followings are the testing requirements for fabrication of pipes at site

	TESTS	**QUANTUM OF CHECKS**
	WPS, PQR, Welder Qualification Test	100%
	DPT on root run	100% for pipes up to 1200 mm diameter
	DPT after back gauging	100% for pipes above 1200 mm diameter

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	RT (For insitu field joints)	5% (For pipes diameter ≥ 1200mm)
	DPT on finished butt weld joints	10%
	Hydraulic Test	100%, 1.5 times the design pressure or 2 times the working-pressure whichever is higher.
4	Dry Cycle Test on Dual Plate Check valve spring for one lakh Cycles shall be carried out as a type test.	
5	Seat Leakage Test for Actuator Operated Valves, shall be done with by closing the valves with actuator.	
6	Tests on rubber parts per batch of rubber mix such as hardness, adhesion, spark test, bleed test and flex test on diaphragm, type test for diaphragm for 50,000 cycles.	
7	Hydraulic Test of Body, Seat and disc-strength shall be carried out in accordance with governing design standard in presence of owner's representatives. Actuator operated valves shall be checked for Seat Leakage by closing the valves with actuator. Seat Leakage Test shall be carried out in both directions. For Proof of Design Test refer respective chapters of engineering portion in the technical specification	
8	Blue matching, wear travel for gates, valves, pneumatic seat leakage, and reduced pressure test for check valves shall be done as per relevant standard. Maximum allowable vacuum loss is 0.5 mm of Hg abs. for valves to be tested for vacuum operation for internal pressure 25 mm of Hg abs. for a period of 15 minutes. Fire safe test for ball valve shall be done wherever specified. Valves shall be offered for hydro test in unpainted condition.	
9	Tensile, Elongation, Hardness, Specific Gravity, Lining Thickness, Humidity Check, Pipe temperature check, Adhesion Test and Holiday Detection Test etc as per applicable standard shall be done for all lining material and application.	
10	10% of welds (Root and finished welds) shall be subjected to DPT.(100% DPT for compressed air line and boiler & deaerator fill line.)	
11	Pressure drop across the strainer for each type and size as a special test shall be carried out. In case of already carried out, the test report shall be submitted for review and acceptance by NTPC Engineering.	
12	During hydraulic and vacuum tests at 25mm Hg abs in 3 positions, the change in the circumference of arch should not be more than 1.5%. 24 hrs after the test permanent set in dimension should not exceed 0.5%.	
13	Tests on rubber for tensile, elongation, hardness, hydraulic stability check as per ASTM D 471, ozone resistance test as per ASTM D 1149 aging test and adhesion strength of rubber to fabric, rubber to metal adhesion shall be carried out.	
14	In addition of all tests as indicated for Cast Butter Fly valve being applicable for fabricated butterfly valves, following test shall be done for Fabricated Butter Fly Valve: a. UT as per ASTM A-435 on plate material for body and disc shall be carried out for plate thickness 20mm and above. b. 100% RT and DPT as per ASTM, Section-VIII, Division-I, on butt joins of body and disc. 10% DPT on other welds shall be done. c. Post weld heat treatment as per ASME, Section-VIII, Division-I on butt joints of body and disc. d. Welders and WPS shall be qualified as per ASME- section IX	
15	Segmental Flanges exceeding 37.5 mm thickness shall be stress relieved after welding. All butt weld joints in segmental flange shall be examined by Radiographic Test. Maximum number of segments shall be 4 only.	
16	For pressure vessel welds RT shall be done as per design code requirements.	

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QA REQUIREMENTS FOR GRP PIPES

Following tests / inspections to be carried out on the finished pipes as per relevant IS/ AWWA/ ASTM standard:

A. Pipes produced are subject to following control checks on 100% basis;
1. Visual Inspection for workmanship, marking, visual defect etc.
2. BARCOL Hardness
3. Dimension
   - Inside Diameter
   - Outside Diameter
   - Wall Thickness
   - Squareness of Pipe ends
   - Length of Pipes
4. Hydrostatic Leak Tightness to be carried out as per clause no 12.00.00 of tech Spec Section- VI Part-B , sub section –III A01 page 8 of 8 for one minute minimum.

B. Following control checks to be performed on representative samples (minimum one sample / 100 pipes for each type, size, grade etc) taken from finished product of each class and size on a random basis;

1. Pipe Stiffness
2. Ring Deflection Test without damage/ structural failure for level A and B.
3. Hoop Tensile strength
4. Axial/ longitudinal Tensile Strength
5. Beam Strength Test

C. Couplings – Hydrostatic leak tightness on coupling shall be done.

D. If GRP pipes are used for Carrying Potable water, Pipe specimen shall be subject to following additional test as specified in order to establish the suitability of GRP pipes for carrying Potable water:

1. Smell of extract
2. Clarity of colour of the extract
3. Acidity and Alkalinity
4. Global migration
5. UV absorbing material
6. Heavy metals
7. Biological tests
8. Un-reacted monomers

QAP FOR POWER CYCLE PIPING IN CPU SERVICE VESSEL AREA

CLAUSE NO.	QUALITY ASSURANCE
	POWER CYCLE PIPING
1.00.00	**H.P.PIPING FOR STEAM GENERATOR AND TURBINE GENERATOR & AUX.**
1.01.00	**Piping:**

(a) All raw materials used shall have co-related mill test certificate meeting material specification.

All tests, as given in respective material code (other than supplementary requirements), shall be carried out as minimum. This includes the tests wherein it is specified in the ASTM code that "the test is to be carried out when specified by the purchaser" or any such indication, in the code

(b) All pipe lengths under this package, including piping where alloy steel is used shall be subjected to 100 % ultrasonic examination as per material specification standard with acceptable notch depth of 5% of the selected wall thickness (1.5mm maximum) except for the following piping system:

DOWN STREAM OF AUX. PRDS (where carbon steel is used) and aux. steam piping system (station HDR, unit HDR, interconnection) where notch depth of 12.5% of the selected wall thickness (1.5mm maximum) will be adhered to.

(c) The edge preparation for shop and site welds in stainless steel /alloy steel shall be subjected to a dye penetrate check.

(d) Pipe bend shall be checked for ovality and thinning by ultrasonic or other acceptable methods on first off lot & on random samples for subsequent pieces for high pressure applications. Outer surface of bends shall be subjected to magnetic particle examination/LPI.

(e) Non-destructive examination of welds shall be carried out after post weld heat treatment, if any.

(f) All butt welds in alloy steel piping of P-91, X -20 , X-22 & material P-5B group & above shall be checked for RT/ UT & MPI after SR.

(g) For welds in P91, X20 & X22 and material P5B group & above Materials requiring heat treatment, induction type of heating shall be deployed for post weld heat treatment, or heat treatment can be carried out in furnace.

(h) Non-destructive examination of welds shall be carried out in accordance with the relevant design/manufacturing codes. However, as a minimum, the following requirements shall be met. Further statutory requirement, wherever applicable shall also be complied with.

(1) Temperature > 400 Deg, C or pressure exceeding 71 bar.

(i) 100% RT/UT on butt welds and full penetration branch welds.

(ii) 100% MPE.

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	(2) Temperature > 175 Deg, C upto 400 Deg. C or pressure exceeding 17 bar and upto 71 bar. (i) 100% RT/UT on butt welds and full penetration branch welds for pipe dia. more than 100 NB. (ii) 10% RT/UT on butt welds and full penetration branch for pipe dia upto 100NB. (iii) 100% MPE. (3) For all other pipes not covered above, shall be subjected 100% MPE/ DPT in case of under ground pipes and 10% MPE/DPT in case of piping above the ground. Further, 10% of butt welds of underground piping shall be subjected to RT. (i) Wherever SR/PWHT is envisaged for alloy steel, above NDTs shall be after SR/PWHT. (j) Hardness survey of welds shall be carried out on alloy steel/stainless steel piping (100% Hardness survey of welds on P91, X20 & X22 & above material grade of P5B above piping) and 3% hardness survey on welds of other alloy steel).
1.02.00	**Fittings :** (a) Raw material of all forged/formed fitting shall be ultrasonically tested. All mother pipes used for fitting shall be ultrasonically tested or hydraulic tested. Forged fitting shall be ultrasonically tested and formed fittings shall be MPI tested. All tests, as given in respective material code (other than supplementary requirements), shall be carried out as minimum. This includes the tests wherein it is specified in the ASTM code that "the test is to be carried out when specified by the purchaser" or any such indication, in the code (b) Fittings shall be subjected to suitable NDT as per applicable standards. However following minimum. NDE requirement shall be applicable / met. (i) For fittings X20, P-91 and material group 5B & above - 100% MPI & - 10% hardness check. - Also 100% UT/RT, for fittings of 200 NB & above (ii) 100% UT/RT for fittings of 200 NB & above for boiler feed discharge, recirculation and spray piping of boiler feed system. (iii) 100% UT/RT for fittings of all other piping of size OD 508 mm & above.
1.03.00	**Hangers & Supports:** (a) All raw materials used shall have co-related mill test certificate meeting mandatory checks of material specification.

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	(b) Completed springs shall be tested for Scragging Test & Load vs Deflection Test and for dia. > 25mm MPI shall be carried out. (c) Butt Welds shall be tested for UT and fillet welds shall be tested for MPI. (d) Turn buckle/ pipe clamps/ Hangers of thickness > 25mm shall be checked by MPI/DPT on bent portion. (e) Assembled Hangers shall be checked for Variation in deflection and Travel vs Load test and shall meet the requirements of NTPC data sheet.
1.04.00	**Thermal Insulation & Lagging, Cladding:**
1.04.01	**Light resign bound mineral wool:** LRB mattresses of Rockwool / Glasswool confirming to IS-8183, tested as per relevant clauses of IS 3144 and shall meet the requirements of NTPC data sheet. Type tests except Thermal Conductivity shall be regularly carried out once in three months, Thermal Conductivity Type Test shall be carried out minimum once in twelve months by the manufacturer. Requirements of various components like Binding wires, Lacing wires, Wire mesh, etc. shall be as per NTPC approved data sheet / as given in respective Sub-Section of Technical Requirements of Power Cycle system.
1.04.02	**Lagging &Cladding:** Aluminium sheeting confirming to ASTM B-203-1060 temper H14 from reputed manufacturer meeting the requirements of NTPC data sheet.
1.05.00	**Valves:** (a) Pressure retaining parts of valves shall be subjected to (min.) NDT as per Table 1. (b) Hardened/stellitted valve disc and seat are to be subjected to LPI and hardness check. (c) Color matching of valve disc/plug and seat shall be carried out to ensure min. 80% contact and no through passage. (d) Hydraulic pressure test and seat leak test shall be carried out as per ANSI 16.34/ IBR. (e) Air seat leak test shall be carried out as per applicable Standards/Codes. (f) Functional testing shall be carried out on each valve to check the following as per the approved valve data sheet (1) Smooth operation (2) Valve travel, closing and opening time. (3) Current drawn by actuators. (g) Springs for safety valves shall be tested with suitable NDT and for spring rate.

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(h) Safety and safety relief valves shall be tested for performance.

(i) All forgings rounds above diameter 40 mm shall be ultrasonically tested.

TABLE-1

Valve size NB in mm	ANSI Class upto 300	ANSI Class above 300 upto 600	ANSI Class above 600 below 900	ANSI Class 900 & above & below 4500
Less than 50	Visual	Visual	Visual	MPI
50 & above but below100	Visual	Visual	MPI	MPI & RT (on 10%of valves on 100% area)
100 & above but less than 300	Visual	MPI	MPI & RT (on 10% of valves on change of section & weld ends)	MPI & RT (on 100% area)
300 and above	MPI	MPI	MPI & RT (on change of sections & weld ends)	MPI, RT on100% area)

NOTE: For body and bonnet forgings UT with MPI may be adopted in place of RT

For austenitic steel MPI may be replaced by LPI.

1.06.00 **CHEMICAL DOSING SYSTEM (HP/LP/OXYGENATED)**

(a) Pumps of chemical **dosing** system shall be performance tested as per relevant international codes.

(b) In case of diaphragm type of pumps, the life cycle test shall be done on pumps. If this test is already conducted for same model in earlier projects of NTPC, then TCs for same shall be reviewed.

(c) Dosing skid shall be subjected to leakage test and functional test.

(d) Oxygen cylinders shall be as per relevant standard meeting statutory requirements.

1.07.00 **MEATLLIC EXPANSION JOINT FOR PIPING (IF APPLICABLE)**

(a.) Hydraulic pressure test shall be carried out on each pipe and expansion bellow.

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	(b.) Longitudinal butt weld on bellow shall be subjected to suitable NDT examination before forming, and after forming MPE / DP test shall be carried out. (c.) All welds shall be subjected to 100% magnetic particle/dye pentrant check and butt welds shall be subjected to 100% radiographic testing. (d.) All the bellows subjected to vacuum service shall be subjected to vacuum test. (e.) The bellows shall be subjected to movement test to establish suitability to perform satisfactorily in site conditions. During this test spring rate shall also be measured. (f.) Life cycle test, meridional yield rupture test and squirm test to be carried out on a prototype/expansion bellow as per Sec.D clause 3.2 of standards of Expansion joint Manufacturer Association (EJMA). In case these tests have already been accepted by NTPC on a prototype expansion bellow, as defined in Sec.D Clause 3.2 of Expansion Joints Manufacturers Association (EJMA) test reports may be furnished by manufacturer for consideration and approval of Employer.

ANNEXURE II

SUB-VENDORS LIST

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
1.	PRESSURE VESSELS	GLOBAL STRUCTURES & COMPOSITE LTD	-	
		JASMINO POLYMERTECH	TALOJA	
		SYSCON ENGINEERS	AMBERNATH	
		S.V. FABRICATORS	NAVI MUMBAI	
		SPARK FABRICATORS / STEELCON	-	
		ANUP ENGINEERING	AHMEDABAD	
		MURTHAL TANKS & VESSELS	SONEPAT	
		TITAN ENGG.	DURGAPUR	
		RISHI INDUSTRIES	BAHALGARH	
		UNIVERSAL HEAT EXCHANGERS	-	
		ATS CHEM	SALEM/HOSUR	
		CHEM PROCESS SYSTEM	SANAND	
		PROGEN	CHENNAI	
		CRYSTAL ENGINEERING	HOSUR	
		ISHAN EQUIPMENTS	VADODARA	
2.	ATMOSPHERIC/ STORAGE TANKS	GLOBAL STRUCTURES & COMPOSITE LTD	-	
		JASMINO POLYMERTECH	TALOJA	
		SYSCON ENGINEERS	AMBERNATH	
		S.V. FABRICATORS	NAVI MUMBAI	
		SPARK FABRICATORS / STEELCON	-	
		ANUP ENGINEERING	AHMEDABAD	
		MURTHAL TANKS & VESSELS	SONEPAT	
		TITAN ENGG.	DURGAPUR	
		RISHI INDUSTRIES	BAHALGARH	
		UNIVERSAL HEAT EXCHANGERS	-	
		ATS CHEM	SALEM/HOSUR	
		CHEM PROCESS SYSTEM	SANAND	
		PROGEN	CHENNAI	
		CRYSTAL ENGINEERING	HOSUR	
		ISHAN EQUIPMENTS	VADODARA	
3.	RUBBER LINING (AT SHOP)	TEMSEC	KOLKATA	
		RISHI INDUSTRIES	SONEPAT	
		CORI ENGINEERS	CHENNAI	
		POLY RUBBER	MUMBAI	
		INDUSTRIAL LINING	VADODARA	
		ARUL RUBBERS	CHENNAI	
		JASMINO POLYMERTECH	TALOJA	
		WESTERN RUBBER	NAVI MUMBAI	
		ELASTOMER LINNING	AMBERNATH	
		EMKAY RUBBER	MUMBAI	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
4.	AIR BLOWERS (TWIN LOBE TYPE)	SWAN PNEUMATIC	NOIDA	
		EVEREST TRANSMISSION	NEW DELHI	
		KAY INTERNATIONAL	NEW DELHI / SONEPAT	
		EVEREST BLOWER	BAHADURGARH	
		KULKARNI POWER TOOLS	KOLHAPUR/ PUNE	
5.	METERING PUMPS	VK PUMPS	NASIK	
		MILTON ROY INDIA	CHENNAI	
		SWELLORE	AHMEDABAD	
		POSITIVE METERING PUMPS	NASIK	
		METACHEM	MUMBAI	
6.	AGITATOR	REMI PEOCESS PLANT & M/C	MUMBAI	
		FIBRE & FIBRE	MUMBAI / SILVASA	
		CEECONS	CHENNAI	
		STANDARD ENGINEERS	MUMBAI	
7.	HORIZONTAL CENTRIFUGAL PUMPS	BEST AND CROMPTON ENGG LTD.	CHENNAI	
		BHARAT PUMPS & COMPRESSORS LTD	ALLAHABAD	
		FLOWMORE LTD.	GURGAON	
		FLOWSERVE INDIA CONTROLS PVT. LTD.	COIMBATORE	
		JYOTI LTD.	VADODARA	
		KIRLOSKAR BROTHERS LTD	PUNE	
		WILO MATHER & PLATT PUMPS PVT. LTD.	PUNE	
		V-FLO PUMPS & SYSTEMS CO. LTD.,	BEIJING-CHINA	
		WPIL LIMITED	KOLKATA	
8.	VERTICAL CENTRIFUGAL PUMPS	BHARAT PUMPS & COMPRESSORS LTD	ALLAHABAD	
		FLOWMORE LTD.	GURGAON	
		FLOWSERVE INDIA CONTROLS PVT. LTD.	COIMBATORE	
		JYOTI LTD.	VADODARA	
		WILO MATHER & PLATT PUMPS PVT. LTD.	PUNE	
		SULZER PUMPS INDIA LTD.	THANE	
		WPIL LIMITED	KOLKATA	
9.	HORIZONTAL CENTRIFUGAL PUMPS (RUBBER LINED)	KISHORE PUMPS	PUNE	
		SU MOTORS	MUMBAI	
10.	NON METALLIC (PP/FRP) HORIZONTAL CENTRIFUGAL PUMPS	ENGINEERS COMBINE	THANE	
		ANTICORROSIVE	VALSAD	
		LEAK PROOF PUMPS PVT. LTD. (RAJEDIA)	-	
11.	MISC. PUMP VERTICAL	KBL	PUNE	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
	TURBINE TYPE	M&P	PUNE	
		WPIL	GHAZIABAD	
		KISHORE PUMPS	PUNE	
		FLOWMORE	SAHIBABAD	
12.	**DC BATTERY CHARGER FOR PLC**	AMARA RAJA POWER SYSTEMS LIMITED	TAMIL NADU	
		CHHABI ELECTRICALS PVT.LTD.	MAHARASHTRA	
		CHLORIDE POWER SYSTEMS & SOLUTIONS LIMITED	KOLKATA	
		DUBAS ENGG PVT LTD	BANGALORE	
		EMERSON NETWORK POWER (INDIA) PVT. LTD.	MAHARASHTRA	
		HBL POWER SYSTEMS LTD	HYDERABAD	
		JEMA ENERGY	SPAIN	FOR STATIC SCR TYPE FULL WAVE FULLY CONTROL TYPE
		MASS-TECH CONTROLS PVT.LTD.	MUMBAI	
		STATCON POWER CONTROLS LTD	NOIDA (U.P)	
13.	**UNDER BED NOZZLE**	JONSONS SCREEN	AUSTRALIA/ IRELAND	
14.	**COATING & WRAPPING MATERIAL TAPE**	IWL LTD.	CHENNAI	
		MP TAR PRODUCT	BHILAI	
		PORWAL INDUSTRIES	RAIPUR	
		RUSTECH	KOLKATA	
		STP	JAMSHEDPUR	
15.	**HEATER**	ESCORTS	FARIDABAD	
		RACOLDS	FARIDABAD	
16.	**RESIN**	ROHM & HASS	FRANCE / USA	
		LANXESS	GERMANY	
		PUROLITE	ROMANIA/CHINA	
17.	**HIGH PRESSURE BUTTERFLY VALVE**	DeZURICK (Upto 400 NB)	USA	
		TYCO VALVES (UPTO 450 NB)	USA	
		BRAY	-	
18.	**BALL VALVE (HIGH PRESSURE) SIZE 100 NB**	VELAN	CANADA	
		BRAY	USA	
19.	**CAST IRON GATE/GLV/NRV/SRV**	A.V. VALVES LTD	AGRA	
		ATAM VALVES PVT. LTD.	JALANDHAR	
		FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD	
		G.M. DALUI AND SONS PVT.LTD.	HOWRAH	
		H.SARKER AND COMPANY	HOWRAH	
		LEADER VALVES LTD.	JALANDHAR	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		VENUS PUMPS AND ENGG. WORKS	KOLKATA	
20.	BALL VALVE (MANUAL /PNEUMATIC/ ELECTRIC) CLASS 150	A.V. VALVES LTD	AGRA	
		AKAY INDUSTRIES PVT.LTD.	DHARWAD	
		BELGAUM AQUA VALVES PVT. LTD.	BELGAUN	
		ASIAN INDUSTRIAL VALVES & INSTRUMENTS.	CHENNAI	
		ATAM VALVES PVT. LTD.	JALANDHAR	
		DEMBLA VALVES LTD.	THANE	
		M/S GM ENGINEERING	RAJKOT	
		HAWA VALVES (INDIA) PVT. LTD.	NAVI MUMBAI	
		INTERVALVE (INDIA) LTD.	PUNE	
		LEADER VALVES LTD.	JALANDHAR	
		MICROFINISH VALVES PVT LTD.	HUBLI	
		NILON VALVES PRIVATE LIMITED	AHMEDABAD	
		SURYA VALVES AND INSTRUMENTS MFG CO.	CHENNAI	
		UNIFLOW	CHENNAI	
		VALTECH INDUSTRIES	MUMBAI	
		VAAS AUTOMATION PVT. LTD.	NEW DELHI	
		WEIR BDK VALVES- A UNIT OF WEIR INDIA PVT. LTD.	NEW DELHI	
21.	ELECTRIC MOTOR	CROMPTON GREAVES	NEW DELHI	
		LAXMI HYDRAULICS PVT. LTD	MAHARASHTRA	
		RAJINDRA ELECT INDUSTRIES	MUMBAI	
		GE-POWER	CHENNAI	
		BHARAT BIJLEE LTD.	NEW DELHI	
		SIEMENS	GURGAON	
		NGEF	NEW DELHI	
		KIRLOSKAR ELECTRIC CO LTD.	BANGALORE	
		ASEA BROWN BOVERI (ABB)	HARYANA	
		MARATHON	FARIDABAD	
22.	BUTTER-FLY VALVE	ADVANCE VALVES PVT. LTD.	NOIDA	
		FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD	
		INSTRUMENTATION LTD.	PALAKKAD	
		INTERVALVE (INDIA) LTD.	PUNE	
		R AND D MULTIPLES (METAL CAST) PVT LTD	MUMBAI	
		SURYA VALVES AND INSTRUMENTS MFG CO.	CHENNAI	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		PENTAIR VALVES AND CONTROLS INDIA PRIVATE LIMITED	NAVI MUMBAI	
		UPADHAYA VALVES MANUFACTURERS PRIVATE LIMITED,	KOLKATA	
		VENUS PUMPS AND ENGG. WORKS	KOLKATA	
		WEIR BDK VALVES- A UNIT OF WEIR INDIA PVT. LTD.	NEW DELHI	
23.	DIAPHRAGM VALVE (MANUAL / PNEUMATIC) CLASS 150	WEIR BDK	HUBLI	
		CRANE FLOW PROCESS	SATARA	
		PROCON	MUMBAI	
		MAJESTIC VALVES (LABLINE)	-	
		HAWA ENGINEERS	AHMEDABAD	
24.	DUAL PLATE CHECK VALVES	ADVANCE VALVES PVT. LTD.	NOIDA	
		FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD	1. DUAL PLATE CHECK VALVE CI - CLASS 150 & UP TO 600NB, 2. DUAL PLATE CHECK VALVE CCS - CLASS 150 & UP TO 500NB
		R AND D MULTIPLES (METAL CAST) PVT LTD	MUMBAI	
		VENUS PUMPS AND ENGG. WORKS	KOLKATA	CI, CCS & STAINLESS STEEL SPRING ASSISTED DUAL PLATE CHECK VALVES UPTO 700 NB AND 150 CLASS RATING.
25.	Y-TYPE STRAINER / STRAINER (WATER SERVICE)	OTOKLIN GLOBAL BUSINESS LIMITED	MUMBAI	
		GRAND PRIX	NEW DELHI	
		JAYPEE	NEW DELHI	
		GREAVES COTTON	MUMBAI	
		MULTITEX FILTRATION ENGINEERS LIMITED,	NEW DELHI / NOIDA	
		FILTERATION ENGINEERS (I) PVT. LTD	MUMBAI	
		FLUIDNYE	-	
		SUNGOV ENGINEERING PVT. LTD.	DELHI	
		GRAND PRIX	FARIDABAD	
		JAYPEE INDUSTRIES PVT. LTD.	DELHI	
		BHATIA ENGINEERING CO.	DELHI	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
26.	RUBBER FLAP TYPE CHECK VALVES	ASHVIK VALVES	-	
		FLOW WAY VALVES	-	
		BDK	-	
		MAJESTIC VALVES (LABLINE INST)	-	
		ADVANCE VALVES	-	
27.	MEMBRANES	DOW		
		TORAY		
		KOCH		
		HYDRONOTICS		
		NORIT		
28.	CHAIN PULLEY BLOCK	ARMSEL MHE PVT. LTD	BANGALORE	
		CENTURY CRANE ENGINEERS PVT. LTD.	FARIDABAD	
		HERCULES HOISTS LTD.	RAIGAD	
		LIFTING EQUIPMENTS AND ACCESSORIES	DELHI	
		TUOBRO FURGUSON (INDIA) PVT LTD	KOLKATA	UPTO 10 TONNE.
		TRACTEL TIRFOR INDIA PVT. LTD.	FARIDABAD	
		TECHNO INDUSTRIES	AHMEDABAD	
		ARMSEL MHE PVT. LTD	BANGALORE	
		ALPHA SERVICES	BHIWADI	
		CONSOLIDATED HOISTS PVT LTD	PUNE	UPTO 20 TONNES
		CENTURY CRANE ENGINEERS PVT. LTD.	FARIDABAD	
		EDDY CRANES PVT. LTD.	MUMBAI	CAPACITY UPTO 10 TONS. BOIS BHEL APP.SUB-VENDORS.
		GRIP ENGINEERS PVT. LTD.,	FARIDABAD,	
		GLOBAL TECHNOLOGIES	HYDERABAD	
		HERCULES HOISTS LTD.	RAIGAD	
		LIFTING EQUIPMENTS AND ACCESSORIES	DELHI	
		MANGLA HOISTS PVT LTD	NEW DELHI	
		MEEKA MACHINERY PVT. LTD.	AHMEDABAD	
		REVA INDUSTRIES LTD.	FARIDABAD	UPTO 25.0 T CAPACITY.
		ROCKWELL HOISTO CRANES PVT. LTD.	BAHADURGARH	
		SAFEX ENERGY PVT. LTD.	AHMEDABAD	
		TUOBRO FURGUSON (INDIA) PVT LTD	KOLKATA	UPTO 15 TONNES.
		TECHNO INDUSTRIES	AHMEDABAD	
29.	ELECTRIC HOIST	ARMSEL MHE PVT. LTD	BANGALORE	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		ALPHA SERVICES	BHIWADI	
		CONSOLIDATED HOISTS PVT LTD	PUNE	UPTO 20 TONNES
		CENTURY CRANE ENGINEERS PVT. LTD.	FARIDABAD	
		EDDY CRANES PVT. LTD.	MUMBAI	CAPACITY UPTO 10 TONS. BOIS BHEL APP.SUB-VENDORS.
		GRIP ENGINEERS PVT. LTD.,	FARIDABAD,	
		GLOBAL TECHNOLOGIES	HYDERABAD	
		HERCULES HOISTS LTD.	RAIGAD	
		LIFTING EQUIPMENTS AND ACCESSORIES	DELHI	
		MANGLA HOISTS PVT LTD	NEW DELHI	
		MEEKA MACHINERY PVT. LTD.	AHMEDABAD	
		REVA INDUSTRIES LTD.	FARIDABAD	UPTO 25.0 T CAPACITY.
		ROCKWELL HOISTO CRANES PVT. LTD.	BAHADURGARH	
		SAFEX ENERGY PVT. LTD.	AHMEDABAD	
		TUOBRO FURGUSON (INDIA) PVT LTD	KOLKATA	UPTO 15 TONNES.
		TECHNO INDUSTRIES	AHMEDABAD	
30.	CABLE GLAND	ALLIED TRADERS & EXPORTERS	NOIDA (U.P.)	
		ARUP ENGG & FOUNDARY WORKS	CALCUTTA	
		BALIGA LIGHTING EQPT.PVT.LTD.	CHENNAI	
		COMMET BRASS PRODUCTS	MUMBAI	
		DOWELLS	MUMBAI	
		ELECTROMAC INDUSTRIES	MUMBAI	
		INCAB	KOLKATA	
31.	CABLE LUGS	DOWELLS	MUMBAI	
		UNIVERSAL MACHINES LTD.	CALCUTTA	
32.	MS PLATES	SAIL		
		ESSAR STEEL		
		TISCO		
		RINL		
		JINDAL		
		LLOYD		
		ISPAT		
		INDIAN IRON & STEEL CO. LTD		
33.	CS PIPE (ASTM A 106 GR. B)	INDIAN SEAMLESS METAL TUBES	AHMEDABAD	UPTO 150 NB
		MAHARASHTRA SEAMLESS	RAIGAD	UPTO 350 NB
34.	MS PIPES (IS: 1239 &	SAIL	ROURKELA	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
	3589)	JINDAL	GHAZIBAD/HISSAR	
		SURYA ROSHNI	BAHADUR GARH	
		TATA TUBE	JAMSHEDPUR	
		PSL	CHENNAI/VIZAG/KUTCH/DAMAN	
		LALIT PROFILE	THANE	
		SAMSHI PIPES INDUSTRIES	VADODARA	
		MUKUT PIPES	RAJPURA	
		INDUS TUBES	G B NAGAR	
		MANN IND	INDORE	
		SURENDRA ENGG	RAJPURA	
		PRATIBHA PIPES & STRUCTURE PVT LTD	THANE	
		JCO GAS PIPE	CHINDWARA	
		NUKAT TANKS AND VESSELS	TARAPUR	
		DADU PIPES	SIKRANDRABAD	
		GOOD LUCK TUBES	SIKANDRABAD	
		ADVANCE STEEL TUBES	SAHIBABAD	
		BIHAR TUBES	SIKANDRABAD	
		HI TECH PIPES	SIKANDRABAD	
		RATNAMANI	KUTCH/AHMEDABAD/CHHATRAL	
		MAHARASHTRA SEAMLESS	RAIGAD	
		WELSPUN	ANJAR/BHARUCH	
35.	SS PIPES / TUBES	APEX TUBES	BEHROR (ALWAR)	
		RATNAMANI	CHATTRAL	
		REMI	TARAPUR	
		PRAKASH STEELAGE	-	
36.	SAFETY SHOWER	UNICARE	-	
		MOHAN INDUSTRIES	-	
		SUPER SAFETY SERVICES	-	
37.	FRP TANKS & FITTINGS	GLOBAL COMPOSITE	-	
		EPP	-	
		DEEPA COMPOSITE	-	
		COROSEAL INDUSTRIES	-	
		CHEMICAL PROCESS & EQUIPMENT PVT LTD	-	
		J.R FIBRE INDUSTRIES PVT LTD	-	
		POLYPLAST	-	
38.	EJECTOR	ESSEM TECHNOLOGIES	-	
		RATNA PRASAD	-	
39.	TANK (FRP)	INDUSTRIAL SERVICE	KOLKATA	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		SUNRISE	BARODA	
		GANDHI & ASSOCIATES	AHMEDABAD	
		MODERN EQUIPMENTS	CHENNAI	
		EAGLE PLAST	PUNE	
		OMEGA PLAST	MUMBAI	
40.	STROKE CONTROLLER	V K PUMPS	NASIK	
		METACHEM	MUMBAI	
		SWELORE	AHMEDABAD	
		MILTON ROY INDIA	CHENNAI	
41.	SAFETY VALVES/RELIEF VALVES	METACHEM	MUMBAI	
		KEYSTONE	BARODA	
		V K PUMPS	NASIK	
		MILTON ROY	CHENNAI	
42.	DUPLEX STRAINER	JAYPEE INDUSTRIES PVT. LTD.	NEW DELHI	
		MULTITEX FILTRATION ENGINEERS LIMITED,	NEW DELHI	
		OTOKLIN GLOBAL BUSINESS LIMITED	MUMBAI	
		SUNGOV ENGINEERING PVT. LTD.	CHENNAI	
43.	STEEL GATE/GLOBE/NR VALVES	A.V. VALVES LTD	AGRA	
		ATAM VALVES PVT. LTD.	JALANDHAR	(1) CARBON STEEL GATE VALVES & NON RETURN VALVES: 15 NB TO 50 NB (#800) & 65 NB TO 300 NB (#150) (2) CARBON STEEL GLOBE VALVES: 15 NB TO 50 NB (#800) & 65 NB TO 200 NB (#150)
		FLUIDLINE VALVES COMPANY PVT.LTD.	KAUSHAMBI	
		M/S GM ENGINEERING	RAJKOT	
		INTERVALVE (INDIA) LTD.	PUNE	A) STEEL GATE VALVES: UPTO 50NB, #800 AND 65NB TO 150NB, #150 B) STEEL GLOBE VALVES: UPTO 50NB, #800 AND 65NB TO 100NB, #150 C)SUPPLIER NOT REGISTERED FOR NR VALVES

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		LEADER VALVES LTD.	JALANDHAR	
		NITON VALVE INDUSTRIES PVT LTD	MUMBAI	
		NSSL LIMITED.	NAGPUR	
		STEEL STRONG VALVES (I) PVT.LTD.,	NAVI MUMBAI	LIMITED TO RANGES & CLASSES AS AVAILABE IN VD FILE.
		VENUS PUMPS AND ENGG. WORKS	KOLKATA	CC/CSS-GATE-BBT-UPTO600NB CL UPTO300,GATE-PSBT UPTO250NB CL 1500,GLV-BBT-UPTO300NB CL UPTO600,SCNRV-BBT-UPTO600NB CL UPTO150,SCNRV-BBT-UPTO300NB CL 300,SCNRV-PSBT-UPTO150NB CL UPTO900
		VALTECH INDUSTRIES	MUMBAI	CAST CARBON & ALLOY STEEL - VALVE/RATING/SIZE- GV/150/900,GV/300/400, GV/600/300 , GV/GLV/NRV/900/250 , GLV/300/300,GLV/150/350/ , SCNRV/150/700, SCNRV/300/350, SCNRV/600/250.
		V.K. VALVES PVT. LTD.,	JALANDHAR	
		WEIR BDK VALVES- A UNIT OF WEIR INDIA PVT. LTD.	NEW DELHI	
44.	SLUICE GATE	H SARKAR	KOLKATA	
		JASH ENGINEERING	-	
		YASHWANT INDUSTRIES	-	
45.	3 WAY VALVE	HI TECH	AHMEDABAD	
		ADVANCE VALVES PVT.LTD	NOIDA	
		BDK	HUBLI	
		FOURESS ENGG.INDIA LTD.	MUMBAI	
		FLUIDLINEVALVES COMPANY PRIVATE LTD.,	MUMBAI	
		INSTRUMENTATION LTD.	PALAKAD	
		KIRLOSKAR BROTHERS LTD.	PUNE	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		VENUS PUMP & ENGG. WORKS	KOLKATA	
		SURYA VALVES AND INSTRUMENTS MANUFACTURING COMPANY	CHENNAI	
		STAFFORD CONTROLS LIMITED	PUNE	
		MICON VALVES (INDIA) PVT.LTD	MUMBAI	
46.	PLUG VALVE(MANUAL)	BDK	HUBLI	
		HAWA ENGINEERS / MARCK & CARE	-	
		MICON VALVES	-	
		MICON VALVES (INDIA) PVT.LTD	MUMBAI	
47.	FITTINGS (CS/SS)	M.S. FITTINGS	KOLKATA	
		METAL LLOYDS	MUMBAI	
		TRUE FORGE	FARIDABAD	
		TUBE PRODUCTS	BARODA	
		NL HAZRA	KOLKATA	
		GUJRAT INFRA PIPES	BARODA	
		EDWARDS	USA	
		PIPEFIT ENGINEERS	BARODA	
		SIDDARTH & GAUTAM	FARIDABAD	
		EBY	MUMBAI	
48.	FLANGES (SS/CS)	PRADEEP METALS LTD	MUMBAI	
		TUBE PRODUCT INCOROPORATION	BARODA	
		MS FITTINGS	KOLKATA	
		HAWA ENGINEERING	-	
		ALIANCE PIPE & PLANGES	KOLKATA	
		JAI AMBE	MUMBAI	
49.	PIPE & FITTING (PP,HDPE,PVC & CPVC)	GEROGE FISHCHER	DELHI	
		ASTROL PLYTECHINC LTD	AHMEDABAD	
		JAIN IRRIGATION	-	
		ORIPLAST	-	
50.	VALVES (GATE/GLOBE/NRV/BALL)- (PP,HDPE,PVC & CPVC)	GEROGE FISHCHER IPING SYSTEMS PVT LTD	DELHI	
		ASTROL PLYTECHINC LTD	AHMEDABAD	
		JAIN IRRIGATION	-	
		ORIPLAST	-	
51.	FILTER MEDIA	GLOBAL ABSORBENT	KOLKATA	
		BHARAT MINERALS		
52.	DC LEAD ACID	EXIDE INDUSTRIES LTD	NEW DELHI	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
	BATTERIES	HBL POWER SYSTEMS LTD	HYDERABAD	TUBULAR TYPE
		HOPPECKE BATTERIEN GMBH & CO.KG,	GERMANY	
53.	**DC NI CD BATTERIES**	AMCO SAFT INDIA LTD	BANGALORE	
		HBL POWER SYSTEMS LTD	HYDERABAD	
54.	**PAINT**	ASIAN PAINTS (I) LTD.		
		BERGER PAINTS INDIA LTD		
		GOODLASS NEROLAC		
		JENSON & NICHOLSON (I) LTD		
		CDC CARBOLINE (I) LTD.		
		SHALIMAR PAINTS LTD.		
		ADDISON PAINTS LTD		
		GRAND POLYCOAT		
		BOMBAY PAINTS		
		HEMPLE PAINTS (SINGAPORE)		
		JOTUN PAINTS		
55.	**PNEUMATIC ACTUATOR**	PROCON ENGINEERS	-	
		TYCO	-	
		CRANE PROCESS	-	
		BDK	-	
		INTERVALVE	-	
		BRAY CONTROL	-	
56.	**FRP CABLE TRAYS & ACCESSORIES**	EPP COMPOSITES PRIVATE LIMITED	RAJKOT-GUJARAT	
		SUMIP COMPOSITES PVT.LTD.	AHMEDABAD-GUJARAT	

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.

PACKAGE WISE REGISTERED SUPPLIER LIST (PERMANENT CATEGORY) AS ON 4/16/2021 PM

Package Name	Supplier Name	Supplier Communication Address	Supplier Works Address
CONTROL VALVE	R.K.CONTROL INSTRUMENTS PVT. LTD.	PLOT NO.A-250, OPP.POLICE STATION, WAGLE INDUSTRIAL ESTATE, THANE Phone- 25820943/2331 Pincode : 400604 Email : rkcipl@vsnl.com ; rkcinpvt@bol.net.in	Works-1->SAVITH KUMAR PLOT NO. A-250, OPP.POLICE STATION,WAGLE INDUSTRIAL ESTATE, THANE -THANE-MAHARASHTRA INDIA Phone- 022-'66060942 FAX : 022-25820801 Pincode : 400 604 Email : rkadmin@rkcipl.co.in
CONTROL VALVE	Mascot Valves Pvt. Ltd.	166-167 GIDC Naroda Ahmedabad Phone- 0792282 1619 Pincode : 382330 Email : dom.sales@mascotvalves.com	Works-1->Varun Patel Dir 166-167 ,GIDC Naroda -Ahmedabad-GUJARAT India Phone- 0792282 1619 / 3369 FAX : Pincode : 382330 Email : dom.sales@mascotvalves.com
CONTROL VALVE	Severn Glocon India Pvt. Ltd.	F96 & F97, Sipcot Industrial Park, Irungattukottai, Chennai, Phone- 044-47104200, Pincode : 602117, Email : info@severnglocon.co.in,	Works-1->Mr. K.Kaushik, F96 & F97, Sipcot Industrial Park,Irungattukottai, -Chennai-TAMIL NADU India Phone- 044-47104200, FAX : 044-47100073, Pincode : 602117, Email : info@severnglocon.co.in
CONTROL VALVE	BOMAFA SPECIAL VALVE SOLUTIONS PVT LTD	Mr. K.M. Anklesaria/ R. M. Anklesaria Plot No: 285/2, Panchratna Estate, Near Ramol Bridge, Vatva Ahmedabad Phone- 079-40083825 Pincode : 382445 Email : info@bomafa-india.com	Works-1->Mr. K.M. Anklesaria/ Mr. R.M. Anklesaria Dir Plot No: 285/2, Panchratna Estate, Near Ramol Bridge, Vatva, -Ahmedabad-GUJARAT INDIA Phone- 079-40083825 FAX : Pincode : 382445 Email : info@bomafa-india.com
CONTROL VALVE	SAMSON CONTROLS PVT. LTD.	Mr. Atul raje-MD D 281, MIDC Ranjangaon Ta Shirur Pune Phone- 02067246600 Pincode : 412220 Email : sales@samsoncontrols.net	Works-1-> Others D 281, MIDC Ranjangaon -Pune-MAHARASHTRA India Phone- 02067246600,8554997963 FAX : Pincode : 412220 Email : sales@samsoncontrols.net
CONTROL VALVE	FORBES MARSHALL ARCA PVT.LTD.	A-34/35 , MIDC ESTATE, H-BLOCK, PIMPRI, PUNE, Phone- 020-27442020, Pincode : 411018 Email : mnadgaundi@forbesmarshall.com	Works-1->Mr. Sanjeev Shinde A-34/35 MIDC Estate,H Block, Pimpri, -Pune-MAHARASHTRA India Phone- 9323176406 FAX : 020-27442040 Pincode : 411018 Email : sshinde@forbesmarshall.com
CONTROL VALVE	INSTRUMENTATION LTD.	KANJIKODE WEST, PALALKKAD, PALAKKAD Phone- 2566127-130,2567128 Pincode : 678623 Email : icvldil@gmail.com;fa2@ilpgt.com	Works-1->D.SASIDHARAN, AGM(Works&PPC) KANJIKODE WEST, -PALAKKAD-KERALA INDIA Phone- 0491-2566536 FAX : 0491-2566135 Pincode : 678623 Email : sasidharan@ilpgt.com;mraj@ilpgt.com;gireesh@ilpgt.com, commercial@ilpgt.com;fa2@ilpgt.com;nazeera@ilpgt.com;pkv@ilpgt.com;remith@ilpgt.com
CONTROL VALVE	Koso India Private Limited,	H 33 & 34, MIDC, Ambad, Nashik, Phone- 09650233433 Pincode : 422010, Email : jetmal.gour@koso.co.in	Works-1->P.J.ASHOK KUMAR/SEEMA ANAND Control Valve Division, H-33&34, MIDC, Ambad, -Nashik-MAHARASHTRA India Phone- 91 944 744 3198 FAX : 0491 - 5269914 Pincode : 422010 Email : pja@koso.co.in;enquiry@koso.co.in Works-2->+P.J.ASHOK KUMAR/SEEMA ANAND J-1,MIDC,Ambad -Nashik-MAHARASHTRA India Phone- 91 944 744 3198 FAX : 0491 - 5269914 Pincode : 422010 Email : pja@koso.co.in;enquiry@koso.co.in
CONTROL VALVE	CIRCOR FLOW TECHNOLOGIES INDIA PVT. LTD.	Mr. Vinodh Gopinath, Senior Director SF No. 337/2, No.15 Naranapuram Village,Ponnandampalayam Coimbatore Phone- 9500928448 Pincode : 641659 Email : santhosh.ponnusamy@circor.com	Works-1->Mr. Santhosh Ponnusamy Others SF No. 337/2, No.15, Naranapuram Village,Ponnandampalayam -Coimbatore-TAMILNADU INDIA Phone- 9500928448 FAX : 04212321600 Pincode : Coimbatore Email : santhosh.ponnusamy@circor.com
CONTROL VALVE	KSB MIL CONTROLS LTD.	Mr.Jacob Cherian/Mr.Geo Jolly Meladoor, Annamanada P.O. MALA, Thrissur Phone- 0480-2695700 Pincode : 680741 Email : biju.simon@ksb.com	Works-1->Mr.Biju Simon/Mr.Jose Paul Meladoor, Annamanada, -Thrissur-KERALA INDIA Phone- 9447555500 FAX : 91 480 2890952 Pincode : 680741 Email : jose.paul@ksb.com
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	Kaustubha Udyog,	S.No. 36/1/1, Sinhgad Road, Vadgaon Khurd, Near Lokmat Press, Pune, Phone- 020-24393577, Pincode : Email : pressure@vsnl.com,	
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	PRECISION MASS PRODUCTS PVT. LTD.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 9999464663 Pincode : 382729 Email : sales@precisionmass.com	Works-1->Mr. Hitesh Parmar/Mr. Hitesh Parmar Plot No.2306, Phase II, GIDC Chhatral, -Kalol-GUJARAT INDIA Phone- 9327359227 FAX : 02764-233440 Pincode : 382729 Email : hitesh.parmar@ashcroftindia.com
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	DRESSER INDUSTRIES INC.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 02764-233682 Pincode : 382729 Email : Nishit.patel@ashcroftindia.com	
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	SWITZER PROCESS INSTRUMENTS PVT. LTD.	Mr. V S Jayaprakash, 128, SIDCO North Phase, Ambattur Estates CHENNAI Phone- 044-26252017/2018 Pincode : 600050 Email : sales@switzerprocess.co.in	Works-1->C S Shankar 127, Sidco North Phase, Ambattur Estates, -CHENNAI-TAMIL NADU INDIA Phone- 8754491904 FAX : 044-26248849 Pincode : 600050 Email : cservice@switzerinstrument.com
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,	Works-1->LARRY DEGARMO/ ROY STUMBOUGH 14685 W. 105TH STREET, LENEXA -KANSAS- USA Phone- 913-888-0767 FAX : 913-888-0767 Pincode : 66215 Email : rstumbough@sorinc.com
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	GENERAL INSTRUMENTS CONSORTIUM	Mr. Amarendra Kulkarni 194/195, Gopi Tank Road, Off. Pandurang Naik Marg, Mahim Mumbai Phone- 9323195251 Pincode : 400016 Email : amarendra@general-gauges.com	
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PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com	Works-1->Mr. Shyam Warilani/Mr. V Suresh Babu Plot No 34 À GIDC À Phase 1, -VAPI-GUJARAT INDIA Phone- +91 11 4161 7111 FAX : 022 2687 3613 Pincode : 396 195 Email : pbajaj@baumer.com
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PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com	Works-1->Scientific Center, Others By-Pass Junction,Near Kalsekar College kausa, mumbra,Thane -Mumbai-MAHARASHTRA INDIA Phone- 022-25491409,9892230623 FAX : Pincode : 400612 Email : sdbpl@vsnl.com
PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Nesstech Instruments Private Limited	26/2, G Type, Global Industrial Park Near Nahuli Railway Crossing, Valvada Vapi Phone- 9920576002 Pincode : 396105 Email : sales@nesstech.co.in	Works-1-> Others 26/2, G Type, Global Ind. Park Near Nahuli Railway Crossing, -Vapi-GUJARAT INDIA Phone- 9920576002 FAX : Pincode : 396105 Email : sales@nesstech.co.in, bkapadia@nesstech.co.in
TEMPERATURE GAUGE	PRECISION MASS PRODUCTS PVT. LTD.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 9999464663 Pincode : 382729 Email : sales@precisionmass.com	Works-1->Mr. Hitesh Parmar/Mr. Hitesh Parmar Plot No.2306, Phase II, GIDC Chhatral, -Kalol-GUJARAT INDIA Phone- 9327359227 FAX : 02764-233440 Pincode : 382729 Email : hitesh.parmar@ashcroftindia.com

Package Name	Supplier Name	Supplier Communication Address	Supplier Works Address
TEMPERATURE GAUGE	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode :	Works-1->Mr. Shyam Warilani/Mr. V Suresh Babu Plot No 34 À GIDC À Phase 1, -VAPI-GUJARAT INDIA Phone- +91 11 4161 7111 FAX : 022 2687 3613 Pincode : 396 195 Email : pbajaj@baumer.com
TEMPERATURE GAUGE	H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	32,INDUSTRIAL SUBURB YESWANTHAPUR BANGALORE Phone- 080-23370300, Pincode : 560022 Email : info@hgurusouth.com	Works-1->Shikha Hazra/ Shyamal Hazra 32, Industrial Suburb,Yeshwanthpur -BANGALORE-KARNATAKA INDIA Phone- 080-23370300 FAX : 080-23379890 Pincode : 560022 Email : shikhahazra@hgurusouth.com
TEMPERATURE GAUGE	GAUGE BOURDON INDIA PVT. LTD.	194/195, Gopi Tank Road, Off Pandurang Naik Marg, Mahim Mumbai, Phone- 011-41607463, Pincode : 400016, Email : gicdelhi@general-gauges.com,	Works-1->Gauge Bourdon India Pvt. Ltd., Plot No-4, 5, 6,Jawahar Co-operative Industrial Estate, -Kalamboli Taluka Panvel-MAHARASHTRA India Phone- 022-27421095, FAX : 022-27421901, Pincode : 410209, Email : info@general-gauges.com
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TEMPERATURE GAUGE	GOA THERMOSTATIC INSTRUMENTS PVT.LTD.	FLAT -B , GF, HILL CROWN APTS., COLLEGE ROAD, MAPUSA Phone- Pincode : 403525 Email : gtilworks@pyro-electric.in	Works-1->Mrs Saanvi Naik BICHOLIM, -BICHOLIM-GOA INDIA Phone- 9595855152 FAX : Pincode : 403 529 Email : saanvi.naik@thermostatic.in
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LEVEL GAUGE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in	Works-1->R Gopinath 27 Nahur Udyog Industrial Premises,M.M.Malviya Road, Mulund(-MUMBAI-MAHARASHTRA INDIA Phone- +912225918567 FAX : +912225918566 Pincode : 400080 Email : sales@sigmainstruments.co.in
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FLOW ELEMENT	MICRO PRECISION PRODUCTS PVT. LTD.	Mr. Anil Bhati, H.B. No.-40, Revenue Estate, Village-Dudhola,Tehsil & Distt. Palwal FARIDABAD Phone- 9560742713;095607427 Pincode : 121002 Email : anil.bhati@wika.com	
TEMP. ELEMENT	DETRIVE INSTRUMENTATION & ELECTRONICS LTD.	320, TV INDUSTIAL ESTATE, OFF.DR.A.BESANT ROAD, BEHIND GLAXO, WORLI, MUMBAI Phone- 24934125,24938403 Pincode : 400025 Email : trivtech@vsnl.com	Works-1->Mr. A.D.Solomon J-14, MIDC, TARAPORE, BOISER STN., -THANE-MAHARASHTRA India Phone- FAX : Pincode : Email : trivtech@vsnl.com
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TEMP. ELEMENT	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com	Works-1->Mr. Shyam Warilani/Mr. V Suresh Babu Plot No 34 À GIDC À Phase 1, -VAPI-GUJARAT INDIA Phone- +91 11 4161 7111 FAX : 022 2687 3613 Pincode : 396 195 Email : pbajaj@baumer.com
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TRANSMITTERS	ABB INDIA LIMITED	MR. RAJIV GOVIL 14, MATHURA ROAD, FARIDABAD Phone- 09971085678 Pincode : 121003 Email : vipin.swami@in.abb.com	
TRANSMITTERS	V. AUTOMAT & INTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com	Works-1->Mr. BHAGWAN SINGH/ Mr. NANDAN SINGH F-61, OKHLA INDL.AREA,PHASE-I -NEW DELHI-DELHI INDIA Phone- 011-47627200 Extn. 3 FAX : 011- 26819440 Pincode : 110 020 Email : production@vautomat.com
TRANSMITTERS	Pune Techtrol Pvt. Ltd.	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune Phone- 9850560042 Pincode : 411 026 Email : ho@punetechtrol.com	
TRANSMITTERS	YOKOGAWA INDIA LIMITED,	PLOT NO.96, ELECTRONICS CITY COMPLEX, HOSUR ROAD, BANGALORE, Phone- 080-41586000, Pincode : Email : uday.shankar@in.yokogawa.com,	Works-1-> PLOT NO.96, ELECTRONICS CITY COMPLEX, HOSUR ROAD, -BANGALORE-KARNATAKA INDIA Phone- 080-41586000, FAX : 080-28521442, Pincode : Email : uday.shankar@in.yokogawa.com
TRANSMITTERS	TOSHNIWAL INDUSTRIES PVT. LTD.,	Industrial Estate, Makhupura, Ajmer, Phone- 9352009000, Pincode : 305002, Email : info@tipl.com,	Works-1-> Khasra No.: 218-230& 235, Industrial Estate,Makhupura, -Ajmer-RAJASTHAN India Phone- 9887865856, FAX : 0145-2695174, Pincode : 305002, Email : rajeev.gupta@tipl.com

PACKAGE WISE REGISTERED SUPPLIER LIST (PERMANENT CATEGORY) AS ON 4/16/2021 PM

Package Name	Supplier Name	Supplier Communication Address	Supplier Works Address
TRANSMITTERS	SBEM PVT. LTD.	MR.N.K. BEDARKAR/MR. VISHWANATH KARANDIK 39, ELECTRONIC CO.OP. ESTATE, PUNE SATARA ROAD PUNE, Phone- 912041030100 Pincode : 411009 Email : newdelhi@sbem.co.in	Works-1->MR. MOHAN PADWAL 691/A/2,BIBWEWADI INDL ESTATE -PUNE-MAHARASHTRA INDIA Phone- 918600042374 FAX : 912024215670 Pincode : 411037 Email : wm@sbem.co.in
TRANSMITTERS	Endress + Hauser (India) Pvt. Ltd.,	Mr. Prakash Vaghela 215-216, DLF Tower 'A', Jasola District Centre, New Delhi, Phone- 9717593001, Pincode : 110025, Email : prakash.vaghela@in.endress.com,	Works-1-> M-171 to 173, MIDC, Waluj, -Aurangabad-MAHARASHTRA India Phone- 9881000474, FAX : 0240-2555179, Pincode : 431136, Email : Narendra.Kulkarni@wetzer.endress.com
TRANSMITTERS	PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business,Parsiwada, Sahar road,Andheri(East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com,	Works-1->Mr. Santosh Shukla Others R-628,TTC Industrial Area, MIDC Rabale, -Navi Mumbai-MAHARASHTRA India Phone- 9821350761, FAX : 022-27695559, Pincode : 400701, Email : sales@panamengineers.com
TRANSMITTERS	Moore Industries International Inc.	Leonard.W. Moore/ Matt Moren 16650 Schoenborn St. North Hills Phone- +1 818 830 5548 Pincode : 91343 Email : mmoren@miinet.com	Works-1->Matt Moren/Gina Cruz 16650 Schoenborn St., North Hills -CALIFORNIA- USA Phone- +1 818 894 7111, ext FAX : +1 818 830 5588 Pincode : 91343 Email : gcruz@miinet.com
TRANSMITTERS	NIVO CONTROLS PVT. LTD.	Mr. Praveen Toshniwal 104-115, Electronic Complex, Indore Phone- 0731-4081305 Pincode : 452010 Email : sales@nivocontrols.com	Works-1->Mr. S L Sadani Others 104 - 115,Electronic Complex -Indore-MADHYA PRADESH INDIA Phone- 0731-4081307 FAX : Pincode : 452010 Email : sales@nivocontrols.com;sadanis@nivocontrols.com
TRANSMITTERS	EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.	Mr. Amit Paithankar/Vikram Raj Singh 206-210,BALARAMA BUILDING 2ND FLR. BANDRA EAST MUMBAI Phone- 9619121500 Pincode : 400051 Email : vikramraj.singh@emerson.com	Works-1->Kalpesh Chandan/Hrishikesh Aghor Plot No. A 145/4 TTC IND AREA,MIDC, PAWANE, -NAVI MUMBAI-MAHARASHTRA INDIA Phone- 9619688001 FAX : 022-66736000 Pincode : 400 705 Email : Kalpesh.chandan@emerson.com
TRANSMITTERS	SIEMENS LIMITED	Dr. Armin Bruck/Sandeep Mathur 130, Pandurang Budhkar Marg Worli Mumbai Phone- 0124 383 7377 Pincode : 400018 Email : ankit.varshney@siemens.com	Works-1->Ankit Varshney Kalwa Works, Thane-Belapur Road, Thane, -MUMBAI-MAHARASHTRA INDIA Phone- FAX : Pincode : 400708 Email :
TRANSMITTERS	SMART INSTRUMENTS LTD, BRAZIL	Agents: Digital Electronic Ltd. 74/11 'C' Cross Road MIDC Andheri (East) MUMBAI Phone- 28208477 Pincode : 400093 Email : corp@delbby.rpgms.ems.vsnl.net.in	
TRANSMITTERS	Honeywell Automation India Limited	Mr. Ritwij Kulkarni 917, INTERNATIONAL TRADE TOWER, NEHRU PLACE, NEW DELHI Phone- 9890200584 Pincode : 110019 Email : rajesh.chaudhary@honeywell.com	Works-1->Mr.Kedar Tillu 53, 54, 56 & 57,Hadapsar Industrial Estate -PUNE-MAHARASHTRA INDIA Phone- 9665034625 FAX : 020 66039905 Pincode : 411013 Email : kedar.tillu@honeywell.com
TEMPERATURE SWITCH	DRESSER INDUSTRIES INC.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 02764-233682 Pincode : 382729 Email : Nishit.patel@ashcroftindia.com	
TEMPERATURE SWITCH	TOSHNIWAL BROTHERS PVT.LTD.	WORKS:TOSHNIWAL IND.PVT.LTD, INDUSTRIAL ESTATE MAKHUPURA, AJMER Phone- 441171 Pincode : 305002 Email : toshniwalprocess@gmail.com	
TEMPERATURE SWITCH	INDFOS (INDIA) LIMITED	MR.L.C.VENKATRANGAN/MR.B.KANNAN New No.17, II Floor, Adwave Towers, Dr.Sevalia Shivaji Salai, T.Nagar Chennai Phone- +91 44 24353407 Pincode : 600017 Email : delhi@indfos.com	
TEMPERATURE SWITCH	SWITZER PROCESS INSTRUMENTS PVT. LTD.	Mr. V S Jayaprakash, 128, SIDCO North Phase, Ambattur Estates CHENNAI Phone- 044-26252017/2018 Pincode : 600050 Email : sales@switzerprocess.co.in	Works-1->C S Shankar 127, Sidco North Phase, Ambattur Estates, -CHENNAI-TAMIL NADU INDIA Phone- 8754491904 FAX : 044-26248849 Pincode : 600050 Email : cservice@switzerinstrument.com
TEMPERATURE SWITCH	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,	Works-1->LARRY DEGARMO/ ROY STUMBOUGH 14685 W. 105TH STREET, LENEXA -KANSAS- USA Phone- 913-888-0767 FAX : 913-888-0767 Pincode : 66215 Email : rstumbough@sorinc.com
SIGHT FLOW INDICATORS	V. AUTOMAT & INTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com	Works-1->Mr. BHAGWAN SINGH/ Mr. NANDAN SINGH F-34, OKHLA INDL.AREA,PHASE-I -NEW DELHI-DELHI INDIA Phone- 011-47627200 Extn. 3 FAX : 011- 26819440 Pincode : 110 020 Email : production@vautomat.com
SIGHT FLOW INDICATORS	BLISS ANAND PVT. LTD.	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B , IMT MANESAR Gurgaon Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com	Works-1->Mr. Bharat Kumar/ Mr. Sasi Kumar Plot No. 240, Sector-3, HSIIDC, Bawal -Rewari-HARYANA INDIA Phone- 0124-4366000 TO 9 FAX : 0124-2290884 Pincode : 123501 Email : bharat@blissanand .com
SIGHT FLOW INDICATORS	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com	
SIGHT FLOW INDICATORS	B.K.EQUIPMENTS PVT.LTD.	T. BALAKRISHNAN/S.VENKATESH 217 , ARCOT ROAD PORUR , CHENNAI Phone- 9444057761 Pincode : 600116 Email : bkequip@gmail.com	Works-1->V.KARUNANIDHI/P.BABU 217 , ARCOT ROAD,PORUR , -CHENNAI-TAMIL NADU INDIA Phone- 9444131187 FAX : 044-24766852 Pincode : 600116 Email : bkequip@gmail.com
SIGHT FLOW INDICATORS	INSTRUMENTATION ENGINEERS PVT LTD	SH.N.V.RAM GOPAL/MS. N.NIHARIKA PLOTS 1,2,3, PHASE-III, IDA, JEEDIMETLA HYDERABAD Phone- 9848407365 Pincode : 500055 Email : iedelhi@ieflowmeters.com	Works-1->MR. A.V.MURTHY/MR. K.T. RAVISANKER PLOTS 1,2,3, PHASE-III,IDA, JEEDIMETLA -HYDERABAD-TELANGANA INDIA Phone- 9885107312 FAX : 040-23096401 Pincode : 500055 Email : sales@ieflowmeters.com
SIGHT FLOW INDICATORS	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in	Works-1->R Gopinath 27 Nahur Udyog Industrial Premises,M.M.Malviya Road, Mulund(-MUMBAI-MAHARASHTRA INDIA Phone- +912225918567 FAX : +912225918566 Pincode : 400080 Email : sales@sigmainstruments.co.in
DIFFERENTIAL PRESSURE SWITCH	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,	
JUNCTION BOX	K.S.INSTRUMENTS PVT.LTD.	S Raghavan No. 72, 3rd Main, 1st Stage Industrial Suburb, Yeshwanthpur Bangalore Phone- 9880385770 Pincode : 560022 Email : sales1@ksinstruments.net	
JUNCTION BOX	SUCHITRA INDUSTRIES	NO-2,OPP-27 AECS LAYOUT 2ND STG REJAMAHALVILAS EXTN 2ND STG BANGALORE Phone- Pincode : Email : suchitra.industriesblr@gmail.com	Works-1->B. Srinivas Suchitra Industries, Opp No 53, Muneshwara Black Devinagar, Lottagal hal -BANGALORE-KARNATAKA INDIA Phone- 080-23511247 FAX : Pincode : 560094 Email : suchitra_industries@yahoo.com
JUNCTION BOX	FLEXPRO ELECTRICALS PVT. LTD.	Mr. Dineshbhai Zaveri C-1/ 27&37, GIDC, Kabilpore, Navsari Phone- 02637-265140,265003 Pincode : 396424 Email : flexpro@flexproltd.com	Works-1->Mr. Dineshbhai Zaveri CEO C-1/ 27&37, GIDC, Kabilpore, -Navsari-GUJARAT INDIA Phone- 02637-265140,265003 FAX : 02637-265308 Pincode : 396424 Email : flexpro@flexproltd.com
JUNCTION BOX	Shrenik & Company,	Mr. Mitesh Shah/Mr. Pulin Shah 39 A/3 ,Panchratna Industrial Estate, Sarkhej-Bavla Road Ahmedabad Phone- 9825024921 Pincode : 382213 Email : sales@pustron.com, pulin@sumip.com	Works-1->Mr.Pulin Shah/ Mr. Kaloesh Parmar 39 A/3 ,Panchratna Industrial Est,Sarkhej-Bavla Road, Changodhar -Ahmedabad-GUJARAT INDIA Phone- 98250 80339 1 FAX : 079-26932424 Pincode : 382213 Email : sales@sumip.com
JUNCTION BOX	AJMERA INDUSTRIAL & ENGINEERING WORKS	JIGNESH MAHENDRA AJMERA DENA BANK BLDG.,SHREE NAGESH INDL. ESTATE,STATION ROAD, MUMBAI Phone- 022 67973578 Pincode : 400 088 Email : ajmera@ajmera.net, jmajmera@yahoo.com	Works-1->JIGNESH MAHENDRA AJMERA DENA BANK BLDG., SHREE NAGESHINDL. ESTATE,STATION ROAD, -MUMBAI-MAHARASHTRA INDIA Phone- 022 67973578 FAX : Pincode : 400 088 Email : ajmera@ajmera.net
INSTRUMENTS TUBE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com	Works-1->S.R.SINGH/ NAVEEN SINGH B - 2, SECTOR - 6, -NOIDA-UTTAR PRADESH INDIA Phone- 0120-4352940 FAX : 0120-4352940 Pincode : 201301 Email : naveensingh@vsnl.com
INSTRUMENTS TUBE FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com	Works-1->ALEX BAPTIST/ K. SRINIVAS 7. SIDHAPURA INDUSTRIAL ESTATE,SV ROAD, GOREGAON(WEST) -MUMBAI-MAHARASHTRA INDIA Phone- 022-42631700 FAX : 022-40035259 Pincode : 400 062 Email : srinivas@precision-engg.com

Package Name	Supplier Name	Supplier Communication Address	Supplier Works Address
INSTRUMENTS TUBE FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com	
INSTRUMENTS TUBE FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Moochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com	Works-1->Mr. Tansen Choudhari/Mr. Mahesh Darekar Shed No.8, Lonavla Indl.Co-op.Estate Ltd,Nagargaon, -Lonavla-MAHARASHTRA INDIA Phone- 9823951347 FAX : (02114) 271132 Pincode : 410 401 Email : factory@hyd-air.com
VENTURI METER	TM TECNOMATIC SPA	MR. ANTONIO NOVIELLO/Mrs. Enrica Bazzocc VIA DELLE INDUSTRIE, 36 CREMONA Phone- 39037221574 Pincode : 26100 Email : info@tmtecnomatic.com	Works-1->Mrs. Enrica Bazzocchi VIA DELLE INDUSTRIE, 36, -CREMONA-Italy Phone- 39037221574 FAX : 39037228318 Pincode : 26100 Email : sales@tmtecnomatic.com
VENTURI METER	MICRO PRECISION PRODUCTS PVT. LTD.	Mr. Anil Bhati, H.B. No.-40, Revenue Estate, Village-Dudhola,Tehsil & Distt. Palwal FARIDABAD Phone- 9560742713;095607427 Pincode : 121002 Email : anil.bhati@wika.com	
VENTURI METER	STAR-MECH CONTROLS (I) PVT.LTD.	SUSHILLOTAM, SUSHILLOTAM, 29/3A/3, SASANE NAGAR, HADAPSAR, PUNE Phone- 02026970450 Pincode : 411028 Email : marketing@starmech.net	Works-1->VIVEK GOTE/ MAHúNDRA BANSODE Sr no.54, Plot No.ll0,Swami ViVekanand Industrial Est.HADAPS -PUNE-MAHARASHTRA INDIA Phone- 02026970450 FAX : 02026970470 Pincode : 411028 Email : marketing@starmech.net
ROTAMETER	INSTRUMENTATION ENGINEERS PVT LTD	SH.N.V.RAM GOPAL/MS. N.NIHARIKA PLOTS 1,2,3, PHASE-III, IDA, JEEDIMETLA HYDERABAD Phone- 9848407365 Pincode : 500055 Email : iedelhi@ieflowmeters.com	Works-1->MR. A.V.MURTHY/MR. K.T. RAVISANKER PLOTS 1,2,3, PHASE-III,IDA, JEEDIMETLA -HYDERABAD-TELANGANA INDIA Phone- 9885107312 FAX : 040-23096401 Pincode : 500055 Email : sales@ieflowmeters.com
ROTAMETER	TANSA EQUIPMENTS PVT. LTD.	Mr. Vardhan Tamhankar, Unit No35/36/41,Om Anand Industrial Est. Mohanjee Sundarjee Road,Raghunath Nagar, Thane Phone- 022-25832323 Pincode : 400604 Email : tansaindia@gmail.com	Works-1-> Others Mohanjee Sundarjee Road, Raghunath Nagar, Thane - Mumbai-MAHARASHTRA INDIA Phone- FAX : Pincode : 400604 Email :
ROTAMETER	EUREKA INDUSTRIAL EQUIPMENTS PVT.LTD.	Mr V. K. Pandit/Mr Ashish Shaha 17-20, Royal chambers, Paud Road Pune Phone- 9370469466 Pincode : 411038 Email : sales@eurekaflow.com	Works-1->Mr S. M. Alawani/Mr V. V. Deshpande J-501, M.I.D.C. Pimpri, -PUNE-MAHARASHTRA INDIA Phone- 9325751732 FAX : 020-30681731 Pincode : 411018 Email : works@eurekaflow.com
ROTAMETER	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com	Works-1->Scientific Centre, S.No. 65, Hissa No. 7,By-Pass Juction, Kausa, -Mumbai-MAHARASHTRA INDIA Phone- 9892230623, FAX : 022-25491408/9 Pincode : 400 612, Email : sales@scientificdevices.com
LEVEL SWITCH-CAPACITANCE TYPE	V. AUTOMAT & INTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com	Works-1->Mr. BHAGWAN SINGH/ Mr. NANDAN SINGH F-61, OKHLA INDL.AREA,PHASE-I -NEW DELHI-DELHI INDIA Phone- 011-47627200 Extn. 3 FAX : 011- 26819440 Pincode : 110 020 Email : production@vautomat.com
LEVEL SWITCH-CAPACITANCE TYPE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com	Works-1->Scientific Center, Others By-Pass Junction,Near Kalsekar College kausa, mumbra,Thane -Mumbai-MAHARASHTRA INDIA Phone- 022-25491409,9892230623 FAX : Pincode : 400612 Email : sdbpl@vsnl.com
LEVEL SWITCH-CAPACITANCE TYPE	Pune Techtrol Pvt. Ltd.	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune Phone- 9850560042 Pincode : 411 026 Email : ho@punetechtrol.com	
LEVEL SWITCH-CAPACITANCE TYPE	LEVCON INSTRUMENTS PVT. LTD.	Mr Shayak Gupta/Badal Jana Rajkamal', 7th floor, 13, Camac Street KOLKATA Phone- 0 33 2283 2766 Pincode : 700017 Email : b_jana@levcongroup.com	
LEVEL SWITCH-CAPACITANCE TYPE	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com	Works-1->Mr. Shyam Warilani/Mr. V Suresh Babu Plot No 34 À GIDC À Phase 1, -VAPI-GUJARAT INDIA Phone- +91 11 4161 7111 FAX : 022 2687 3613 Pincode : 396 195 Email : pbajaj@baumer.com
LEVEL SWITCH-CAPACITANCE TYPE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in	Works-1->R Gopinath 27 Nahur Udyog Industrial Premises,M.M.Malviya Road, Mulund(-MUMBAI-MAHARASHTRA INDIA Phone- +912225918567 FAX : +912225918566 Pincode : 400080 Email : sales@sigmainstruments.co.in
LEVEL SWITCH-CONDUTIVITY TYPE	Sapcon Instrument Pvt Ltd.	131, PALSHIKAR COLONY Contact Person- Mr. Ashwin (9826080207) INDORE Phone- +91-731-4085751, Pincode : 452004 Email : sales@sapconinstruments.com	Works-1->Mr. Ashwin R Palshikar/Mr. Navin Bodse 131 PALSHIKAR COLONY, -INDORE-MADHYA PRADESH INDIA Phone- 9754261005 FAX : 0731-2475475 Pincode : 452004 Email : sales@sapcon.in
LEVEL SWITCH-CONDUTIVITY TYPE	LEVCON INSTRUMENTS PVT. LTD.	Mr Shayak Gupta/Badal Jana Rajkamal', 7th floor, 13, Camac Street KOLKATA Phone- 0 33 2283 2766 Pincode : 700017 Email : b_jana@levcongroup.com	Works-1-> 38G, PICNIC GARDEN ROAD, -KOLKATA-WEST BENGAL INDIA Phone- FAX : Pincode : Email :
LEVEL SWITCH-CONDUTIVITY TYPE	BLISS ANAND PVT. LTD.	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B , IMT MANESAR Gurgaon Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com	Works-1->Mr. Bharat Kumar/ Mr. Sasi Kumar Plot No. 92B & 93B,Sec-V, IMTManesar -GURGAON-HARYANA INDIA Phone- 0124-4366000 TO 9 FAX : 0124-2290884 Pincode : 122002 Email : bharat@blissanand .com
LEVEL SWITCH-CONDUTIVITY TYPE	HI-TECH SYSTEMS & SERVICES LTD.	Mr. Vikash Agrawal/Mr. Tarun Debnath 119, PARK STREET , KOLKATA Phone- 033-22290045 Pincode : 700016 Email : sandeep@hitech.in	Works-1->Mr. Jitendra Kumar/Mr. Debasis Dey 82/1, Sarsuna Main Road, -KOLKATA-WEST BENGAL INDIA Phone- 9883994030 FAX : Pincode : 700061 Email : jitendra@hitech.in
LEVEL SWITCH-CONDUTIVITY TYPE	RAMAN INSTRUMENTS PVT.LTD.	Mr. N R Shenoy/Mr G B Vijh 8, First Floor.Plot : 160A Bait-Ush-Sharaf, 29th Road,Bandra(W) MUMBAI Phone- 09892331381 Pincode : 400050 Email : ramanbpl@vsnl.com	Works-1->NA -- Phone- FAX : Pincode : Email :
LEVEL SWITCH-CONDUTIVITY TYPE	V. AUTOMAT & INTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com	Works-1->Mr. BHAGWAN SINGH/ Mr. NANDAN SINGH F-61, OKHLA INDL.AREA,PHASE-I -NEW DELHI-DELHI INDIA Phone- 011-47627200 Extn. 3 FAX : 011- 26819440 Pincode : 110 020 Email : production@vautomat.com
LEVEL SWITCH-CONDUTIVITY TYPE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in	Works-1->R Gopinath 27 Nahur Udyog Industrial Premises,M.M.Malviya Road, Mulund(-MUMBAI-MAHARASHTRA INDIA Phone- +912225918567 FAX : +912225918566 Pincode : 400080 Email : sales@sigmainstruments.co.in
LEVEL SWITCH-CONDUTIVITY TYPE	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,	Works-1->LARRY DEGARMO/ ROY STUMBOUGH 14685 W. 105TH STREET, LENEXA -KANSAS- USA Phone- 913-888-0767 FAX : 913-888-0767 Pincode : 66215 Email : rstumbough@sorinc.com
LEVEL SWITCH-FLOAT TYPE	Pune Techtrol Pvt. Ltd.	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune Phone- 9850560042 Pincode : 411 026 Email : ho@punetechtrol.com	
LEVEL SWITCH-FLOAT TYPE	V. AUTOMAT & INTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com	Works-1->Mr. BHAGWAN SINGH/ Mr. NANDAN SINGH F-61, OKHLA INDL.AREA,PHASE-I -NEW DELHI-DELHI INDIA Phone- 011-47627200 Extn. 3 FAX : 011- 26819440 Pincode : 110 020 Email : production@vautomat.com
LEVEL SWITCH-FLOAT TYPE	D.K. INSTRUMENTS PVT.LTD.	N.SIKDAR/ SUMIT SIKDAR 76/2,SELIMPUR RD DHAKURIA Kolkata Phone- 033-2415-1310. Pincode : 700031 Email : dkinst@vsnl.net	
LEVEL SWITCH-FLOAT TYPE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com	Works-1->Scientific Center, Others By-Pass Junction,Near Kalsekar College kausa, mumbra,Thane -Mumbai-MAHARASHTRA INDIA Phone- 022-25491409,9892230623 FAX : Pincode : 400612 Email : sdbpl@vsnl.com
LEVEL SWITCH-FLOAT TYPE	LEVCON INSTRUMENTS PVT. LTD.	Mr Shayak Gupta/Badal Jana Rajkamal', 7th floor, 13, Camac Street KOLKATA Phone- 0 33 2283 2766 Pincode : 700017 Email : b_jana@levcongroup.com	
LEVEL SWITCH-FLOAT TYPE	GENERAL INSTRUMENTS CONSORTIUM	Mr. Amarendra Kulkarni 194/195, Gopi Tank Road, Off. Pandurang Naik Marg, Mahim Mumbai Phone- 9323195251 Pincode : 400016 Email : amarendra@general-gauges.com	

Package Name	Supplier Name	Supplier Communication Address	Supplier Works Address
LEVEL SWITCH-FLOAT TYPE	SBEM PVT. LTD.	MR.N.K. BEDARKAR/MR. VISHWANATH KARANDIK 39, ELECTRONIC CO.OP. ESTATE, PUNE SATARA ROAD PUNE, Phone- 912041030100 Pincode : 411009 Email : newdelhi@sbem.co.in	Works-1->MR. MOHAN PADWAL 691/A/2,BIBWEWADI INDL ESTATE -PUNE-MAHARASHTRA INDIA Phone- 918600042374 FAX : 912024215670 Pincode : 411037 Email : wm@sbem.co.in
LEVEL SWITCH-FLOAT TYPE	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com	Works-1->Mr. Shyam Warilani/Mr. V Suresh Babu Plot No 34 À GIDC À Phase 1, -VAPI-GUJARAT INDIA Phone- +91 11 4161 7111 FAX : 022 2687 3613 Pincode : 396 195 Email : pbajaj@baumer.com
LEVEL SWITCH-FLOAT TYPE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in	Works-1->R Gopinath 27 Nahur Udyog Industrial Premises,M.M.Malviya Road, Mulund(-MUMBAI-MAHARASHTRA INDIA Phone- +912225918567 FAX : +912225918566 Pincode : 400080 Email : sales@sigmainstruments.co.in
LEVEL SWITCH-FLOAT TYPE	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,	Works-1->LARRY DEGARMO/ ROY STUMBOUGH 14685 W. 105TH STREET, LENEXA -KANSAS- USA Phone- 913-888-0767 FAX : 913-888-0767 Pincode : 66215 Email : rstumbough@sorinc.com
INSTRUMENTS PIPE FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com	
INSTRUMENTS PIPE FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com	Works-1->ALEX BAPTIST/ K. SRINIVAS 7. SIDHAPURA INDUSTRIAL ESTATE,SV ROAD, GOREGAON(WEST) -MUMBAI-MAHARASHTRA INDIA Phone- 022-42631700 FAX : 022-40035259 Pincode : 400 062 Email : srinivas@precision-engg.com
INSTRUMENTS PIPE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com	Works-1->S.R.SINGH/ NAVEEN SINGH B - 2, SECTOR - 6, -NOIDA-UTTAR PRADESH INDIA Phone- 0120-4352940 FAX : 0120-4352940 Pincode : 201301 Email : naveensingh@vsnl.com
INSTRUMENTS PIPE FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Moochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com	Works-1->Mr. Tansen Choudhari/Mr. Mahesh Darekar Shed No.8, Lonavla Indl.Co-op.Estate Ltd,Nagargaon, -Lonavla-MAHARASHTRA INDIA Phone- 9823951347 FAX : (02114) 271132 Pincode : 410 401 Email : factory@hyd-air.com
ULTRASONIC FLOW METERS	Electronet Equipments Pvt Ltd.	Mr. Rajendra Nagaonkar/MD, Plot No. 84, 85 & 86, Tiny Industrial Estate Kondhwa Budruk, Pune Phone- 9822015256 Pincode : 411048 Email : ho@eeplindia.com	Works-1-> Others Plot No. 84, 85 & 86, Tiny Industrial Estate, Kondhwa Budruk -Pune-MAHARASHTRA INDIA Phone- 20-26932039 FAX : 20-26934122 Pincode : 411048 Email : ho@eeplindia.com
ULTRASONIC FLOW METERS	Adept Fluidyne Pvt. Ltd.	Vinayak Gadre Plot No 4,S.No.17/1-B Kothrud Industrial Estate Pune Phone- 020 25464551 Pincode : 411038 Email : info@adeptfluidyne.com	Works-1-> Plot No 4,S.No.17/1-B Kothrud Industrial Estate -Pune-MAHARASHTRA india Phone- 020 25464551 FAX : Pincode : 411038 Email : info@adeptfluidyne.com
ULTRASONIC FLOW METERS	FLEXIM Flexible Industriemesstechnik GmbH	Boxberger Str., 4, Berlin Berlin Phone- 0049 30 93 66 76 60 Pincode : 12681 Email : info@flexim.de	Works-1-> Others Boxberger Str. 4, -Berlin- GERMANY Phone- 0049 30 93 66 76 60 FAX : Pincode : 12681 Email : info@flexim.de
ULTRASONIC FLOW METERS	Rockwin Flowmeter India Pvt. Ltd.	B-24, Site-IV, Sahibabad Industrial Area Ghaziabad, Phone- 9810129687 Pincode : 201010, Email : amiya@rockwin.com	Works-1->MR Rajiv PRAKASH B-24, Site-IV, Sahibabad Industrial Area, -Ghaziabad-UTTAR PRADESH India Phone- 9810129687 FAX : 01202895450 Pincode : 201010, Email : rajiv@rockwin.com
ULTRASONIC FLOW METERS	FLASH FORGE PVT LTD	Mr. Gautam Makker, 503, 'A'-wing, Delphi, Orchard Avenue Road, Powai Mumbai Phone- 022-42784300 Pincode : 400076 Email : hemendrapatil@f-f.co.in	Works-1-> Others M/s Endress & Hauser, Aurangabad, Maharastra -Aurangabad-MAHARASHTRA INDIA Phone- FAX : Pincode : Email : Works-2->+ Others M/s Endress & Hauser, Bhiwandi,Thane -Thane-MAHARASHTRA INDIA Phone- FAX : Pincode : Email :
ULTRASONIC FLOW METERS	TOSHNIWAL INDUSTRIES PVT. LTD.,	Industrial Estate, Makhupura, Ajmer, Phone- 9352009000, Pincode : 305002, Email : info@tipl.com,	Works-1->RAJEEV TOSHNIWAL, MD Others INDUSTRIAL ESTATE, MAKHUPURA -AJMER-RAJASTHAN INDIA Phone- FAX : 1456601111 Pincode : 305002 Email : info@tipl.com
ULTRASONIC FLOW METERS	NIVUS GMBH	Mr. Marcus Fischer Im Taele 2, D - 75031 Eppingen Phone- 00491712233770 Pincode : Email : carolin.schuster@nivus.com	Works-1->Mr. Marcus Fischer CEO Im Taele 2, Eppingen, -Baden Wuerttemberg,-Foreign Country GERMANY Phone- 0049-726291910 FAX : Pincode : 75031 Email : carolin.schuster@nivus.com
FLOW ELEMENT - ORIFICE	TANSA EQUIPMENTS PVT. LTD.	Mr. Vardhan Tamhankar, Unit No35/36/41,Om Anand Industrial Est. Mohanjee Sundarjee Road,Raghunath Nagar, Thane Phone- 022-25832323 Pincode : 400604 Email : tansaindia@gmail.com	Works-1-> Others Mohanjee Sundarjee Road, Raghunath Nagar, Thane -Mumbai-MAHARASHTRA INDIA Phone- FAX : Pincode : 400604 Email :
FLOW ELEMENT - ORIFICE	MINCO (INDIA) PRIVATE LIMITED	Mr. Rajeev Vasudeva, D/35, TIVIM INDUSTRIAL ESTATE, KARASWADA, MAPUSA, Goa, Phone- 9313637073 Pincode : 403526, Email : gicdelhi@general-gauges.com	Works-1-> D/35,TIVIM INDUSTRIAL ESTATE, KARASWADA,MAPUSA, -Goa-Goa India Phone- 9320197825, FAX : 0832-2257262, Pincode : 403526, Email : santoshkumar@general-gauges.com
FLOW ELEMENT - ORIFICE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com	Works-1->Scientific Center, Others By-Pass Junction,Near Kalsekar College kausa, mumbra,Thane -Mumbai-MAHARASHTRA INDIA Phone- 022-25491409,9892230623 FAX : Pincode : 400612 Email : sdbpl@vsnl.com
FLOW ELEMENT - ORIFICE	Electronet Equipments Pvt Ltd.	Mr. Rajendra Nagaonkar/MD, Plot No. 84, 85 & 86, Tiny Industrial Estate Kondhwa Budruk, Pune Phone- 9822015256 Pincode : 411048 Email : ho@eeplindia.com	Works-1-> Others Plot No. 84, 85 & 86, Tiny Industrial Estate, Kondhwa Budruk -Pune-MAHARASHTRA INDIA Phone- 20-26932039 FAX : 20-26934122 Pincode : 411048 Email : ho@eeplindia.com
FLOW ELEMENT - ORIFICE	INSTRUMENTATION LTD.	KANJIKODE WEST, PALALKKAD, PALAKKAD Phone- 2566127-130,2567128 Pincode : 678623 Email : icvldil@gmail.com;fa2@ilpgt.com	Works-1->D.SASIDHARAN, AGM(Works&PPC) KANJIKODE WEST, -PALAKKAD-KERALA INDIA Phone- 0491-2566536 FAX : 0491-2566135 Pincode : 678623 Email : sasidharan@ilpgt.com;mraj@ilpgt.com;gireesh@ilpgt.com, commercial@ilpgt.com;fa2@ilpgt.com;nazeera@ilpgt.com;pkv@ilpgt.com;remith@ilpgt.com
FLOW ELEMENT - ORIFICE	MICRO PRECISION PRODUCTS PVT. LTD.	Mr. Anil Bhati, H.B. No.-40, Revenue Estate, Village-Dudhola,Tehsil & Distt. Palwal FARIDABAD Phone- 9560742713;095607427 Pincode : 121002 Email : anil.bhati@wika.com	Works-1->Mr. SANJEEV CHAUHAN ,H.B. No.-40 Others Revenue Estate, Village-Dudhola, Tehsil & Distt.-Palwal -Faridabad-Haryana India Phone- 9560742713 FAX : Pincode : 121002 Email : anil.bhati@wika.com
FLOW ELEMENT - ORIFICE	MINCO (INDIA) FLOW ELEMENTS PVT. LTD.	Mr. Raghavendra M. Kulkarni D2-49/50, Tivim Industrial Estate, Karaswada Mapusa Phone- 0832-2257059 Pincode : 403526 Email : gicflowelement@giconindia.com	Works-1->Mr. Raghavendra M. Kulkarni Dir D2-49/50, Tivim Industrial Estate,Karaswada -Mapusa-GOA INDIA Phone- 0832-2257059 FAX : 022-24455026 Pincode : 403526 Email : gicflowelement@giconindia.com
FLOW ELEMENT - ORIFICE	STAR-MECH CONTROLS (I) PVT.LTD.	SUSHILLOTAM, SUSHILLOTAM, 29/3A/3, SASANE NAGAR, HADAPSAR, PUNE Phone- 02026970450 Pincode : 411028 Email : marketing@starmech.net	Works-1->VIVEK GOTE/ MAHúNDRA BANSODE Sr no.54, Plot No.ll0,Swami ViVekanand Industrial Est.HADAPS -PUNE-MAHARASHTRA INDIA Phone- 02026970450 FAX : 02026970470 Pincode : 411028 Email : marketing@starmech.net
FLOW ELEMENT - ORIFICE	CHEMTROLS INDUSTRIES PVT. LTD.	Mr. K. NANDAKUMAR AMAR HILL, SAKI VIHAR ROAD, POWAI, MUMBAI Phone- 022-67151261 Pincode : 400072 Email : manikandan@chemtrols.com	Works-2->+Works -II :M/s Chemtrols Samil (I) Pvt. Ltd.,Plot No.F-43,44 Others Additional Ambernath Industrial ,M.I.D.C., Ambernath -Thane-MAHARASHTRA INDIA Phone- 22-67151261,9821014902 FAX : 91-22-28571913 Pincode : 421503 Email : manikandan@chemtrols.com
FLOW ELEMENT - ORIFICE	INSTRUMENTATION ENGINEERS PVT LTD	SH.N.V.RAM GOPAL/MS. N.NIHARIKA PLOTS 1,2,3, PHASE-III, IDA, JEEDIMETLA HYDERABAD Phone- 9848407365 Pincode : 500055 Email : iedelhi@ieflowmeters.com	Works-1->MR. A.V.MURTHY/MR. K.T. RAVISANKER PLOTS 1,2,3, PHASE-III,IDA, JEEDIMETLA -HYDERABAD-TELANGANA INDIA Phone- 9885107312 FAX : 040-23096401 Pincode : 500055 Email : sales@ieflowmeters.com

PACKAGE WISE REGISTERED SUPPLIER LIST (PERMANENT CATEGORY) AS ON 4/16/2021 PM

Package Name	Supplier Name	Supplier Communication Address	Supplier Works Address
FLOW ELEMENT - ORIFICE	DYNAFLUID VALVES AND FLOW CONTROLS (P) LTD.	Mr. Yogish M. Kulkarni Plot # 23, Udyambag, Belgaum Phone- 0831-4210386 Pincode : 590008 Email : yogish@dyna-fluid.com	Works-1->Mr. Yogish M. Kulkarni Dir Plot # 23, Udyambag, -Belgaum-KARNATAKA INDIA Phone- 0831-4210386 FAX : 0831-4210386 Pincode : 590008 Email : yogish@dyna-fluid.com
INSTRUMENT FITTINGS	Arya Crafts & Engineering Pvt. Ltd.	Mr.Sanjay Brahman/Mr.Shyam Vazirani 102, Vora Industrial Estate No.4 Navghar, Vasai Road (E) Dist.Thane, Mumbai Phone- +91-250-2392246 Pincode : 401210 Email : arya@aryaengg.com	
INSTRUMENT FITTINGS	Perfect Instrumentation Control (India) Pvt. Ltd.	MD Hussain Shaikh/Shahanawaz Khan Gala No. 168, Loheki Chwal,216/ 218, Maulana Azad Rd. Nagpada Junction Mumbai Phone- 91-9324383121 Pincode : 400008 Email : shahanawaz.khan@perfectinstrumentation.com	Works-1->Shahanawaz Khan Vishweshwar Ind. Premises Co-op Soc. Ltd,F-18/19, Pradhikaran,Bhosadi MIDC -PUNE-MAHARASHTRA INDIA Phone- 020-30694134 FAX : 022-23013010 Pincode : 411026 Email : shahanawaz.khan@perfectinstrumentation.com
INSTRUMENT FITTINGS	FLUIDFIT ENGINEERS PVT. LTD.	Mr. Abbas Bhola Potia Building No. 2, Office No. 3,292, Bellasis Road,Mumbai Central (East) Mumbai Phone- 9920044113 Pincode : 400008 Email : ab@fluidfitengg.com	Works-1->Mr. Abbas Bhola Unit No. 16, Supreme Industrial Estate,Kaman Bhiwandi Road,Devdal, -Vasai East-MAHARASHTRA India Phone- 9920044113 FAX : 07303178243 Pincode : 401208 Email : ab@fluidfitengg.com
INSTRUMENT FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com	Works-1->S.R.SINGH/ NAVEEN SINGH B - 2, SECTOR - 6, -NOIDA-UTTAR PRADESH INDIA Phone- 0120-4352940 FAX : 0120-4352940 Pincode : 201301 Email : naveensingh@vsnl.com
INSTRUMENT FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Moochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com	Works-1->Mr. Tansen Choudhari/Mr. Mahesh Darekar Shed No.8, Lonavla Indl.Co-op.Estate Ltd,Nagargaon, -Lonavla-MAHARASHTRA INDIA Phone- 9823951347 FAX : (02114) 271132 Pincode : 410 401 Email : factory@hyd-air.com
INSTRUMENT FITTINGS	PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business,Parsiwada, Sahar road,Andheri(East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com,	Works-1->Mr. Santosh Shukla Others R-628,TTC Industrial Area, MIDC Rabale, -Navi Mumbai-MAHARASHTRA India Phone- 9821350761, FAX : 022-27695559, Pincode : 400701, Email : sales@panamengineers.com
INSTRUMENT FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com	Works-1->ALEX BAPTIST/ K. SRINIVAS 7. SIDHAPURA INDUSTRIAL ESTATE,SV ROAD, GOREGAON(WEST) -MUMBAI-MAHARASHTRA INDIA Phone- 022-42631700 FAX : 022-40035259 Pincode : 400 062 Email : srinivas@precision-engg.com
INSTRUMENT FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com	
INSTRUMENT FITTINGS	Comfit & Valve Pvt. Ltd.	Mr. Jeetu Jain/Mr. Vinay Sosa Survey No. 23/1, Part 2, Ahmedabad-Mehsana Highway Laxmipura, Nandasan Phone- 02764-267036/37 Pincode : 382705 Email : marketing@com-fit.com	Works-1->Miss Sonal Pithadia/Miss Pavan Chavda Survey No. 23/1, Part 2, Ahmedabad-Mehsana Highway, Laxmipura -Nandasan-GUJARAT INDIA Phone- 8460848087 FAX : 2764-267036/37 Pincode : 382705 Email : domestic@com-fit.com
INSTRUMENT FITTINGS	HP VALVES & FITTINGS INDIA PVT. LTD.	S. Harichandran/P.S. Pandi B-11, Mugappair Industrial Estate, CHENNAI Phone- 044 26252537 Pincode : 600037 Email : sales@hpvalvesindia.com	Works-1->S. Harichandran/ P.S. Pandi B-11, Mugappair Industrial Estate, -CHENNAI-TAMIL NADU INDIA Phone- 044-25252537 FAX : 044-26252538 Pincode : 600037 Email : sales@hpvalvesindia.com
ELECTROMAGNETIC FLOW METER	Adept Fluidyne Pvt. Ltd.	Vinayak Gadre Plot No 4,S.No.17/1-B Kothrud Industrial Estate Pune Phone- 020 25464551 Pincode : 411038 Email : info@adeptfluidyne.com	Works-1-> Plot No 4,S.No.17/1-B Kothrud Industrial Estate -Pune-MAHARASHTRA india Phone- 020 25464551 FAX : Pincode : 411038 Email : info@adeptfluidyne.com
ELECTROMAGNETIC FLOW METER	Electronet Equipments Pvt Ltd.	Mr. Rajendra Nagaonkar/MD, Plot No. 84, 85 & 86, Tiny Industrial Estate Kondhwa Budruk, Pune Phone- 9822015256 Pincode : 411048 Email : ho@eeplindia.com	Works-1-> Others Plot No. 84, 85 & 86, Tiny Industrial Estate, Kondhwa Budruk -Pune-MAHARASHTRA INDIA Phone- 20-26932039 FAX : 20-26934122 Pincode : 411048 Email : ho@eeplindia.com
ELECTROMAGNETIC FLOW METER	V.A Valves	Mr.Vishal Jain, Udyog Nagar, Gadaipur, Jalandhar Phone- 9872626376 Pincode : 144004 Email : support@fedrelflowmeters.com	Works-1->Mr.Vishal Jain Dir Udyog Nagar, Gadaipur, -Jalandhar-PUNJAB INDIA Phone- 01812601741,9872626376 FAX : Pincode : 144004 Email : support@fedrelflowmeters.com
ELECTROMAGNETIC FLOW METER	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com	Works-1->Scientific Center, Others By-Pass Junction,Near Kalsekar College kausa, mumbra,Thane -Mumbai-MAHARASHTRA INDIA Phone- 022-25491409,9892230623 FAX : Pincode : 400612 Email : sdbpl@vsnl.com
ELECTROMAGNETIC FLOW METER	NIVO CONTROLS PVT. LTD.	Mr. Praveen Toshniwal 104-115, Electronic Complex, Indore Phone- 0731-4081305 Pincode : 452010 Email : sales@nivocontrols.com	Works-1->Mr. S L Sadani Others 104 - 115,Electronic Complex -Indore-MADHYA PRADESH INDIA Phone- 0731-4081307 FAX : Pincode : 452010 Email : sales@nivocontrols.com;sadanis@nivocontrols.com

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.

SUB-VENDOR LIST FOR LT MOTORS

SL NO.	VENDOR NAME	
1	ABB	14, MATHURA ROAD, FARIDABAD, HARYANA-121003
2	BHARAT BIJLEE LTD.	BHARAT BIJLEE LIMITED, 1ST FLOOR, 7-B, RAJINDRA PARK, PUSA ROAD, NEW DELHI - 110 060.
3	CROMPTON GREAVES	3RD FLOOR, EXPRESS BUILDING,9-10, BAHADUR SHAH ZAFAR MARG, NEAR ITO CROSSING,NEW DELHI-110002, INDIA
4	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032
5	KIRLOSKAR ELECTRIC CO LTD.	P.O. BOX 5555 , MALLESWARAM WEST ,BANGALORE 560055
6	LAXMI HYDRAULICS PVT. LTD	129/130, INDUSTRIAL ESTATE PATIL NAGAR, HOTGI ROAD SOLAPUR-413003, MAHARASHTRA
7	MARATHON	MARATHON ELECTRIC INDIA PRIVATE LTD.SECTOR - 11, MODEL TOWN, FARIDABAD - 121006
8	NGEF	POCKET NO.10, FLAT NO. 37 & 38, EXPANDABLE DDA FLATS, NASIRPUR DWARKA, PHASE-I NEW DELHI-110 045
9	RAJINDRA ELECT INDUSTRIES	14 SHAH IND.ESTATE VEERA DESAI RD,ANDHERI(W) MUMBAI-400053
10	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA

SUB-VENDOR LIST FOR GLANDS

1	ALLIED TRADERS & EXPORTERS	C-124 A, SECTOR-2, NOIDA -201 301, UTTAR PRADESH, INDIA
2	ARUP ENGG & FOUNDARY WORKS	391/119,PRINCE ANWAR SHAH ROAD, CALCUTTA-700068
3	BALIGA LIGHTING EQPT.PVT.LTD.	63A,CP RAMASWAMY ROAD, ALWARPET,P.B.No 6910, CHENNAI-600018
4	COMMET BRASS PRODUCTS	NUTAN CHEMICAL COMPOUND, WALBHAT ROAD, GOREGAON, MUMBAI-400063
5	DOWELLS	M/S. DOWELLS ELECTRICALS 47/47A, SATGURU INDUSTRIAL ESTATE. OFF AAREY ROAD, GOREGOAN (EAST). MUMBAI 400 063.
6	ELECTROMAC INDUSTRIES	27/28AF NEW EMPIRE IND.ESTT., R.KRISHNA MANDIR RD.JB NGR ,ANDHERI(E),MUMBAI-400059
7	INCAB	HARE STREET,KOLKATA,WEST BENGAL-700001

SUB-VENDOR LIST FOR LUGS

1	DOWELLS	M/S. DOWELLS ELECTRICALS 47/47A, SATGURU INDUSTRIAL ESTATE. OFF AAREY ROAD, GOREGOAN (EAST). MUMBAI 400 063.

2	UNIVERSAL MACHINES LTD.	4,B.B.D.BAG (EAST) 90,STEPHEN HOUSE,5TH FLR CALCUTTA-700001

SUB-VENDOR LIST FOR DC LEAD ACID BATTERY

1	EXIDE INDUSTRIES LTD	NEW DELHI
2	HBL POWER SYSTEMS LTD (FOR TUBULAR TYPE)	HYDERABAD-TELANGANA
3	HOPPECKE BATTERIEN GMBH & CO.KG,	HOPPECKE, GERMANY

SUB-VENDOR LIST FOR DC NI-CD BATTERY

1	AMCO SAFT INDIA LTD	BANGALORE-KARNATAKA
2	HBL POWER SYSTEMS LTD	HYDERABAD-TELANGANA

SUB-VENDOR LIST FOR DC BATTERY CHARGER

1	AMARA RAJA POWER SYSTEMS LIMITED	TAMIL NADU
2	CHHABI ELECTRICALS PVT.LTD.	MAHARASHTRA
3	CHLORIDE POWER SYSTEMS & SOLUTIONS LIMITED	KOLKATA
4	DUBAS ENGG PVT LTD	BANGALORE
5	EMERSON NETWORK POWER (INDIA) PVT. LTD.	MAHARASHTRA
6	HBL POWER SYSTEMS LTD	HYDERABAD
7	JEMA ENERGY (For Static SCR Type Full Wave fully Control type)	Lasarte-Oria--SPAIN
8	MASS-TECH CONTROLS PVT.LTD.	MUMBAI-MAHARASHTRA
9	STATCON POWER CONTROLS LTD	NOIDA-UTTAR PRADESH

SUB-VENDOR LIST FOR FRP CABLE TRAYS & ACCESSORIES

1	EPP COMPOSITES PRIVATE LIMITED	Rajkot-Gujarat
2	SUMIP COMPOSITES PVT.LTD.	Ahmedabad-Gujarat

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.

"The Vendor list as included is not exhaustive and prepared from prior experience of WBPDCL. In case of items not covered in the list or if the bidder seeks additional vendor on the items already covered in the list, the same should be done with proper written request for approval from WBPDCL enclosing the vendor credentials. Maximum effort should be exercised to include only such proven vendors who are already registered in the Bidder's Vendor directory and the bidder has prior experience of supply items from such reputed vendors."

Sl. No.	Item Description	Vendor Name	
1	SEVERE SERVICE CONTROL VALVE. (PRDS & SH/RH ATTEMPERATION APPLICATION)	1	CONTROL COMPONENTS INC
		2	DRESSER VALVE INDIA PVT.LTD.
2.	BFP RECIRCULATION CONTROL VALUE	1	CONTROL COMPONENTS INC
		2	DRESSER VALVE INDIA PVT.LTD.
3.	NORMAL SERVICE CONTROL VALVE	1	MIL CONTROLS LTD.
		2	FISHER SANMAR LTD.
		3	DRESSER VALVE INDIA PVT.LTD.
		4	CONTROL COMPONENTS INC
4.	OIL TRIP VALVES (FUEL OIL SYSTEM)	1	MIL CONTROLS LTD.
		2	KHUME ARMATUREN GMBH
		3	DRESSER VALVE INDIA PVT. LTD.
5.	STEEL GATE / GLOBE / NR VALVES	1	WEIR B.D.K VALVES INDIA PVT. LTD.
		2	KIRLOSKAR BROTHERS LTD.
		3	LEADER VALVES LTD.
		4	KSB VALVES
		5	FOURESS ENGG.INDIA LTD.
		6	VAG VALVES
		7	AUDCO INDIA
		8	DEWARANCE
6.	BALL VALVES	1	FLOW CHEM INDUSTRIES
		2	FISHER SANMAR LIMITED
		3	KIRLOSKAR BROS. LTD.
		4	LEADER VALVES LTD.
		5	KSB VALVES
		6	WEIR B.D.K VALVES INDIA PVT. LTD.
		7	VAG VALVES
7.	CAST IRON GATE /GLOBE/ NRV/ SAFETY RELIEF VALVES	1	H.SARKER & COMPANY
		2	G.M.DALUI & SONS PVT.LTD.
		3	KIRLOSKAR BROS. LTD.

Sl. No.	Item Description	Vendor Name	
		4	LEADER VALVES LTD.
		5	VENUS PUMP & ENGG. WORKS
8.	GUN METAL VALVES	1	LEADER VALVES LTD.
		2	SANT VALVES PVT. LTD.
		3	VALTECH INDUSTRIES ,MUMBAI
		4	SURYA VALVES AND INSTRUMENTS MANUFACTURING COMPANY,CHENNAI
		5	VAG VALVES
9	BUTTER FLY VALVES (STEAM SERVICE)	1	FOURESS ENGG.INDIA LTD.
		2	INSTRUMENTATION LTD.
		3	BDK PROCESS CONTL. HUBLI
10.	BUTTER FLY VALVES (WATER SERVICE)	1	WEIR B.D.K VALVES INDIA PVT. LTD.
		2	FOURESS ENGG.INDIA LTD.
		3	INSTRUMENTATION LTD.
		4	LARSEN & TOUBRO LTD.
		5	KIRLOSKAR BROS. LTD.
		6	VENUS PUMP & ENGG. WORKS
		7	TYCO VALVES & CONTROLS INDIA PVT.LTD.
11.	SPRING LOADED BYPASS VALVES	1	WEIR VALVES & CONTROLS M.E.
12.	PLUG VALVES	1	WEIR B.D.K VALVES INDIA PVT. LTD.
		2	FISHER SANMAR LIMITED
		3	LARSEN & TOUBRO LTD
		4	LEADER VALVES LTD.
13.	ANGLE DRAIN VALVES	1	REINEKE MEB-UND REGELTECHNIK GMBH
		2	SEMPELL AG, GERMANY
		3	VELAN INC.,CANADA
14.	AIR RELEASE VALVES	1	H.SARKER & COMPANY
		2	LEADER VALVES LTD.
		3	VENUS PUMP & ENGG. WORKS
		4	G.M.DALUI & SONS PVT.LTD.
15.	DUAL PLATE CHECK VALVES	1	VENUS PUMP & ENGG. WORKS
		2	FLUIDLINEVALVES COMPANY PRIVATE LTD.
		3	SURYA VALVES AND INSTRUMENTS MANUFACTURING COMPANY
		4	CHEMTECH INDUSTRIAL VALVES PVT.

Sl. No.	Item Description	Vendor Name	
			LTD.
		5	ASIAN INDUSTRIAL VALVES & INSTRUMENTS,
16.	FLOAT VALVES	1	H.SARKER & COMPANY
		2	G.M.DALUI & SONS PVT.LTD.
		3	LEADER VALVES LTD.
17.	FUEL OIL PUMPS (POSITIVE DISPLACEMENT PUMPS)	1	TUSHACO PUMPS PVT. LTD.,
		2	ALEKTON ENGG.INDUSTRIES PVT.LTD.
		3	U.T.PUMPS & SYSTEMS (P) LTD.
18.	JACKING OIL PUMPS WITH MOTOR (SCREW TYPE)	1	TUSHACO PUMPS LIMITED
		2	ALLWEILER AG ,GERMANY
19.	AUX. OIL PUMP (AOP) & EMERGENCY OIL PUMP WITH MOTOR (EOP)	1	KSB PUMPS LIMITED
		2	MATHER & PLATT PUMPS
		3	KBL
20	VACUUUM PUMPS	1	EDWARDS LIMITED, UK
		2	NI-TECH INC. USA
		3	NASH ELOM INDUSTRIES, GERMANY
21	LUB OIL TRANSFER PUMPS	1	MATZ PUMPS PVT.LTD.
		2	TUSHACO PUMPS PVT.LT
22	CONCRETE VOLUTE PUMP	1	KIRLOSKAR BROS. LTD.
		2	CLYDE UNION PUMPS
		3	FLOWSERVE CORPORATION
23.	PUMPS (VERTICAL)	1	KIRLOSKAR BROS. LTD.
		2	KSB PUMPS LTD.
		3	SULZER PUMPS INDIA LTD.
		4	WEIR,UK
		5	WPIL LIMITED
		6	FLOWMORE
24.	PUMPS (HORIZONTAL)	1	KIRLOSKAR BROS. LTD.
		2	MATHER & PLATT PUMPS LTD.
		3	KSB PUMPS LTD.
		4	SULZER PUMPS INDIA LTD.
		5	WEIR,UK
25.	SUMP PUMPS / SUBMERSIBLE PUMPS/ SLUDGE PUMP	1	KISHOR PUMPS PVT.LTD
		2	KIRLOSKAR BROS. LTD.
		3	KSB PUMPS LTD.
		4	SAM TURBO
26.	LUBE OIL PUMPS	1	KSB PUMPS LTD.

Sl. No.	Item Description	Vendor Name	
	(CENTRIFUGAL)FOR TDBFP	2	KIRLOSKAR EBARA, KIRLOSKARWADI
		3	SULZER, MUMBAI.
27.	LUBE OIL PUMPS (SCREW TYPE) FOR TDBFP	1	ALLWEILER, GERMANY
		2	IMO PUMP, USA
		3	TUSHACO, DAMAN
		4	LEISTRITZ (EMPIRE), GERMANY
28.	JACKING OIL PUMP TDBFP	1	TUSHACO, (DELTA CORP)
		2	HAGULLAND DENSION
29.	SCANNER AIR FAN	1	M/S.C.DOCTOR & CO.PVT.LTD.
		2	M/S PATELS AIRFLOW LTD.
		3	M/S.AIR CONTROL & CHEMICAL ENGG. CO.LTD.
30.	FLOW ELEMENTS	1	MICRO PRECISION PRODUCTS
		2	M/S ESPL KOLKATA
		3	IL PALGHAT
31.	OIL PURIFICATION UNIT (OIL CENTRIFUGE)/PORTABLE OIL PURIFIERS	1	PENNWALT LIMITED, INDIA
		2	ALFA LAVAL LIMITED, INDIA
		3	SERVIZE INDUSTRIAL, ITALY
32.	ELECTRICAL HOIST	1	AVON CRANES PVT.LTD.
		2	LIFTING EQUIPMENTS & ACCESSORIES
		3	REVA INDUSTRIES LTD
		4	CONSOLIDTED HOIST PVT LTD
		5	TUOBRO FURGUSON(INDIA)PVT.LTD
		6	HERCULES HOISTS LTD.
		7	DYNAMECH CRANES (P) LTD.
		8	UNIVERSAL HOIST – O- FABRIK
		9	ARMSEL MHE PVT.LTD
33	CHAIN PULLEY BLOCK	1	ARMSEL MHE PVT LTD
		2	LIFTING EQUIPMENT & ACCESPROES
		3	UNIVERSAL HOIS –O-FABRIK
		4	HERCULES HOISTS LTD.
		5	TUOBRO FURGUSON(INDIA)PVT.LTD
34	DOUBLE GIRDER EOT CRANE ABOVE 50T TO 150T (TG/GT HALL & OTHER AREAS)	1	HEAVY ENGG. CORPORATION LTD.
		2	MUKAND LIMITED,
		3	THE TATA IRON & STEEL CO.LTD
		4	UNIQUE INDUSTRIAL HANDLERS PVT.LTD
		5	WMI CRANES LTD.
		6	FURNACE & FOUNDRY EQUIPMENT

Sl. No.	Item Description	Vendor Name	
			CO.
35	DOUBLE GIRDER EOT CRANES UPTO 50T	1	WMI CRANES LTD.
		2	THE TATA IRON & STEEL CO.LTD
		3	UNIQUE INDUSTRIAL HANDLERS PVT.LTD
		4	MUKAND LIMITED,
		5	AVON CRANES PVT.LTD.
		6	REVA INDUSTRIES LTD.
		7	HEAVY ENGG. CORPORATION LTD.
		8	FURNACE & FOUNDRY EQUIPMENT CO.
36	SINGLE GIRDER EOT MISC.CRANES	1	REVA INDUSTRIES LTD.
		2	CONSOLIDTED HOIST PVT LTD
		3	LIFTING EQUIPMENTS & ACCESSORIES
		4	TUOBRO FURGUSON(INDIA)PVT.LTD
37	FURNACE MAINTENANCE PLATFORM	1	N.V.SKY CLIMBER EUROPE S.A
		2	N.V.SKY MAN INTERNATIONAL S.A.
		3	HING WING GONDOLA (HK) CO LTD, HONGKONG
38	ELEVATOR-PASSENGER CUM GOODS	1	KONE ELEVATOR INDIA LTD.
		2	OTIS ELEVATOR
		3	CITY LIFT (I) LTD.
		4	ECE Industries Ltd
39.	CASTABLE REFRACTORY	1	BASKAR REFRACTORIES AND S.W PIPES(P)LTD
		2	THE ACE REFRACTORIES LTD.
		3	DALMIA REFRACTORIES
		4	SOUVENIOR CERAMICS
40.	POURABLE INSULATION	1	BASKAR REFRACTORIES & STONEWARE PIPES(P)LTD
		2	THE ACE REFRACTORIES LTD.
		3	DALMIA REFRACTORIES
41.	FIRE BRICKS	1	BASKAR REFRACTORIES AND STONEWARE PIPES (P) LTD
		2	THE ACE REFRACTORIES LTD.
		3	DALMIA REFRACTORIES
		4	R V REFRACTORIES
42.	WOOL MATTRESS	1	ROCKWOOL INDUSTRIES LTD
		2	MINWOOL ROCK FIBRES LTD
		3	LAPINUS ROCKWOOL PVT. LTD

Sl. No.	Item Description	Vendor Name	
		4	ROCKWOOL INDIA LTD.
		5	LLOYD INSULATION (I) LTD.
		6	LLOYD ROCKFIBRES LTD.
43.	THERMAL INSULATION OF STEAM TURBINE/THERMAL INSULATION OF TURBINE INTEGRAL PIPING/THERMAL INSULATION- ROCKWOOL MATTRESSES/ PIPE SECTIONS	1	LLOYD INSULATIONS
		2	MINWOOL ROCK FIBERS
		3	ROCKWOOL
		4	LAPNNUS ROCKWOOL
44.	THERMAL INSULATION - ANCILLARY MATERIAL	1	LLOYD INSULATIONS (INDIA) LIMITED
		2	SURESH INDUSTRIAL CORPORATION
		3	ALLIED INSULATIONS (INDIA), GHAZIABAD
		4	ENERGY SAVING & ALLIED PRODUCTS
45	STEAM TRAPS	1	PREMIUM ENERGY TRANSMISSION LTD (GREAVES)
		2	SPIRAX MARSHALL PVT.LTD.
		3	PENNANT ENGINEERING PVT.LTD.
		4	LEADER VALVES LTD.
		5	OTOKLIN PLANTS AND EQUIPMENTS
46	AIR TRAPS	1	PENNANT ENGINEERING PVT.LTD.
		2	SPIRAX MARSHALL PVT.LTD.
47	CW TREATMENT PLANT (Items to be procured from the approved Vendor List)	1	CLEAR WATER LTD.
		2	THERMAX LTD.
		3	DRIPLEX WATER ENGG. LTD.
		4	CHEMBOND ASHLAND WATER TECHNOLOGIES LTD.,MUMBAI
		5	VA TEC WABAG LTD
48	GRAVIMETRIC FEEDER	1	STOCK INDIA
		2	MERRICK
49.	PORTABLE FIRE EXTINGUISHERS	1	ALERT FIRE SERVICES
		2	KOOVERJI DEVSHI & CO.PVT.LTD
		3	SAFEX FIRE SERVICES LTD.
		4	VIJAY INDUSTRIES & PROJECTS LTD
		5	ZENITH FIRE SERVICES (INDIA) PVT LTD
		6	NEW ENGINEERING CORPORATION
		7	NITIN FIRE PROTECTION INDUSTRIES LTD

Sl. No.	Item Description	Vendor Name	
		8	KANADIA FYR FYTER PVT.LTD.,
		9	GUNNEBO INDIA LIMITED
50	COMPRESSED AIR SYSTEM	1	ATLAS COPCO (INDIA) LTD.
		2	KOBELCO-KIRLOSKAR PNEUMATIC CO.LTD.
		3	INGERSOLL RAND (INDIA) LTD.
			KBL (only for Reciprocating type)
		4	TOSIBA,JAPAN
51	MILL REJECT SYSTEM (PNEUMATIC) (Items to be procured from the approved Vendor List)	1	MACAWBER BEEKAY PVT.LTD.
		2	DC INDTL.PLANT SERVICES PVT.LTD
		3	UNITED CONVEYOR CORPORATION (INDIA) PVT.LTD.,KOLKATA
52	CHLORINATION PLANT (Items to be procured from the approved Vendor List)	1	IEC FABCHEM LIMITED
		2	PERFECT CHLORO SYSTEMS
		3	CAPITAL CONTROLS INDIA PVT. LTD.
		4	PENWATT INDIA LTD
		5	METITO POLLUTION CONTROL INDIA LTD
53	CHEM. DOSING PLANT	1	MILTON ROY INDIA (P) LTD.
		2	SWELORE ENGG.PVT.LTD
		3	V.K.PUMP INDUSTRIES PVT.LTD.
		4	TECHNO CONSULTANTS
		5	PSI ENGINEERING SYSTEMS (P) LTD.,CHENNAI
		6	ENPRO INDUSTRIES PVT.LTD.,PUNE
55	COLTCS / SCS/DEBRIS FILTER (Items to be procured from the approved Vendor List)	1	TECHNOS, FRANCE
		2	GEA BGR ENERGY SYSTEM INDIA LTD.
		3	MULTITEX FILTRATION ENGINEERS LTD.
		4	FILTRATION ENGINEERS LTD.
		5	EIMCO WATER TECHNOLOGIES ,LLC, USA
		6	TAPROGGE GmbH
		7	KLUMP & KOLLER GmbH

Sl. No.	Item Description	Vendor Name	
56	ALUMINIUM SHEETS/ COILS	1	BHARAT ALUMINIUM CO.LTD.
		2	INDIAN ALUMINIUM CO.LTD.
		3	HINDALCO INDUSTRIES LTD.
		4	NATIONAL ALUMINIUM COMPANY LTD.
57	HOC TYPE GAS DRIER	1	DELAIR INDIA PVT. LTD.
		2	ATLAS COPCO (INDIA) LTD.
58	REFRIGERATION TYPE GAS DRIER	1	DELAIR INDIA PVT. LTD.
		2	SUMMIT
		3	SAVRO
59	HP BYPASS SYSTEM.	1	SULZER-CCI AG, SWITERZERLAND
60	LP BYPASS SYSTEM.	1	SULZER-CCI AG, SWITERZERLAND
		2	BOMAFA, GERMANY
		3	WELLAND & TUXHORN, GERMANY
61	MISC. TANKS (SHOP)	1	GENERAL MECHANICAL WORKS
		2	UNITECH MACHINES LTD.
		3	TECHNO ELECTRIC & ENGG. CO. LTD.
		4	THERMOPADS PVT LIMITED
		5	VIJAY TANKS & VESSELS LTD
62.	FLAME ARRESTOR (MISCELLANEOUS TANKS)	1	PROCESS INSTRUMENTS
		2	ASIAN INDUSTRIAL VALVES
		3	ACCOUSTICS INDIA PVT. LTD.
		4	MULTITEX FILTERS PVT. LTD.
63	M.E. BELLOWS	1	FLUIDINE ENGRS.INDIA PVT.LTD
		2	EXPANSION JOINT SYSTEMS INC. USA
		3	MUNRO & MILLER FITTINGS LTD., U.K
		4	SENIOR FLEXONICS, U.K.
		5	SUR INDUSTRIES PVT.LTD.,KOLKATA
		6	CORBIS
64	HEAT EXCHANGERS (PLATE TYPE)	1	ALFA LAVAL (INDIA) LTD.
		2	GEA ECOFLEX INDIA PVT LTD
		3	TRANTER INDIA PRIVATE LIMITED
		4	L&T
65	JOURNAL BEARING BFP & BP/THRUST CUM JOURNAL BEARING FOR CEP/THRUST BEARING (BFP & BP)	1	COLHERENE, UK
		2	WAUKESHA BEARINGS (GLACIER), UK
		3	KINGSBURY, USA
		4	MITCHELL, UK
66.	HYDRAULIC COUPLING	1	VOITH TURBO PVT LTD

Sl. No.	Item Description	Vendor Name	
67.	DISCONNECTING COUPLING FOR TDBFP	1	ZURN INC, USA
68.	SUCTION STRAINERS (BFP, BP & CEP)	1	OTOKLIN
		2	MULTITEX
		3	GUJARATH OTOFILT
69.	MECHANICAL SEAL (BFP/BP & CEP)	1	BURGMANN, GERMANY.
		2	EAGLE POONAWALA LTD.PUNE
		3	FLOWERVE SANMAR, CHENNAI
70	CONNECTING COUPLING FOR MD BFP SET & CEP	1	FLEXIBOX LTD., UK
		2	TURBOFLEX, UK
		3	BIBBY TURBOFLEX (FORMERLY EUROFLEX), UK
		4	EUROFLEX TRANSMISSION LTD., HYDERABAD.
71	CONNECTING COUPLING (MEMBRANE TYPE/GEAR TYPE) FOR TDBFP	1	EUROFLEX TRANSMISSION, HYDERABAD.
		2	RENK AG,GERMANY
		3	JOHN CRANE, UK
		4	KOPFLEX, USA
		5	BIBBY TURBOFLEX (FORMERLY EUROFLEX), UK
		6	AMERIDRIVES (ZURN), USA
		7	LUFKIN, USA/FRANCE
		8	BHS, GERMANY
		9	FLENDER GRAFFENSTADEN, FRANCE
74	GEAR BOX FOR TDBFP	1	WALCHAND NAGAR, PUNE
		2	RENK AG,GERMANY
		3	LUFKIN, USA/FRANCE
		4	FLENDER GRAFFENSTADEN, FRANCE
		5	BHS, GERMANY
75.	BARE RUBBER BELLOWS	1	CORI ENGINEERS PVT. LTD CHENNAI.
		2	SRM ESOFLEX PVT. LTD. KOLKATTA
		3	CORBIS
76.	SPRING SUPPORTS / HANGERS	1	SARATHI ENGG. ENTERPRISES PVT. LTD.
		2	HYDERABAD PIPING & ENERGY PRODUCTS (P) LTD. NEW DELHI
		3	SHAPE BAHADARABAD
		4	DARSHANI-INDIA
		5	PAL ENGINEERING YAMUNANAGAR
77.	SELF LUBRICATING BEARING	1	TEN MAT LTD UK

Sl. No.	Item Description	Vendor Name	
	TUBES FOR BF VALVES	2	(FEROFORM T 814 TUBES)
		3	THORDON
		4	THORPLAS TUBES, CANADA
78	FLUIDIZING AIR HEATER	1	ESCORTS
		2	SPHEREHOT
		3	RAYCOLD
		4	INDURE PVT. LTD.
79	ALLOY C.I. FITTINGS & LINERS	1	MENON METALLIKS
		2	CRAWLEY & RAY
		3	SAM CASTINGS
		4	CRESENT
80	ASH SLURRY PUMP/ BA OVERFLOW PUMP	1	SAM TURBO
		2	INDURE PVT. LTD.
81	KNIFE GATE VALVES	1	VAAS
		2	SISTAG, SWITZERLAND
		3	TYCO, USA
		4	VELAN, UK/USA
		5	INDURE PVT. LTD.
		6	ORBINOX INDIA (P) LTD.
82	MS AND GI PIPES	1	SAIL
		2	JINDAL
		3	INDUS TUBES
		4	SURYA ROSHNI
		5	TATA
83	STAINLESS STEEL PIPES	1	RATNAMANI METAL & TUBES
84	BASALT LINED PIPES AND FITTINGS	1	INDURE PVT. LTD.
		2	DEMECH
		3	ENVIRO ABRASION
85	MS ERW PIPES (SLURRY DUTY)	1	SAIL
		2	JINDAL
		3	JCO GAS PIPES
		4	TATA
86	TWIN LOBE TYPE ROTARY FLUDIZING AIR BLOWER	1	SWAM PNEUMATICS
		2	KAY INTERNATIONAL
		3	EVEREST
87	VACUUM PUMP / MECHANICAL EXHAUSTER (LIQUID RING TYPE)	1	KAKATI KARSHAK
		2	VACUNAIR
		3	GARDNER DENVER,KOREA
88	CRUSHER	1	THYSSENKRUPP.

Sl. No.	Item Description	Vendor Name	
		2	MCNALLY BHARAT ENGG. CO. LTD.
		3	LARSEN & TOUBRO
		4	ELECON ENGINEERING CO. LTD
		5	TRF LIMITED
89	APRON FEEDER	1	THYSSENKRUPP
		2	LARSEN & TOUBRO
		3	ELECON ENGINEERING CO. LTD.
		4	TRF LIMITED
		5	FL SMITH
		6	METSO
		7	MCNALLY BHARAT ENGG. CO. LTD
90	BELT VULCANIZER	1	SHAW ALMEX
		2	NILOS
		3	S. V. DATTAR
91	CONVEYOR BELT	1	SEMPERTRANS NIRLON, MUMBAI
		2	JONSON RUBBER
		3	PHONIX YULE, KOLKATA
		4	HILTON-FORECH
		5	MRF
		6	YOKOHAMA
92	ROLLER SCREEN	1	MSEL
		2	THYSSENKRUPP.
		3	ELECON ENGINEERING CO. LTD
92	REDUCTION GEAR BOX (Coal Handling Plant Only)	1	PREMIUM ENERGY TRANSMISSION
		2	FLENDER LIMITED
		3	ELECON ENGINEERING CO. LTD.
93	FLUID COUPLING (Coal Handling Plant Only)	1	VOITH
		2	PREMIUM ENERGY TRANSMISSION
		3	FLUIDOMAT
94	FLEXIBLE GEAR COUPLING	1	ELECON ENGINEERING CO. LTD.
		2	FENNER
		3	WELLMAN
		4	CONCORD
		5	GMB MFG. (P) LTD., KOLKATA
		6	HI-CLIFF
		7	LOVEJOY
95	BELT CLEANERS (SPRUNG TYPE) / MODULAR TYPE SKIRT	1	HOSCH EQUIPMENT, KOLKATA
		2	TRF
		3	CORBID ENGINEERING, MUMBAI

Sl. No.	Item Description	Vendor Name	
	SEALING	4	MASYC PROJECT PVT LTD.
		5	HYQUIP LTD, HYDERABAD.
96	THRUSTER BRAKE	1	BENGAL TECHNOCRAT
		2	WITTON KRAMER
		3	STROM CRAFT
97	BELT WEIGHER	1	INDUSTRIES SYNDICATE
		2	PBL
		3	TRANSWEIGH
		4	IPA
		5	SHENEICK PROCESS
98	TRAVELLING TRIPPER	1	MSEL
		2	BENGAL TOOLS
		3	HMTC
99	IN-LINE MAGNETIC SEPARATOR / SUSPENDED MAGNET	1	ELECTRO-ZAVOD
		2	PBL
		3	ELECTROMAGNETIC INDUSTRIES
100	ELECTRONIC METAL DETECTOR	1	ELECTROMAG DEVICES LTD., MUMBAI
		2	M. R. EQUIPMENT
		3	POWER BUILD, VALLABH VIDYANAGAR
101	CONVEYOR PULLEYS	1	BENGAL TOOLS
		2	MCNALLY BHARAT ENGG. CO. LTD.
		3	ELECON
		4	ARUDRA
102	CONVEYOR IDLERS	1	ELECON ENGINEERING CO. LTD.
		2	ARUDRA
		3	TRF LIMITED
		4	MCNALLY BHARAT, ENGG. CO. LTD.
		5	TEGA
		6	BENGAL TOOLS.
103	CENTRIFUGAL FANS (DE System)	1	ABB
		2	FLAKT INDIA
		3	TOURBOVANT
		4	APC
		5	DUSTVEN
104	VIBRATION ISOLATION	1	GERB
105	IDLER BEARING	1	FAG
		2	SKF
		3	HKT

Sl. No.	Item Description	Vendor Name	
		4	TATA TIMKEN
		5	ZKL
		6	KOYO
		7	NBC
106	RAIL CLAMP	1	SILVERLINE INTERNATIONAL.
		2	TECONNEX
107	PULLEY BEARING (SPLIT TYPE)	1	FAG
		2	SKF
		3	HKT
		4	COOPER
108	SELF ALIGNMENT (CARRIER & RETURN) ROLLER	1	TEGA.
		2	TRF LIMITED
109	RAIL	1	SAIL
		2	TATA
110	DUST EXTRACTION SYSTEM	1	THERMEX
		2	F. HARLEY
		3	TPS,DELHI
		4	SPRAYING SYSTEM , BANGALORE
111	DUST SUPPRESSION SYSTEM	1	KAVERI ULTRA POLYMER LTD.
		2	F. HARLEY
		3	TPS,DELHI
112	COAL SAMPLING UNIT	1	SUNRISE
		2	EASTMAN CRUSHER
113	ADOPTOR SLEEVE	1	SKF.
		2	BENGAL TOOLS
114	ENERGY CHAIN	1	IGUS
115	HYDRAULIC DRIVE FOR BELT CONVEYORS	2	HAGGLUNDS
116	BUNKER SEALING BELT	1	SYNERGY KOLKATA
		2	DHANVANTHRI ENGINEERS PVT. LTD.
		3	ALEX CONVEYOR
		4	MESTO
117	STRAINER	1	STRAINWELL INDIA
		2	ACME FLUID SYSTEMS
		3	SRK STRAINERS & VALVES INDIA
118	ROCK BREAKER AND GRABBER	1	JEHEL
		2	NAKODA MACHINARY
		3	MCQUAID ENGINEERING
		4	JCB INDIA LTD.

Sl. No.	Item Description	Vendor Name	
119	RACK AND PINION GATE	1	BENGAL TOOL
		2	MSEL
		3	HMTC
		4	DA ENGG.
120	FLAP GATE	1	DA ENGG.
		2	MERIT CHENNI
		3	MMHE
		4	MSE
121	LINER PLATE	1	SAIL
		2	TATA STEEL
122	TECHNOLOGICAL STRUCTURE MATERIAL	1	SAIL
		2	TATA STEEL
		3	ZINDAL
123	HOPPER CHUTE, SKIRT BOARD WITH SUPPORTING STRUCTURE	1	MSEL
		2	HMTC
		3	MMHE
124	REVERSIBLE BELT CONVEYOR	1	DHANVANTHRI ENGINEERS PVT. LTD.
		2	ALEX CONVEYOR
		3	MESTO
		4	LA MINING
	ELECTRICAL SYSTEM VENDORS		
1	HT SWITCHGEAR (11KV, 3.3 KV)	1	
		2	AREVA LTD.
		3	BHEL.
		4	SIEMENS LTD
2	PMCC, PCC & MCC	1	AREVA LTD.
		2	LARSEN & TOUBRO LTD.
		3	SIEMENS LTD
		4	SCHNEIDER
		5	ABB
3	AIR CIRCUIT BREAKER	1	AREVA LTD.
		2	LARSEN & TOUBRO LTD.
		3	SIEMENS LTD (3WL model only)
		4	SCHNEIDER
		5	ABB
4	AC CONTACTOR / AUX. CONTACTOR	1	L&T
		2	SIEMENS LTD

Sl. No.	Item Description	Vendor Name	
		3	SCHNEIDER
		4	ABB
		5	GE Power
5	AMMETER (INDICATING)	1	AUTOMATIC ELECTRIC
		2	IMP
		3	RISHABH INDUSTRIAL (L&T)
6	BREAKER CONTROL SWITCH/ SELECTOR SWITCH	1	KAYCEE
		2	ALSTOM LTD.
		3	GE – POWER
		4	SALZER, L&T
7	CURRENT TRANSFORMER	1	KAPPA ELECTRICALS
		2	PRAGATI ELECTRICALS
		3	PRAYOG
		4	SILKAANS
		5	PRECISE ELECTRICS
		6	SOUTHERN ELECTRICS
		7	SIEMENS
		8	AUTOMATIC ELECTRIC
		9	INDCOIL
8	CONTROL TRANSFORMERS	1	KAPPA ELECTRICALS
		2	SILKAANS
		3	SOUTHERN ELECTRICS
		4	PRECISE ELECTRICALS
		5	AUTOMATIC ELECTRIC
		6	INDCOIL
9	VOLTAGE TRANSFORMERS (VT)	1	INDCOIL
		2	KAPPA ELECTRICALS
		3	PRAGATI ELECTRICALS
		4	PRAYOG
		5	PRECISE ELECTRICALS
		6	SILKAANS
		7	SOUTHERN ELECTRICS
		8	AUTOMATIC ELECTRIC
		9	SIEMENS
10	ACDB, DCDB, AC/DC FUSE BD, MLDB, ELDB, PDB, WELDING DB, VENTILATION DB	1	SCHNEIDER
		2	L&T
		3	SIEMENS
		4	GE – POWER
		5	ABB

Sl. No.	Item Description	Vendor Name	
11	OIL FILLED TRANSFORMER (More than 10 MVA)	1	BHEL
		2	GE
		3	AREVA T & D INDIA LIMITED
		4	FUJI
		5	ABB
		6	ALSTOM
12	OLTC	1	BHEL
		2	CTR
		3	MASCHINENFABRIK REINHAUSEN(MR)
13	OIL FILLED TRANSFORMER (Less than 10MVA)	1	CROMPTON GREAVES LTD.
		2	GE
		3	AREVA T & D INDIA LIMITED NAINI
		4	FUJI
		5	ABB
		6	ALSTOM
		7	KIRLOSKAR ELECTRIC CO. LTD.
		8	VOLTAMP TRANSFORMER LTD.
		9	ANDREW YULE & COMPANY LTD.
		10	BHEL
		11	SUDHIR TRANSFORMER
14	ELECTRONIC MOTOR PROTECTION RELAY (EMPR) INCLUDING EOCR	1	AREVA
		2	SIEMENS
		3	L&T
		4	GE – POWER
		5	SCHNEIDER
15	ENERGY METER	1	SECURE METERS (SEMS)
		2	SCHNEIDER CONZERVE
		3	L&T
16	FUSES ALONG WITH FUSE BASE	1	L&T
		2	ALSTOM LTD.
		3	SIEMENS
		4	SCHNEIDER
		5	ABB
17	ISOLATING SWITCH	1	SALZER, L&T
		2	SIEMENS
		3	ALSTOM LTD.
		4	GE – POWER
		5	SCHNEIDER

Sl. No.	Item Description	Vendor Name	
		6	ABB
		7	KAYCEE
18	INTERPOSING RELAYS	1	JYOTI
		2	OEN
		3	ABB
		4	ELESTA
19	INDICATING LAMP (LED)	1	SIEMENS
		2	VAISHNO
		3	L&T
		4	ALSTOM LTD.
		5	BCH
		6	GE – POWER
		7	SCHNEIDER
		8	CONCORD
		9	TECKNIC CONTROLS
		10	ABB
		11	ESSEN DEINKI
20	NON SEGREGATED PHASE BUS DUCTS	1	M/S KGS Engineering Limited
		2	L&T
		3	SIEMENS
		4	ALSTOM LTD.
		5	BEST & CROMPTON
21	LPBS (NON-FLAME PROOF)	1	L&T
		2	SCHNEIDER
		3	SIEMENS
22	LPBS(FLAME PROOF)	1	BALLIGA
		2	EX-PROTECTA
23	LOCAL MOTOR STARTER	1	L&T
		2	TELEMACHANIQUE (SCHNEIDER)
		3	SIEMENS
		4	ABB
		5	GE – POWER
24	MCCB(AC)	1	L&T
		2	GE – POWER
		3	SIEMENS
		4	SCHNEIDER
		5	ABB.
25	MCCB(DC)	1	L&T
		2	GE – POWER

Sl. No.	Item Description	Vendor Name	
		3	SIEMENS
		4	SCHNEIDER
		5	ABB.
26	MULTIFUNCTION METER	1	SECURE METERS (SEMS)
		2	SCHNEIDER CONZERVE
27	MINIATURE CIRCUIT BREAKER (MCB)	1	SCHNEIDER
		2	L&T
		3	SIEMENS
		4	ABB
28	MOTOR PROTECTION CIRCUIT BREAKER (MPCB)	1	AREVA
		2	SIEMENS
		3	L&T
		4	SCHNEIDER
		5	ABB.
29	NGR	1	RESITECH
		2	S. R. NARKHEDE
		3	RSI SWITCHGEAR
30	NUMERICAL RELAY	1	ABB
		2	AREVA MICOM
		3	SIEMENS (SIPROTEC)
		4	GE – POWER
		5	SCHNEIDER MICOM
		6	ALSTOM MICOM
31	SYNCHROSCOPE	1	AUTOMATIC ELECTRIC
		2	GEC - ALSTHOM
32	SWITCH & SOCKET (INDUSTRIAL TYPE)	1	CROMPTON GREAVES
		2	BCH
		3	ANCHOR
		4	BEST & CROMPTON
		5	ABB
33	SPACE HEATER	1	C&S ELECTRIC
		2	SPACEAGE
34	TRANSDUCER	1	AUTOMATIC ELECTRIC LTD.
		2	ELSTER
		3	SOUTHERN TRANSDUCERS
		4	CAMILLE BAUER, GERMANY
35	THERMAL OVERLOAD RELAY	1	L&T
		2	SIEMENS
		3	SCHNEIDER

Sl. No.	Item Description	Vendor Name	
		4	GE – POWER
		5	ABB
36	TIMER	1	BCH
		2	ALSTOM
		3	L&T
		4	SCHNEIDER
		5	ABB
37	TERMINALS BLOCK (FIXED / DRAW OUT)	1	PHOENIX
		2	CONNECT WELL
		3	ELEMEX
		4	WAGO
		5	ESSEN DEINKI
38	VOLTMETER (INDICATING)	1	AUTOMATIC ELECTRIC
		2	IMP
		3	RISHABH INDUSTRIAL (L&T)
39	LT PVC CONTROL CABLES	1	CABLE CORPORATION OF INDIA
		2	CORDS CABLE INDUSTRIES LTD
		3	DELTON CABLES LTD.
		4	KEC
		5	CRYSTAL CABLE INDUSTRIES LTD.
		6	KEI INDUSTRIES LTD.
		7	NICCO CORPORATION LTD.
		8	POLYCAB WIRES PVT.LTD
		9	TORRENT CABLES LTD.
		10	UNIVERSAL CABLES D.
		11	RPG
40	LT XLPE POWER CABLES	1	CABLE CORPORATION OF INDIA
		2	HINDUSTHAN VIDYUT PRODUCTS
		3	KEC INTERNATIONAL
		4	TORRENT CABLES LTD.
		5	UNIVERSAL CABLES LTD.
		6	POLYCAB WIRES PVT.LTD
		7	KEI INDUSTRIES LTD.
		8	NICCO
		9	CRYSTAL CABLE INDUSTRIES LTD.
41	LT PVC POWER CABLES	1	CORDS CABLE INDUSTRIES LTD
		2	CRYSTAL CABLE INDUSTRIES LTD.
		3	HINDUSTHAN VIDYUT PRODUCTS
		4	KEI INDUSTRIES LTD.

Sl. No.	Item Description	Vendor Name	
		5	NICCO CORPORATION LTD.
		6	POLYCAB WIRES PVT.LTD
		7	TORRENT CABLES LTD.
		8	UNIVERSAL CABLES LTD.
		9	CABLE CORPORATION OF INDIA
42	HT XLPE POWER CABLES	1	CABLE CORPORATION OF INDIA
		2	KEI INDUSTRIES LTD.
		3	HINDUSTHAN VIDYUT PRODUCTS
		4	NICCO CORPORATION LTD.
		5	UNIVERSAL CABLES LTD.
43	SCREENED CONTROL CABLES	1	DELTON CABLES LTD.
		2	KEI INDUSTRIES LTD.
		3	NICCO CORPORATION LTD.
		4	POLYCAB WIRES PVT.LTD
		5	CORDS CABLE INDUSTRIES LTD
		6	THERMO CABLES
44	220V DC LEAD ACID BATTERIES (TUBULAR AND PLANTE)	1	EXIDE INDUSTRIES LTD
		2	HOPPECKE, GERMANY / MALAYSIA
45	NICKEL – CADMIUM BATTERY	1	HBL POWER SYSTEMS, HYDERABAD
46	220V DC BATTERY CHARGER (More than 100 AH)	1	CHLORIDE POWER SYSTEMS & SOLUTIONS LTD
		2	STATCON POWER LTD.
		3	HBL POWER SYSTEMS LTD
47	220V DC BATTERY CHARGER (Upto 100 AH)	1	CHHABI ELECTRICALS PVT. LTD.
		2	AMARA RAJA POWER SYSTEMS PVT. LTD
		3	CHLORIDE POWER SYSTEMS & SOLUTIONS LTD
		4	STATCON POWER LTD.
		5	HBL POWER SYSTEMS LTD
48	TRANSFORMER (DRY TYPE)	1	VOLTAMP
		2	BHARAT BIJLEE
		3	AREVA
		4	CGL
		5	SUDHIR TRANSFORMER
		6	BHEL
49a	HT MOTORS (above 500 kW)	1	ABB
		2	BHEL
		3	SIEMENS

Sl. No.	Item Description	Vendor Name	
49b	HT MOTORS (upto 500 kW)	1	ABB
		2	BHEL
		3	SIEMENS
		4	CROMPTON GREAVES
		5	MARATHON
50	LT MOTORS	1	ABB
		2	SIEMENS
		3	CROMPTON GREAVES
		4	KIRLOSKAR
		5	BHARAT BIJLEE
		6	MARATHON
51	LIGHTING SYSTEM	1	BAJAJ ELECTRICALS LTD.
		2	CROMPTON GREAVES LTD.
		3	PHILIPS INDIA LTD.
52	LIGHTING MAST, LIGHTING TOWER	1	CGL
		2	BAJAJ
		3	PHLLIPS
53	LIGHT FITTINGS	1	BAJAJ
		2	PHLLIPS
		3	CGL
54	CABLE TERMINATION & JOINTING KITS	1	RAYCHEM RPG LIMITED,MUMBAI
		2	3M ELECTRO & COMMUNICATION
55	CABLE TRAYS & ACCESSORIES	1	JAMNA METAL COMPANY
		2	UNITECH FABRICATORS & ENGINEERS
		3	PATNY SYSTEMS (P) LTD.
		4	RATAN PROJECTS & ENGINEERING CO. PVT.LTD.
		5	INDUSTRIAL PERFORATION (INDIA) PRIVATE LIMITED.
		6	RABI ENGINEERING WORKS ,
		7	PREMIER POWER PRODUCTS PVT.LTD.
		8	PARMAR METAL PVT. LTD.
56	CABLE TRAYS SUPPORT SYSTEM WELDED TYPE (HOT DIP GALVANIZED)	1	JAMNA METAL COMPANY
		2	INDUSTRIAL PERFORATION (INDIA) PRIVATE LIMITED.
		3	PATNY SYSTEMS (P) LTD.
		4	RATAN PROJECTS & ENGINEERING CO. PVT.LTD.
		5	RABI ENGINEERING WORKS

Sl. No.	Item Description	Vendor Name	
		6	UNITECH FABRICATORS & ENGINEERS PVT.LTD.
57	TREFOIL CLAMPS	1	MOULDED FIBRE GLASS PRODUCTS
		2	ELECTROMAC INDUSTRIES
		3	SUMIP COMPOSITES PVT.LTD.
		4	AJMERA INDUSTRIAL & ENGINEERING WORKS
58	ABOVE GROUND EARTHING MATERIALS, GS FLAT, MATERIAL FOR LIGHTNING PROTECTION	1	RATAN PROJECTS &ENGINEERING CO. PVT.LTD.
		2	RABI ENGINEERING WORKS
		3	UNITECH FABRICATORS & ENGINEERS PVT.LTD.
		4	INDUSTRIAL PERFORATION (INDIA) PRIVATE LIMITED.
		5	JAMNA METAL COMPANY
		6	PATNY SYSTEMS (P) LTD.
59	MS ROD FOR BELOW GROUND EARTHING	1	STEEL AUTHORITY OF INDIA LIMITED
		2	RASHTRIYA ISPAT NIGAM LIMITED
60	400 kV DISC INSULATOR/ LONG ROD INSULATOR (120KN)/ BUS POST INSULATOR (For Switchyard)	1	BHEL
		2	NGK BIRLA, JAYASHREE
		3	W.S
		4	INDIAN POTTERIES
		5	SARBHANA
61	INSULATOR HARDWARE	1	EMC
		2	ITPPL
		3	TYCO
		4	Tag Corporation, Chennai
		5	IAC
		6	ELECTROMECH & TRANSTECH
62	CLAMPS & CONNECTOR	1	KLEMMEN
		2	UTSAV
		3	TYCO
		4	IAC
		5	MEGHNA
		6	ELECTROMECH & TRANSTECH
63	400 kV SF6 BREAKERS	1	ABB
		2	CGL
		3	SIEMENS
		4	AREVA T&D
64	400 kV SWITCHYARD CT	1	ABB
		2	CGL

Sl. No.	Item Description	Vendor Name	
		3	ALSTOM
		4	SIEMENS
65	400 kV SWITCHYARD PT	1	ABB
		2	CGL
		3	SIEMENS
		4	ALSTOM
		5	BHEL
66	400 kV ISOLATOR	1	SIEMENS
		2	ABB
67	400 kV EARTH SWITCH	1	SIEMENS
		2	ABB
68	400 KV STRUCTURE	1	GOOD LUCK STEEL TUBES LTD., BULANDSHAHAR (UP)
		2	UTKARSH TUBES AND PIPES LIMITED, KOLKATA, WEST BENGAL
69	400 kV LIGHTNING ARRESTER	1	CGL
		2	ELPRO INTERNATIONAL LIMITED, PUNE
		3	ALSTOM
		4	OBLUM ELECTRICAL INDUSTRIES PVT.LTD., HYDERABAD
70	LIGHTING POLE	1	BOMBAY TUBE & POLES CO..
		2	BAJAJ ELECTRICALS LTD.
71	SEGREGATED PHASE BUSDUCTS	1	M/S KGS Engineering Limited
		2	L&T
		3	SIEMENS
		4	ALSTOM LTD.
		5	BEST & CROMPTON
		6	BHEL
72	ISOLATED PHASE BUS-DUCT	1	BHEL
		2	SIMELECTRO, FRANCE
73	SURGE ARRESTOR (Less than 15 kV)	1	ELPRO
		2	CGL
		3	OBLUM
74	POST INSULATORS	1	BHEL
		2	ADITYA BIRLA INSULATORS
		3	MOULDED FIBRE GLASS PRODUCTS
		4	W.S. INDUSTRIES LTD,CHENNAI
75	DISK/PIN INSULATOR	1	BHEL
		2	ADITYA BIRLA INSULATORS

Sl. No.	Item Description	Vendor Name	
		3	IEC
76	MOOSE CONDUCTOR	1	HINDUSTAN VIDYUT PRODUCTS LTD., HARYANA
		2	GUPTA POWER INFRASTRUCTURE LTD., BHUBANESWAR
		3	HIREN ALUMINIUM Ltd., SILVASSA DADRA & NAGAR HAVELI
77	ALUMINIUM TUBE	1	HINDALCO INDUSTRIES LIMITED
		2	JINDAL ALUMINIUM LIMITED
		3	BALCO
78	STRUCTURE HARDWARE	1	DEEPAK FASTNERS LTD
		2	NAVEEN METAL INDUSTRIES, KOLKATA
		3	NEW INDIA ENGINEERING CORPORATION
79	LUGS	1	UNIVERSAL MACHINES
		2	COMET
		3	MAHAVEER ENGINEERING
		4	DOWELLS
		5	SUNIL & CO. PVT. LTD.
80	FAST BUST TRANSFER	1	AARTECH SOLONICS LTD, MP
		2	ABB
81	RAIL POLE	1	SAIL
		2	RINL
		3	TATA
82	FRP JUNCTION BOXES/ JUNCTION BOXES (POWER/CONTROL), LIGHTING JB	1	SCHNEIDER
		2	CONTROL DEVICE
		3	SWITCHING CIRCUIT
		4	JASPER ENGINEERS
		5	BAJAJ ELECTRICALS
		6	AJMERA
		7	S B EIEC. EENGINEERING CORP. Ltd
		8	PYROTECH
		9	ENGG. CONSTRUCTION CORP.
		10	L&T
83	LOCAL STARTER PANEL, LOCAL CONTROL PANEL, LIGHTING PANEL, ACELP, DCELP	1	PYROTECH
		2	L&T
		3	CONTROL DEVICE
		4	SCHNEIDER
84	LIGHTING WIRE	1	ISI MARK

Sl. No.	Item Description	Vendor Name	
85	ACTUATOR	1	AUMA
		2	LIMITORQUE
86	CABLE for ROLLED -E-CHAIN	1	IGUS
87	CABLE GLAND	1	SUNIL & COMPANY
		2	ARUP ENGG. & FOUNDRY WORKS
		3	COMMET BRASS PRODUCTS
		4	ELECTROMAC INDUSTRIES
		5	BALIGA LIGHTING EQPT.
88	BAY CONTROL UNIT	1	ALSTOM
		2	SIEMENS
		3	ABB
89	TRANSFORMER BUSHING	1	ABB
		2	AREVA
		3	ALSTOM
		4	BHEL
90	EARTH LEAKAGE CB	1	SCHNEIDER
		2	L&T
		3	SIEMENS
		4	ABB
91	EARTH LEAKAGE RELAY [ELR] ALONG WITH CBCT	1	AREVA
		2	PRO'KDEVICES
92	PUSH BUTTON	1	BCH
		2	L&T
		3	SCHNEIDER
		4	SIEMENS
		5	TECKNIC CONTROL
		6	GE – POWER
		7	ABB
93	RELAYS (OTHER THAN INTERPOSING & NUMERICAL RELAYS)	1	ABB
		2	AREVA
		3	SIEMENS
		4	GE – POWER
		5	ALSTOM
94	ENERGY MANAGEMENT SYSTEM	1	SCHNEIDER
		2	SECURE

Sl. No.	Item Description	Vendor Name	
	CONTROL & INSTRUMENTATION SYSTEM VENDORS		
1	DISTRIBUTED CONTROL SYSTEM	1	ABB
		2	HONEYWELL
		3	EMERSON
		4	VALMET (FORMERLY METSO)
2	PLC (Programmable Logic Controller)	1	ROCKWELL AUTOMATION INDIA LTD.
		2	GE
		3	SCHNEIDER ELECTRIC INDIA PVT.LTD.
3	DIGITAL INDICATOR	1	ABB
		2	GOSSEN / CAMILLE BAUER / METRAWATT
		3	YOKOGAWA
4	VERTICAL MOVING COIL INDICATOR	1	ABB
		2	GOSSEN
		3	CAMILLE BAUER
		4	METRAWATT
		5	YOKOGAWA
5	TRANSDUCERS	1	SIEMENS
		2	ABB
		3	CAMILLEBAUER
		4	ELSTER
		5	PYROTECH
		6	SOUTHERN TRANSDUCERS
		7	ADEPT
6	LARGE VIDEO SCREEN	1	BARCO
		2	PLANAR
7	PC	1	DELL
8	TFT MONITOR	1	DELL
		2	HP
		3	IBM-LENOVO
9	DOT MATRIX PRINTERS	1	EPSON
		2	TVS
10	PRINTERS (LASER)	1	HP
		2	IBM
11	COMPUTER FURNITURE	1	ADARSH CONTROLS
		2	COSMOS MEDIA
		3	FEATHER LITE
		4	GODREJ
		5	OTS

Sl. No.	Item Description	Vendor Name	
		6	PYROTECH
12	CONTROL PANEL/RACK	1	PYROTECH
		2	RITTAL
13	PRESSURE GAUGES	1	A. N. INSTRUMENTS PVT. LTD.
		2	ASHCROFT INDIA
		3	GENERAL INSTRUMENTS CONSORTIUM
		4	MANOMETER (INDIA) PVT.LTD
		5	WIKA
		6	FORBES MARSHALL LTD.
		7	GLUCK (INDIA) MFG.CO.
		8	WAAREE INDUSTRIES
		9	BUDENBERG GAUGE CO. LTD.
14	PRESSURE SWITCHES	1	ASHCROFT INDIA
		2	INDFOS INDUSTRIES LTD.
		3	SOR INC.
		4	SWITZER INSTRUMENT CO.
		5	TRAFAG-INDIA
		6	DELTA CONTROLS LTD.
15	ELECTRONIC TRANSMITTER	1	EMERSON PROCESS
		2	HONEYWELL
		3	YOKOGAWA
		4	FUJI
16	TEMPERATURE GAUGE	1	A. N INSTRUMENTS PVT. LTD.
		2	ASHCROFT INDIA
		3	GENERAL INSTRUMENTS CONSORTIUM
		4	GOA THERMOSTATIC INSTUMENTS
		5	WIKA
		6	FORBES MARSHALL
		7	WAREE
17	TEMPERATURE SWITCH	1	GENERAL INSTRUMENTS CONSORTIUM
		2	INDFOS INDUSTRIES LTD.
		3	SWITZER INSTRUMENT CO.
		4	AN INSTRUMENTS
18	TEMPERATURE ELEMENT	1	DETRIVE
		2	GENERAL INSTRUMENS CONSORTIUM

Sl. No.	Item Description	Vendor Name	
		3	INDUSTRIAL INSTRUMENTS
		4	PYRO ELEC INSTRUMENTS GOA P. LTD.
		5	TEMPSENS INSTRUMENTS (I) PVT. LTD.
19	ROTA METER	1	EUREKA
		2	FLUIDYNE INSTREMENTS
		3	IEPL
		4	PLACKA INSTRUMENTS INDIA PVT. LTD.
		5	TRAC
20	SIGHT FLOW INDICATOR	1	CHEMTROLS SAMIL
		2	LEVCON INSTRUMENTS PVT. LTD.
		3	V.AUTOMAT & INSTRUMENTS PVT LTD.
		4	FORBES MARSHALL LTD.
21	FLOW SWITCH	1	GENERAL INSTRUMENTS CONSORTIUM
		2	KROHNE MARSHALL
		3	SWITZER INSTRUMENT CO.
22	IMPACT HEAD TYPE ELEMENT	1	DETRIECH / EMERSON PROCESS
		2	MIDWEST
		3	STARMECH
		4	SWITZER INSTRUMENT CO.
		5	VERIS INC.
23	LEVEL GAUGE	1	CHEMTROLS ENGG. (P) LTD.
		2	LEVCON INSTRUMENTS (P) LTD.
		3	S. B. ELECTRO-MECHANICALS PVT. LTD.
		4	V. AUTOMAT & INSTRUMENTS PVT. LTD.
		5	DK INSTRUMENTS
		6	SIGMA INSTRUMENTS COMPANY
24	LEVEL SWITCH (FLOAT TYPE)	1	CHEMTROLS
		2	MAGNETROL INTERNATIONAL NV
		3	DK INSTRUMENTS
		4	LEVCON INSTRUMENTS P LTD.
25	LEVEL SWITCH (CONDUCTIVITY TYPE)	1	LEVEL STATE, UK
		2	SOLARTON/MOBREY, UK
		3	YARWAY
26	LEVEL SWITCH	1	ENDRESS + HAUSER

Sl. No.	Item Description	Vendor Name	
	(CAPACITANCE TYPE)	2	DK INSRTUMENTS
27	LEVEL SWITCH (DISPLACEMENT TYPE)	1	DRESSER VALVES INDIA LTD.
		2	CHEMTROLS
		3	DK INSRTUMENTS
		4	ECKARDT
28	LEVEL TRANSMITTER (ULTRASONIC TYPE)	1	EMERSON PROCESS
		2	ENDRESS + HAUSER
		3	SIEMENS MIL TRONICS
		4	VEGA
29	LEVEL TRANSMITTER (RADAR Type)	1	ENDRESS + HAUSER
		2	VEGA
30	BUNKER/SILO LEVEL 3D MONITORING (ULTRASONIC TYPE)	1	E & H
		2	SIEMENS
		3	VEGA-GERMANY
31	VIBRATION MONITORING SYSTEM /TURBINE SUPERVISORY MONITORING SYSTEM	1	GE (for BENTLY NEVADA SYSTEM)
		2	MEGGIT
		3	SHINKAWA, JAPAN
32	MERCURY MONITORING	1	DURAG GMBH AND CO KG
		2	SICK
		3	SHINKAWA
33	Dust Density Monitor	1	CODEL INTERNATIONAL LTD.
		2	DURAG GMBH AND CO KG
		3	LAND INSTRUMENTS INTERNATIONAL
		4	SICK GMBH
34	CO Analyzer (in situ type)	1	CODEL INTERNATIONAL LTD.
		2	LAND INSTRUMENTS INTERNATIONAL
		3	SICK GMBH
35	Oxygen Analyzer (Zirconia Probe type)	1	EMERSON PROCESS MANAGEMENT
36	SO_2-NOx/CO/CO_2 Analyzer(Insitu Type)	2	CODEL INTERNATIONAL LTD
		3	PROCAL
		4	SICK GMBH
37	SWAS system (with selected analysers from Rosemount Analytical / Hack Ultra-France, Orion – USA, Hach-USA. ABB – UK, Polymetron-France/Zeltwegger -Analyticals)	1	ABB LTD.
		2	EMERSON PROCESS MANAGEMENT INDIA PVT.
		3	FORBES MARSHALL
38	DUST MONITOR	1	SIEMENS MILLTRONICS

Sl. No.	Item Description	Vendor Name	
		2	FILTER SENSE
		3	BIN MASTER
39	PULSE JET CONTROLLER	1	SWITCHING CIRCUIT
		2	ADVANCE CONCEPT
		3	VOLTCRAFT
		4	SQUARE M
		5	MICRO SYSTEM
40	AIR FILTER REGULATOR	1	JRU INSTRUMENTS (Formerly PLACKA)
		2	SHAVO NORGREN (INDIA) PVT. LTD.
41	ELECTRO PNEUMATIC CONTROLLER	1	MTL INDIA PVT. LTD.
		2	WATSON SMITH LTD.
		3	FAIRCHILD
42	SMART POSITIONER	1	EMERSON PROCESS MANAGEMENT
		2	SIEMENS
		3	ABB
43	SOLENOID VALVE	1	ASCO (I) LTD.
		2	ROTEX AUTOMATION LTD.
		3	NUCON INDUSTRIES PVT LTD
44	FEP INSULATED CABLE (For TG control)	1	DELTON CABLES
		2	HABIA CABLES
		3	LAPP CABLES
		4	LEONI KERPEN
		5	TEMPENS INSTRUMENTS (I) PVT. LTD.
		6	THERMOELECTRIC
45	PTFE INSULATED CABLES (For TG control)	1	ADVANCE CABLES TECHNOLOGIES
		2	DELTON CABLES
		3	FLUTEF INDUSTRIES
		4	RELIANCE INDUSTEIES
		5	RJ INDUSTRIAL CORPORATION
		6	TEMPSENS INSTRUMENTS (I) PVT. LTD
		7	TOSHNIWAL CABLES PRIVATE LTD
		8	UNIVERSAL CABLES LIMITED
46	INSTRUMENTATION CONTROL CABLE/ COMPENSATING CABLE / THERMOCOUPLE EXTENSION CABLES	1	ADVANCE CABLES TECHNOLOGIES
		2	CORDS CABLE INDUSTRIES PVT. LTD.
		3	DELTON CABLES LTD.
		4	HAVIA CABLES
		5	KEI INDUSTRIES LTD.
		6	KERPEN CABELS

Sl. No.	Item Description	Vendor Name	
		7	LAPP CABLES
		8	NICCO CABLE
		9	POLYCAB WIRES PVT.LTD
		10	THERMO CABLES LTD.
		11	THERMO ELECTRIC
		12	UNIVERSAL CABLES LTD.
47	POWER CABLE (LT)	1	CCIL
		2	KEI INDUSTRIES LTD.
		3	POLYCAB
		4	RELIANCE ENGRS.
		5	THERMO ELECTRIC
		6	ADVANCE CABLES TECHNOLOGIES
		7	RELIANCE ENGRS.
		8	CORDS CABLES
		9	DELTON CABLES
		10	INCAB
		11	PARAMOUNT CABLES
		12	RADIANT CABLES
		13	TORRENT
		14	UNIVERAL CABLES
48	FO CABLES	1	SYSTIMAX
		2	TYCO/AMP
		3	MOLEX
49	UPS & ACDB	1	EMERSON NETWORK
		2	MERLINEGERINE
		3	HITACHI HIREL ELECTRONICS
50	24 V DC BATTERY CHARGER & DCDB	1	CALDYNE
		2	CHHABI ELECTRICALS
		3	HBL POWER SYSTEMS
		4	DB POWER
51	HART COMMUNICATOR (HAND HELD)	1	EMERSON PROCESS
		2	YOKOGAWA
		3	ABB
		4	HONEYWELL
52	MASTER & SLAVE CLOCK SYSTEM	1	HATHWAY
		2	HOPF
		3	SERTEL ELECTRONICS
		4	MASIBUS

Sl. No.	Item Description	Vendor Name	
53	PUBLIC ADRESSING SYSTEM (ANALOG SYSTEM)	1	BOSCH SECURITY SYSTEMS
	PUBLIC ADRESSING SYSTEM (IP ADDRESSABLE)	2	STENTOFONE (from ZENITAL GROUP)
		3	INDUSTRONIC
		4	COMMEND
54	EPABX	1	ABB INDIA PVT. LTD.
		2	BPL TELECOM PVT. LTD.
		3	CROMPTON GREAVES LTD.
		4	HCL INFINET LTD.
		5	SIEMENS LTD.
		6	ABC INDIA PVT LTD.
55	CCTV System	1	BOSCH
		2	HONEYWELL
		3	PELCO
56	LIE/LIR	1	CHEMIN CONTROLS
		2	ELECTRONICS CORP. OF INDIA LTD.
		3	PYROTECH
		4	FORBES MARSHAL
		5	INSTRUMENTATION LIMITED
		6	PRAMMEN INDUSTRIES
57	CONDENSATE POTS	1	FLOWTECH
		2	INSTRUMENTATION LIMITED
		3	PRECISION ENGG INDUSTRIES
		4	BALDOTA VALVE AND FITTING CO. PVT LTD.
		5	METPRESS ENGINEERING WORKS
		6	MICROPRECISION
58	IMPULSE PIPES	1	BHARAT HEAVY ELECTRICALS LTD.
		2	INDIA SEAMLESS METAL TUBES LTD. (only for CS Pipes)
		3	JINDAL SAW PIPES LTD.
		4	MAHARASHTRA SEAMLESS (only for CS Pipes)
		5	MANNESMANN AG
		6	SUMITOMO CORPORATION
		7	TPS TECHNITUBE ROHREN WERKE GMBH
		8	TROUVAY CAUVIN GULF E.C. DUBAI
		9	BALDOTA VALVE AND FITTING CO. PVT. LTD.

Sl. No.	Item Description	Vendor Name	
		10	BHARAT HEAVY ELECTRICALS LTD.
		11	EXCEL HYDRO – PHEUMATICS PVT. LTD.
		12	INSTRUMENTATION LTD.
		13	METPRESS ENGINEERING WORKS
		14	MAHALAKSHMI SEAMLESS
		15	RATNAMANI METALS & TUBES LTD.
59	INSTRUMENT VALVES / MANIFOLDS	1	BHARAT HEAVY ELECTRICALS LTD.
		2	BALDOTA VALVE AND FITTING CO PVT LTD.
		3	INSTRUMENTATION LIMITED
		4	METPRESS ENGINEERING WORKS
		5	EXCEL HYDRO-PNEUMATICS PVT. LTD.
		6	METPRESS ENGINEERING WORKS
		7	FLOWTECH
60	COMPRESSION FITTINGS	1	PARKER HANNIFIN
		2	PRECISION ENGG INDUSTRIES
		3	TROUVAY & CAUVIN
		4	HOKE (TECHNICAL PARTS CO. MUMBAI)
		5	SWAGELOCK
		6	METPRESS ENGINEERING WORKS
61	SOCKET WELD FITTINGS	1	EXCEL HYDRO-PNEUMATICS PVT. LTD.
		2	METPRESS ENGINEERING WORKS
		3	V.K. INDUSTRIES
		4	VIKAS INDUSTRIAL PRODUCTS
		5	BALDOTA VALVE AND FITTING CO PVT LTD.
		6	FLOWTECH
	FIRE DETECTION AND HYDRANT SYSTEM VENDORS		
1	HYDRANT VALVES	1	SHAH BHOGILAL
		2	SUKAN
		3	NEWAGE
		4	VENUS
		5	WINCO
2	FIRE HOSES	1	NEWAGE
		2	CHATTARIA RUBBER
3	WATER MONITOR & WATER-	1	SHAH BHOGILAL

Sl. No.	Item Description	Vendor Name	
	CUM FOAM MONITORS	2	HD FIRE
		3	NEW AGE
4	BRANCH PIPE, NOZZLES, COUPLINGS & FIRE BRIGDAE CONNECTIONS	1	SUKAN
		2	VENUS
		3	NEW AGE
		4	WINCO
5	DELUGE VALVES	1	HD FIRE
		2	TYCO (GRINELL)
		3	KIDDE (I) LTD.
6	HVW/ MVW SPRAY NOZZLE	1	KIDDE (I) LTD.
		2	TYCO
		3	HD FIRE
7	QUARTZOID BULB SPRINKLERS/DETECTORS	1	TYCO(GRINELL)
		2	HD FIRE
		3	NEWAGE INDUSTRIES
8	HYDRO PNEUMATIC TANK	1	ARC WELD ENGINEERS
9	MICROPROCESSOR BASED FIRE ALARM PANEL	1	SIMPLEX
		2	SCHRACK
		3	ESSER HONEYWELL
		4	DETECTOMAT
		5	SECUTRON
		6	GENT
10	LHS CABLE (FO Type)	1	AP SENSING,Germany
		2	SENSA,UK
	LHS CABLE (Intelligent Addressable Thermal Sensor Based)	1	Listec (Schrack)
11	FOAM PUMP	1	DEL PD PUMPS & GEARS
12	FOAM TANKS	1	ARC WELD ENGINEERS
13	ADDRESSABLE MULTISENSOR TYPE DETECTORS	1	SIMPLEX
		2	SCHRACK
		3	ESSER HONEYWELL
		4	DETECTOMAT
		5	SECUTRON
		6	GENT
14	ADDRESSABLE PHOTO ELECTRIC TYPE DETECTORS	1	SIMPLEX
		2	SCHRACK
		3	ESSER HONEYWELL
		4	DETECTOMAT
		5	SECUTRON

Sl. No.	Item Description	Vendor Name	
		6	GENT
15	ADDRESSABLE HEAT DETECTORS	1	SIMPLEX
		2	SCHRACK
		3	ESSER HONEYWELL
		4	DETECTOMAT
		5	SECUTRON
		6	GENT
16	INFRA RED DETECTORS	1	PATOL
		2	SYSTEM SENSOR
17	COATING & WRAPPING MATERIAL/ TAPE (COAL TAR BASED)	1	IWL LTD.
		2	RUSTECH
18	INERT GAS SYSTEM	1	GINGEKERR
		2	ANSUL
		3	SRI
		4	SIEMENS
19	BATTERY	1	EXIDE
		2	AMCO
20	FIRE SURVIVAL CABLES	1	POLYCAB
		2	RRKABEL
		3	KEI
		4	DELTON
21	HOSE REEL	1	SIEMENS
		2	WINCO
23	FIRE EXTINGUISHER	1	BIS APPROVED SOURCES WITH VALID LICENSE
24	PROBE TYPE HEAT DETECTOR	1	KIDDE
		2	TYCO
	HVAC SYSTEM VENDORS		
1	AIR WASHER & UAF	1	HYDERABAD POLUTION CONTROL
		2	ADVANCE VENTILATION
		3	DRAFT AIR
		4	BLUE STAR
		5	VOLTAS
		6	STERLING WILSON
		7	ROOTS COOLING SYSTEM
		8	C DOCTOR
2	CENTRIFUGAL FAN	1	FLAKT
		2	KRUGER

Sl. No.	Item Description	Vendor Name	
		3	DRAFT AIR
		4	HYDERABAD POLUTION CONTROL
		5	ADVANCE VENTILATION
		6	PATEL AIR
		7	MARATHON
		8	CB DOCTOR
		9	SARLA
3	FRESH AIR/ SUPPLY/ EXHAUST/ RE UNIT FANS / PROPELLAR	1	HYDERABAD POLUTION CONTROL
		2	ADVANCE VENTILATION
		3	KRUGER
		4	NICOTRA
		5	MARATHON
		6	FLAKT
		7	CB DOCTOR
		8	KHAITAN
4	PUMPS	1	BEST & CROMPTON
		2	JYOTI
		3	SAM TURBO
		4	KBL
		5	KSB
		6	M&P
		7	VOLTAS
		8	WORTHINGTON
		9	FLOWMORE
		10	SULZER PUMPS INDIA LTD.
		11	FLOWSERVE INDIA CONTROL PVT LTD
5	LV MOTORS (NON FLAME PROOF)	1	SIEMENS
		2	ABB
		3	CGL
		4	MARATHON
		5	KEC
		6	BHARAT BIJLEE
		7	NGEF
6	AIR FILTER	1	PUROLATOR
		2	FMI
		3	ANFILCO
		4	JOHN FOWLER
		5	SPECTRUM

Sl. No.	Item Description	Vendor Name	
		6	AIR TECH
		7	PUROMATIC
7	INSULTATION MATERIAL	1	BEARDSHEL
		2	ARMAFLEX
		3	LLOYDS
		4	UP TWIGA
		5	AEROCELL
8	FIRE DAMPER	1	TSC
		2	CARRYAIRE
		3	RAVISTAR (SYSTEM AIR)
9	GRILL/ DIFFUSER/ VOLUME CONTROL DAMPER	1	CARRYAIRE
		2	RAVISTAR (SYSTEM AIR)
10	HUMIDISTAT	1	JHONSON CONTROL
		2	HONEYWELL AUTOMATION
		3	PENN
11	SCREW CHILLER	1	CARRIER
		2	KIRLOSKAR
		3	DUNHAM BUSH
		4	BLUE STAR
		5	VOLTAS
		6	MCQUAY (DAIKIN)
		7	CLIMAVENETA
12	PRECISION AC	1	STULZ
		2	UNIFLAIR
		3	BLUEBOX
		4	EMERSON PROCESS MANAGEMENT
		5	CLIMAVENETA
13	SPLIT AC	1	VOLTAS
		2	BLUE STAR
		3	CARRIER
		4	HITACHI
		5	DAIKIN
		6	LG
14	AIR HANDLING UNITS	1	VOLTAS
		2	BLUE STAR
		3	ZECO
		4	CARRYAIRE (flakt)
		5	EDGETECH

Sl. No.	Item Description	Vendor Name	
		6	ETHOS
		7	SYSTEM AIR
		8	WAVES AIRCON
15	AHU FAN (CENTRIFUGAL FAN)	1	CB DOCTOR
		2	FLAKT
		3	KRUGER
		4	NICOTRA
		5	COMEFRI
		6	MARATHON
		7	ADVANCE
		8	DRAFT AIR
		9	HYDERABAD POLLUTION
16	PUMPS	1	BEST & CROMPTON
		2	JYOTI
		3	SAM TURBO
		4	KBL
		5	KSB
		6	M&P
		7	VOLTAS
		8	BEACON-WEIR
		9	WORTHINGTON
		10	FLOWMORE
		11	SULZER PUMPS INDIA LTD.
		12	FLOWSERVE INDIA CONTROL PVT LTD
		13	V-FLOW PUMPS & SYSTEMS CO
17	COOLING TOWER	1	PAHARPUR COOLING TOWER
		2	FLOWTECH
		3	BELL
18	LV MOTORS (NON FLAME PROOF)	1	SIEMENS
		2	ABB
		3	CGL
		4	MARATHON
		5	KEC
		6	BHARAT BIJLEE
		7	NGEF
		8	JYOTI
19	AIR FILTER	1	PUROLATOR

Sl. No.	Item Description	Vendor Name	
		2	FMI
		3	ANFILCO
		4	TENACITY
		5	JOHN FOWLER
		6	SPECTRUM
		7	AIR TECH
		8	PUROMATIC
20	BALANCING VALVE	1	ADVANCE
21	4 WAY MIXING VALVE WITH ACTUATING MOTOR	1	SIEMENS BUILDING TECHNOLOGY
		2	JOHNSON
		3	BELIMO
		4	HONEYWELL AUTOMATION
		5	RAPID CONTROL
		6	ALC
22	Y / POT STRAINER	1	MULTITEX
		2	GREAVES COTTON
		3	JAYPEE
		4	SANT VALVES
		5	OTOKLIN
		6	GUJARAT OTOFILT
		7	DS ENGG
		8	SAROJINI ENTERPRISE
		9	BHATIA ENGINEERING
		10	FILTERATION ENGINEERS INDIA PVT LTD
23	STRIP HEATER	1	ESCORTS
		2	RACOLDS
		3	ALCO
		4	HEATCO
24	PAN HUMIDIFIER	1	RAPID COOL
		2	HOTSET
		3	ALCO
25	RELIEF / PURGE VALVE	1	BRASSOMATIC
26	THERMOSTATS	1	HONEYWELL AUTOMATION
		2	RANCO
		3	PENN
		4	DANFOSS
		5	RANUTROL
		6	INDFOSS JHONSON CONTROL

Sl. No.	Item Description	Vendor Name	
27	ANTI FREEZE THERMOSTAT	1	RANCO
		2	HONEYWELL AUTOMATION
		3	PENN
		4	DANFOSS
		5	INDFOSS
28	RH SENSOR/TEMP SENSOR	1	HONEYWELL AUTOMATION
		2	JOHNSON
		3	SIEMENS
		4	GENERAL INSTRUMENT CONSORTIUM
29	WATER SOFTENING PLANT	1	THERMAX
		2	ION EXCHANGE

NOTE:

1. THE SUB VENDOR LIST ABOVE 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

PERFORMANCE GUARANTEES

1.01.00 SCHEDULE OF GUARANTEES WHICH ATTRACT LIQUIDATED DAMAGES [CATEGORY-A]

NOT APPLICABLE

1.02.00 SCHEDULE OF GUARANTEES WHICH DO NOT ATTRACT LIQUIDATED DAMAGES FOR VARIOUS EQUIPMENT WHICH INCLUDE BUT ARE NOT LIMITED TO THE FOLLOWING [CATEGORY-B]:

1.02.00 CONDENSATE POLISHING UNIT (CATEGORY-B)

A. The design flow (through working vessels) for each condensate polishing plant shall be the corresponding condensate flow of TG unit at VWO (Valve wide open) condition at 1% cycle make-up (flow through each service vessel indicated in the data sheet).

B. Following dissolved solid concentrations and conditions shall be used as a basis of design for the condensate polishing system. The ionic concentrations indicated below are as such:

CONTAMINANT	UNIT	NORMAL CONDITION	START UP CONDITION	TUBE LEAKAGE CONDITION
Ammonia	Ppb	250	1500	
Total dissolved solids (TDS, ammonia and silica excluded)	Ppb	100	650	
Silica (as SiO2)	Ppb	30	500	
Iron (dissolved)	Ppb	50	1000	
Chloride (as Cl)	Ppb	20	100	
pH (polisher runs at 25^{O}C with H/OH mode)		8.5-9.0	9.0-9.6	
Conductivity (25 Deg. C)	Micro S/cm	0.5	2	
Sodium (as Na)	Ppb	10	20	< 20
Crud (mostly black oxide of iron)	Ppb	50	1000	

N : 1:

For temperature 50˚C and above the silica value in the effluent shall be based on the resin supplier's recommendations.

Under the Normal Condition, each Condensate Polisher Mixed Bed shall be designed to operate in hydrogen cycle for not less than 240 hours of continuous operation, while maintaining the above treated condensate quality.

Under condenser tube leak condition, the CP System shall be designed for ingress of 2000 ppb TDS in addition to the influent contaminants under Design Condition as stated above.

C. ANALYSIS OF TREATED CONDENSATE UNDER **NORMAL AND START UP CONDITION**

The following concentration and conditions shall be used as a basis of design for the condensate polishing system:

CONTAMINANT	UNIT	EFFLUENT UNDER NORMAL CONDITION	EFFLUENT UNDER START UP CONDITION	TUBE LEAKAGE CONDITION
Total dissolved solids (TDS)	ppb	< 25	< 50	
Silica (as SiO2)	ppb	< 5 (Refer note # 1)	< 20 (Refer note # 1)	
Iron (dissolved)	ppb	< 2	< 10	

Chloride (as Cl)	ppb	< 2	< 10	
pH (polisher runs at 25^{O}C with H/OH mode)		6.5-7.5	6.5-7.5	
Electric Conductivity after cation column (25 Deg. C)	Micro S/cm	< 0.1	< 0.2	
Sodium (as Na)	ppb	< 2	< 5	< 20
Crud (mostly black oxide of iron)	ppb	< 5	< 100	

Note-1: For temperature 50˚C and above the silica value in the effluent shall be based on the resin supplier's recommendations.

Under the Normal Condition, each Condensate Polisher Mixed Bed shall be designed to operate in hydrogen cycle for not less than 240 hours of continuous operation, while maintaining the above treated condensate quality.
Useful service run under startup condition & Condenser Tube leakage condition shall be 48 hours before regeneration.

In addition to the dissolved solids, the influent condensate shall also contain some quantities of suspended solids (crud) derived from the corrosion of water and steam carrying pipelines, turbine condenser and steam side of the feed water heater. Normally this concentration will not exceed about 50 ppb and the polisher beds shall provide sufficient filtering action to restrict the effluent crud content to less than 5 ppb & same shall be guaranteed.

D. Influent water quality as indicated in the above clauses is minimum only. Bidder to check the same and higher values, if felt by them, shall be considered in the design so as to meet the specified effluent quality.

E. The bed cross section in the service vessels shall be such that the average velocity of condensate through it shall not exceed 2 meters/ min (120 m3/ hr. / m2) at the design flow rate for spherical vessel. Internal diameter of the service vessels (excluding the rubber lining) of spherical type shall be selected meeting the above mentioned velocity criteria. The effective depth of mixed bed in condensate polisher service vessel shall be not less than 1100 mm.

F. At the design flow rate, the pressure drop between inlet and outlet flanges of the polisher Condensate Polisher Mixed Beds with clean resin bed shall not exceed 2.0 bar (g). This pressure drop shall include losses due to entrance and exit nozzles, distributors, under drains, resins and the effluent resin traps. Maximum pressure drop under dirty conditions shall be restricted to about 3.5 bar (g) including the pressure drop across effluent resin traps.

G. Cation resins shall be regenerated by technical grade hydrochloric acid to IS: 265 (concentration 30-33% by volume) and anion resins by sodium hydroxide, rayon grade to IS: 252 available as 48% lye. For calculations, regeneration temperature should be taken as 25°C. In no case, the regeneration levels cannot be lower than the valves indicated below:

- Cation resin: 125 kg of 100% HCl per cubic meter of resin.
- Anion resin: 160 kg of 100% NaOH per cubic meter of resin.

H. Each rinse water outlet header of condensate polishing unit shall be provided with a pressure reducing station with isolating valves, suitably designed to enable the water entry to the both condenser's hot well which is operating under vacuum. Each pressure reducing station shall consist of either a pressure reducing valve from design pressure of service vessel to condenser vacuum or a combination of orifice plates to reduce pressure from design pressure of service vessel to 2 kg/cm2 and a pressure reducing valve from 2 kg/cm2 to condenser vacuum.

I. While calculating pump head, 10% margin (minimum) shall be considered of the value of friction losses. Pipe friction loss shall be calculated as per Willam-Hazen formula and "C" value to be adopted shall be as below: -

1.	Carbon Steel pipe	:	100
2.	CI pipe/ ductile Iron	:	100
3.	Rubber lines steel pipe	:	120
4.	Stainless steel pipe	:	100
5.	CPVC/ HDPE pipe	:	140

J. Each Pump shall be guaranteed for capacity, total dynamic head and power consumption for CPU package.

K. All blowers shall be guaranteed for head and power consumption for CPU package.

L. Each Condensate Polisher Mixed Bed will have a rated continuous treated water output capacity of not less than design value. Each Condensate Polisher Mixed Bed Unit shall be regenerated once after every 240 hours of continuous service run during normal operation.

M. Net output from each of Condensate Polisher Mixed Beds shall be not less than design volume of treated water for the design water analysis as exhibited in cl. no. 1.02.00 B, 1.02.00 C. In case water analysis is different from the design values, guaranteed quantity shall be calculated as indicated elsewhere in this specification and guarantee shall be applicable on this calculated quantity.

N. Chemical consumption of the Condensate Polisher Mixed Bed as indicated by the bidder shall be guaranteed against the regeneration level employed and resin volume provided without any tolerance.

O. Qualities of treated water from Condensate Polisher Mixed Bed shall be as per treated water analysis as exhibited in cl. no. 1.02.00 B, 1.02.00 C.

P. Noise level of all pumps and blowers at the rated duty point shall be demonstrated at site.

- Maximum noise level shall not exceed 85 dB (A) when measured at 1.0M away from the noise emission source.

- Maximum noise level from its source within the premises shall not exceed 70 dB (A) as per Environment (Protection) Rules 1986, Schedule-III, `Ambient Air Quality Standards' in respect of noise.

- Any statutory changes in stipulations regarding noise limitation that may occur in future according to State Pollution Control Board or Central Pollution Control Board or Ministry of Environment & Forest regulation during tenure of the contract, the Bidder shall comply with the requirement.

Q. Liquidate Damages (LD) for Non Achievement of Specific Performance:

The performance guarantees parameters for Condensate Polishing System have been indicated in above clauses.

No negative tolerance in respect flow, head and other performance guarantee parameters are acceptable to the Purchaser. In case, any equipment of Condensate Polishing System is not able to achieve the performance guarantee parameters during the Performance Guarantee Tests, Bidder shall make necessary modifications or replace the Equipment/ Plant or any part. If even after rectification, the Equipment/Plant is not able to achieve the guaranteed performance parameters, the Purchaser shall have right to reject the Equipment/Plant. In such case, the Bidder shall pay back the total amount paid to them with reference to the Equipment/Plant (with all taxes and duties as applicable) to the Purchaser.

ANNEXURE - IV

DRAWING DOCUMENTS SUBMISSION/ DISTRIBUTION PROCEDURE

- Bidder shall submit soft copy/hard copy/ CD ROMs of all the finally approved drawings and O&M Manuals as required by Customer/ Customer's 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 during 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 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 layout of the service vessel area and regeneration area.
  - Equipment cable tray layout for service vessel area and regeneration area
  - Equipment earthing layout service vessel area and regeneration area
  - Civil scope drawings.
  - Piping layout drawing for service vessel area, regenerative area and yard piping layout.
  - Valve schedule
  - Instrument schedule
  - Cable Schedule
  - I/O list and drive list
  - Any other document/ drawing as required by BHEL/ customer

Other requirements

- 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.

ANNEXURE - V

PAINTING SPECIFICATION

SECTION-XIII

PROTECTIVE LINING AND PAINTING

1.00.00 INTENT OF SPECIFICATION

1.01.00 This specification addresses the requirements of all labour, material, and appliances necessary with reference to preparations for lining / painting, application as well as finishing of all lining / painting for all mechanical and electrical equipment, piping and valves, structures etc. included under the scope of this Package.

1.02.00 The Bidder shall furnish and apply all lining, primers including wash primers if required, under-coats, finish coats and colour bands as described hereinafter or necessary to complete the work in all respects.

2.00.00 CODES & STANDARDS

2.01.00 The Bidder shall follow relevant Indian and International Standards wherever applicable in cleaning of surface, selection of lining material / paints and their application. The entire work shall conform to the following standards / specifications (latest revision or as specified).

a)	SSPC SP 10 / NACE 2 /	:	Near White Blast Cleaning
b)	SSPC PA 2	:	Measurement of dry film Coating Thickness with magnetic gauges.
c)	ASTM D 4541	:	Method for pull off strength using portable Adhesion Tester.
d)	NACE RP 0274 – 2004	:	High-Voltage Electrical Inspection of Pipeline Coatings
e)	NACE SP 0188 – 2006	:	Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates
f)	NACE RP 0169 – 2002	:	Control of External Corrosion on Underground or Submerged Metallic Piping Systems
g)	AWWA C 210 – 2007	:	Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
h)	IS 3589:2001 Annexure B	:	Steel Pipes for Water and Sewage Specification.

i) AWWA C222-2000 : Polyurethane Coating for the Interior and Exterior of Steel Water Pipe and Fittings.

j) IS 13213 : 2000 : Polyurethane Full Gloss Enamel (Two pack)

3.00.00 GENERAL REQUIREMENTS

3.01.00 The steel surface preparation prior to actual commencement of coating shall conform to SSPC SP 10 / NACE 2 / Sa2½ (near white metal) with sand blasting.

3.02.00 The contractor shall submit a detailed written description in the form of a manual covering coating equipment, procedures, materials inspection test, and repair etc. to Owner/Consultant for approval.

3.03.00 The contractor shall also provide copies of test reports from NABL approved laboratory (like National Test House, Kolkata) in support of the paint/primer materials to be used shall conform to the specification requirement.

3.04.00 The contractor shall also provide certificates from paint/primer manufacturer mentioning the batch numbers, date of manufacture and shelf life etc. of the materials to be used. In addition to that Manufacturing Quality Plan (MQP) and Field Quality Plan (FQP) shall also be submitted prior to commencement of supply of material and field application.

3.05.00 Paint/coating application work at site shall be done either by paint manufacturer or by their authorized applicator. The authorized applicator shall have proper training & certification from manufacturer. Applicator shall possess all the necessary specialized equipment and manpower experienced in similar job.

3.06.00 Applied coating shall be tested for dry film thickness, holiday (electrical inspection for continuity) and adhesion as per relevant standard such as SSPC PA 2, NACE RP 0274 and ASTM D 4541.

3.07.00 If necessary, the material may be heated and applied by airless spray / plural component spray system.

3.08.00 Manufacturer's specific recommendation, if any, shall be followed during application of lining / paints.

3.09.00 In areas where there is danger of spotting automobiles or other finally finished equipment or building by wind borne particles from paint spraying, a Purchaser approved method shall be adopted.

3.10.00 The colour scheme of the entire Plant, covered under this specification shall be approved by the Purchaser in advance before application.

3.11.00 All indoor and outdoor piping, insulated as well as uninsulated will have approved colour bands painted on the pipes at conspicuous places throughout the system, as approved by Purchaser.

3.12.00 Inside surfaces of vessels / tanks shall be protected by anticorrosive paints or rubber lining as required / specified elsewhere in the specification. External surfaces of all vessels / tanks shall be protected by anti corrosive painting.

3.13.00 For vessels / tanks requiring lining and epoxy painting all inside surface shall be blast cleaned using non-siliceous abrasive after usual wire brushing.

3.14.00 Natural rubber lining shall be provided on the inside of vessels / tanks as required / specified elsewhere in the specification, in three layers resulting in a total thickness not less than 4.5 mm.

3.15.00 Surface hardness of rubber lining shall be 65 +/- 5 deg. A (shore).

3.16.00 After the lining is completed, the vessels / tanks shall not be subjected to any prolonged exposure to direct sunlight in course of its transportation, erection etc. They shall not be stored in direct sunlight. No further lining or burning shall be carried out on the vessel, after application of the lining.

3.17.00 All lining projecting outside of the vessel shall be protected adequately from mechanical damages during shipment, handling storage etc.

3.18.00 Suitable warnings, indicating the special care that must be taken with respect to these lined vessels shall be stenciled on their outside surface with the letters at least 12 mm high.

3.19.00 All insulated piping shall have aluminium sheet jacketing.

4.00.00 EQUIPMENT, MATERIAL AND SERVICES TO BE FURNISHED BY THE BIDDER

4.01.00 After erection at site, the outside surfaces of all equipment having a shop coat shall be given further priming coat and finished coats of paint as detailed in following clauses. However, if the painting system is such that the shop coat and primer coat to be applied at site are not compatible, then shop coat has to be removed from the surface of equipment before application of primer coat with prior blasting.

All factory finished paints shall be touched up at site as required.

All uninsulated piping shall be finished with final paintings after use of proper wash primer and primer. Aluminium sheet jacketed piping need not be painted.

Colour bands of Purchaser's approved shade shall however be applied on jacketed piping near walls or partitions, at all junctions, near valves and all other places as instructed by the Purchaser. All structures shall be painted with approved paint.

4.02.00 Surface Preparation

4.02.01 Unless mentioned otherwise, all rust and mill scale shall be removed by blasting to Sa 2-1/2 Swiss Standard before applying the primer.

4.02.02 Special care shall be taken to remove grease and oil by means of suitable solvents like Trichloroethylene or Carbon Tetrachloride.

4.02.03 The minimum degree of surface preparations for all equipment, piping, fittings, valves, structures etc. shall be "Near White" according to Steel Structure, Painting Council-SSPC-SP-10 before application of any primer/paint.

4.03.00 Painting

4.03.01 Specification for application of paints for external surfaces protection of vessels / tanks / equipment / piping / fittings / valves etc. to be installed indoor shall be as follows :

a) Surface preparation shall be done either manually or by any other approved method.

b) Primer Coat shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber based zinc phosphate.

c) Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber based paint pigmented with Titanium Dioxide.

d) Top Coat shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber paint of approved shade and colour with glossy finish.

e) Total DFT of paint system shall not be less than 150 microns.

4.03.02 Specification for application of paints for external surfaces protection of vessels / tanks / equipment / piping / fittings / valves etc to be installed **outdoor** shall be as follows :

a) Surface preparation shall be done by means of sand blasting, which shall conform to Sa 2-1/2 Swiss Standard.

b) Primer Coat shall consist of one coat (minimum DFT of 100 microns) of epoxy resin based zinc phosphate primer.

c) Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 100 microns) epoxy resin based paint pigmented with Titanium Dioxide.

d) Top Coat shall consist of one coat (minimum DFT of 75 microns) of epoxy paint of approved shade and colour with glossy finish. Additional one coat (minimum DFT of 25 microns) of Finish Coat of polyurethane shall be provided.

e) Total DFT of paint system shall not be less than 300 microns.

4.03.03 Specification for application of paints for external surfaces protection of steel pipes and fittings which are **buried underground / laid inside a hume pipe & or submerged Under Water and laid under Pipe Trenches** (in road/rail/pipe or trench crossings) shall be as follows :

External surface of the pipe, fittings, specialties etc. handling raw water/clarified water/filter water shall be painted with one coat of two part chemically cured polyurethane primer of min 50 micron dry film thickness followed by three or maximum four coats of two part solvent less polyurethane to build up coating of dry film thickness of 2000 micron including primer coat.

4.03.04 Specification for application of paints for **internal surface protection of large diameter pipes** (sizes above 600 mm NB and above) if any, shall be as follows :

a) All Internal surfaces of steel pipes, fittings, specialties etc. buried underground or located within pipe trenches shall be given epoxy coating to protect them from (except for drinking water service, where the compatible painting shall be so selected to meet relevant quality standards) corrosion.

b) Internal surface of the pipe should be coated with one coat of two part epoxy primer with not less than 50 micron DFT (dry film thickness) followed by two part polyamide cured solvent less epoxy.

c) The minimum dry film thickness (DFT) of internal lining shall be 600 micron.

4.03.05 Specification for application of paints for protection of **internal surfaces of DM Water Storage Tank(s)** shall be as follows :

a) Primer - One coat of epoxy primer containing high level of Zinc Phosphate anticorrosive pigment. Total Dry Film Thickness (DFT) of primer shall not be less than 125 microns.

b) Finish Paint - Three (3) coats Polyamine HB Epoxy Paint. Total Dry Film Thickness (DFT) of finish paint shall not be less than 125 microns per coat.

c) Total thickness of primer and paint should not be less than 500 microns.

4.03.06 All motors, local push button stations, cable racks, structures used for supports etc. are to be painted with acid proof paint.

4.03.07 The following surfaces shall not be painted - stainless steel, galvanized steel, aluminum, copper, brass, bronze and other nonferrous materials.

4.03.08 No painting or filler shall be applied until all repairs, hydrostatic tests and final shop inspection are completed.

4.03.09 All machined surfaces shall have two (2) coats of water repellant grease after thorough cleaning.

5.00.00 COATING PROCEDURE AND APPLICATION

5.01.00 Surface Preparation :

Pipe shall be blast cleaned by sand. The cleanliness achieved prior to application shall be in accordance with the requirement of SSPC SP 10 / NACE 2 / Sa2½ of ISO 8501 (near white metal)

a) The blast pattern or profile depth shall be 40 to 100 micron and shall be measured by dial micrometer.

b) Before sand blasting is started or during blasting or coating, temperature of the pipe surface should be more than 3°C above dew point temperature. Blast cleaned surface should be primed within 4 hours and shall be protected from rainfall or surface moisture and shall not be allowed to flash rust. If the rust occurs, the surface again to be prepared by sand blasting or wire brushing.

5.02.00 Application of Epoxy Coating

a) Coating shall be applied when

i) When the pipe surface temperature shall be atleast 3°C above dew point temperature.
ii) The temperature of mixed coating material and the pipe at the time of application shall not be lower than 10°C or greater that 50°C.

b) Material preparation shall be in accordance with manufacturer's recommendations.

c) Application of epoxy coating system :

The epoxy coating system shall be applied as per recommendation of the manufacturer and shall be applied by airless spray / plural component spray machine. For more than one coat, the second shall be applied with the time limits as recommended by the manufacturer.

5.03.00 Application of PU Coating

a) PU coating shall be applied when the pipe surface temperature atleast 3°C above dew point temperature (when R.H is more than 85%).

b) Material preparation and application shall be done as per manufacturer recommendation.

6.00.00 TEST REQUIREMENTS

6.01.00 Measurement of dry film thickness

Measurement of dry film thickness of coating : Coating thickness shall be in the range of ±20% and as per SSPC PA 2.

6.01.01 Apparatus / Instrument:-

The instrument used for dry film thickness may be Type 1 pull of gauges or Type 2 electronic gauges.

6.01.02 Procedures:-

a) Number of measurements:
For 100 square feet (9.29 square meters), five (5) spots per test area (each spot is 3.8 cm) in diameter. Three gauge readings per spot (average becomes the spot measurement).

b) If the structure is less than 300 square feet, each 100 square feet should be measured.

c) If the structure is between 300 and 1000 sq ft, select 3 random 100 square feet test areas and measure.

d) For structure exceeding 1000 square feet, select 3 random 100 square feet testing areas for the first 1000 sq ft and select 1 random 100 square feet testing area for each additional 1000 square feet

e) Coating thickness Tolerance: Individual reading taken to get a representative measurement for the spot are unrestricted (usually low or high readings are discarded). Spot measurements (the average of 3 gauge readings) must be within 80% of the minimum thickness and 120% of the maximum thickness. Area measurement must be within specified range.

6.02.00 **ELECTRICAL INSPECTION (HOLIDAY) TESTS**

6.02.01 All the coated / lined pipes shall be tested with an approved high voltage holiday detector preferably equipped with an audio visual signaling device to indicate any faults, holes, breaks or conductive particles in the protective coating.

6.03.00 The applied output voltage of holiday detector shall have a spark discharge of thickness equal to at least twice the thickness of the coating to assure adequate inspection voltage and compensate for any variation in coating thickness. The electrode shall be passed over the coated surface at approximately half the spark discharge distance from the coated surface only one time at the rate of approximately 10 to 20m/min. The edge effect shall be ignored. Excessive voltage shall be avoided as it tends to induce holiday in the coated surface thereby giving erroneous readings.

6.04.00 While selecting test voltages, consideration should be given to the tolerance on coating thickness and voltage should be selected on the basis of maximum coating thickness likely to be encountered during testing of a particular pipe.

The testing voltage shall be calculated by using following formula. (as per NACE 0274 : 2004)

Testing Voltage V = 7900 $\sqrt{T}$ ± 10 percent where T is the average coating thickness in mm.

6.05.00 Any audio visual sound or spark leads to indicate pinhole, break or conductive particle.

6.06.00 **ADHESION PULL OFF TEST**

After holiday the coated surface is subjected to adhesion pull off test as per ASTMD 4541.

6.06.01 Apparatus / Instrument: Adhesion tester consists of three basic components:

A hand wheel, a black column containing a dragging indicator pin and scale in the middle and a base containing three legs and a pulling “Jaw” at the bottom and also dollies.

6.06.02 Prepare the test surface

Once test area is selected, test area shall be free of grease, oil, dirt, water. The area should be flat surfaces and large enough to accommodate the specified number of replicate test.

6.06.03 Prepare Dolly (Test Pull Stub)

The dolly is a round, two sided aluminium fixture. Both sides of the dolly looks same, however, one side sloped on top surface while flat on bottom surface. As the surface of the dolly is polished aluminium, roughen the same using a coarse sand paper.

6.07.00 Select an adhesive:

Use araldite, a 100% solid epoxy adhesive. This adhesive requires at least 24 hours at room temperature to cure.

6.08.00 Attach the dolly to the surface.

a) Using a wooden stick, apply an even layer of adhesive to the entire contact surface area of the dolly.

b) Carefully remove the excessive adhesive by using a cotton swab. Allow the adhesive to fully cure before performing the adhesion test.

c) Attach the dolly to the coated surface and gently push downward to displace any excessive adhesive.

d) Push the dolly inward against the surface, then apply tape across the head of the dolly.

6.09.00 Adhesion Test Procedure

a) Attach the adhesion tester to the dolly by rotating the hand wheel counter clockwise to lower the jaw of the device.

b) Slide the jaw completely under the head of the dolly. Position the three legs of the instruments so that they are sitting flat on the coated surface.

c) Slide the dragging indicator pin on the black column to zero by pushing it downward.

d) Firmly hold the base of the instrument in one hand and rotate the handwheel clockwise to raise the jaw of the device that is attached to the head of the dolly. The dragging indicator pin will move upward on the black column as the force is increased and will hold the reading. Apply the tension using a moderate speed. Continue to increase the tension on the head of the dolly until (a) the minimum PSI/MPa/Kg/cm² required by project specification is exceeded and the test is discontinued, (b) the maximum PSI/MPa/Kg/cm² of adhesion tester has been achieved and dolly is still attached, (c) The force applied by the adhesion tester causes the dolly to dislodge.

e) Read the scale and record the adhesion value.

6.10.00 **COATING REPAIR**

Defective Coating shall be repaired in accordance with the following subsections.

6.10.01 Surface Preparation:

Accessible areas of pipe requiring coating repairs shall be cleaned to remove debris and damaged coating using surface grinders or other means. The

adjacent coating shall be feathered by sanding, grinding or other method. Accumulated debris shall be removed by blowing with contaminant free air or wiping with clean rags.

6.10.02 Areas not accessible for coating repair such as interior surfaces of small diameter pipe shall be reprocessed and recoated.

6.11.00 Coating Application

The coating system shall be applied to the prepared areas in accordance with procedure.

6.12.00 Repair Inspection

Repaired portion shall be electrically inspected using a holiday detector.

6.13.00 **WELDED FIELD JOINTS**

6.13.01 Preparation :

The weld joints shall be cleaned so as to be free from mud, oil, grease, welding flux, weld spatter and other foreign contaminants. The cleaned metal surfaces of the weld joint shall then be blasted or abraded using rotary abrading pads. The adjacent liquid Epoxy / PU coating shall be feathered by abrading the coating surface for a distance of 25 mm.

6.13.02 Electrical Inspection :

After curing the coating system applied to the welding joints shall be holiday tested. Any holidays indicated by the detector shall be marked with chalk to identify the area of repair.

7.00.00 INFORMATION/DATA REQUIRED

The Bidder shall submit complete list of paints and primers proposed, giving detail information, such as, chemical composition, drying time etc. and also unit rates for application of each type of paint along with supply shall be furnished.

ANNEXURE VI

MANDATORY SPARE LIST

Sl. No.	Equipment/Package Name	Quantity to be supplied for the Package
(iv)	Temperature switch-water tem-perature high	1No.
(v)	Rotameter Complete assembly	1Set
(vi)	Diaphragm for valve	4Nos.each type and size
6.10.20	Blowers	
(i)	Rotating Assembly	1Set for each type and rating
(ii)	Complete Set of Bearing	1Set for each type and rating
(iii)	Electrical Spares as applicable as per the Electrical List	Applicable Item & Quantity same as indicated in Electrical list Sl. No.7.08.00, 7.21.00
6.10.21	Strainer	1No. for each type
6.10.22	Electrical Spares as applicable as per the Electrical List	Applicable Item & Quantity same as indicated in Electrical list Sl. No.7.08.00 & 7.12.00
6.10.23	C&I Field Instruments & Others as applicable as per the C&I List	Applicable Item & Quantity same as indicated in C&I list Sl. No.8.04.00 & 8.10.00
6.11.00	Condensate Polishing Unit	
6.11.01	Screens and Nozzles for the under drain system	
(i)	Activated Carbon Filter	15% of ACF Vessel.
(ii)	Polisher Service Vessels	100% for one vessel of each type
6.11.02	Ion Exchange resins for makeup losses during first three (3) years of operation which have been guaranteed by the bidder. (But in any case the make-up quantity to be supplied by bidder shall not be less than the quantity considering as attrition loss of 3% per annum for cation resins and 12% per annum for Anion resins).	1 Lot
6.11.03	Blowers for Regeneration and Service Vessel	
(i)	Bearings	1Set for each type /size/ ratings (one set means complete replacement for 1 no. of each type/rating of blower)
(ii)	Impeller	1Set for each type /size/ ratings (one set means complete replacement for 1 no. of each type/rating of blower)
(iii)	Electrical Spares as applicable as per the Electrical List	Applicable Item & Quantity same as indicated in Electrical list Sl. No.7.21.00
6.11.04	Horizontal Centrifugal Pumps	
(i)	Impeller complete Assembly	1Set for each type /size/ ratings (one set means complete replacement for 1 no. of each type/rating of pump)
(ii)	Bearings for the pumps	1 Sets for each type /size/ ratings (one set means complete replacement for 1 no. of each type/rating of pump)
(iii)	Shafts	1No. for each type /size/ ratings (one set means complete replacement for 1 no. of each type/rating of pump)
(iv)	Shaft Sleeve of each type /	1 Nos. for each type /size/ ratings (one set means complete replacement for 1 no. of each type/rating of pump)
(v)	Casing wearing rings (if applicable)	1Sets for each type /size/ ratings (one set means complete replacement for 1 no.

Sl. No.	Equipment/Package Name	Quantity to be supplied for the Package
		of each type/rating of pump)
(vi)	Impeller wearing rings (if applicable)	1Sets for each type /size/ ratings (one set means complete replacement for 1 no. of each type/rating of pump)
(vii)	Thrust Bearings (if applicable)	1Sets for each type /size/ ratings (one set means complete replacement for 1 no. of each type/rating of pump)
(viii)	Sleeve nuts and O-rings	1Set for each type /size/ ratings (one set means complete replacement for 1 no. of each type/rating of pump)
(ix)	Gland & Gland Packing (if applicable)	2Sets for each type /size/ ratings (one set means complete replacement for 1 no. of each type/rating of pump)
(x)	Fasteners	1Set for each type /size/ ratings (one set means complete replacement for 1 no. of each type/rating of pump)
(xi)	Complete Coupling (Pump and Motor)	1Set for each type /size/ ratings (one set means complete replacement for 1 no. of eachl type/rating of pump)
(xii)	Mechanical seal (if applicable)	1Set for each type /size/ ratings (one set means complete replacement for 1 no. of each type/rating of pump)
(xiii)	Electrical Spares as applicable as per the Electrical List	Applicable Item & Quantity same as indicated in Electrical list Sl. No.7.21.00
6.11.05	Complete Assembly of Metering (Dosing) Pumps & motor	1Set for each type/size/rating
6.11.06	Valves	
(i)	Check Valves	1No. for each type/size/rating
(ii)	Complete Set of On/Off Valve with Pneumatic Actuator (including those having Diaphragm of different material)	1No. for each type/size/rating of valves
(iii)	Diaphragm Valve (including those having Diaphragm of different material)	1No. for each type/size/rating of valves
6.11.07	Electrical Spares as applicable as per the Electrical List	Applicable Item & Quantity same as indicated in Electrical list Sl. No. 7.08.00 & 7.12.00
6.11.08	PLC with MMI System	Applicable Item & Quantity same as indicated in C&I list Sl. No. 8.03.00
6.11.09	Field Instruments & Others as applicable as per the C&I List	Applicable Item & Quantity same as indicated in C&I list Sl. No. 8.04.00, 8.05,00, 8.07.01 & 8.10.00
7.00.00	Electrical Items All applicable items separately shall be considered and supplied for BTG area, Coal Handling Plant area and Ash Handling Plant area	
7.01.00	Generator Transformer	
7.01.01	Bushing	
(i)	HV Bushing with metal parts, connectors and gaskets	1No
(ii)	HV Neutral bushing with metal parts, connectors and gaskets	1No.

Sl. No.	Equipment/Package Name	Quantity to be supplied for the Package
8.03.27	Micro PLC system (i.e. inegrated CPU & I/O system, where above mentioned components are not applicable)	One Complete Set
8.04.00	Field Instrument	
8.04.01	Electronic Transmitters	
(i)	Pressure	1(One) no. complete set for each type and model/range used in the system
(ii)	Differential Pressure	1(One) no. complete set for each type and model/range used in the system
(iii)	Level	1(One) no. complete set for each type and model/range used in the system
(iv)	Speed	1(One) no. complete set for each type and model/range used in the system
(v)	FlowTransmitter	1(One) no. complete set for each type and model/range used in the system
(vi)	3-D Ultrasonic level Transmitter	1(One) no. complete set for each type and model/range used in the system
8.04.02	Different type of Switches	
(i)	Pressure Switch	2(two)no. of each type & model/range used in the system
(ii)	Differential Pressure Switch	2(two)no. of each type & model/range used in the system
(iii)	Level Switch	2(two)no. of each type & model/range used in the system
(iv)	Flow Switch	2(two)no. of each type & model/range used in the system
(v)	Temperature Switch	2(two)no. of each type & model/range used in the system
(vi)	Dust Detector	1(one)no. of each type & model used in the system
8.04.03	Thermocouple	10 % of each type and length used in one unit
8.04.04	RTD	10 % of each type and length used in one unit
8.04.05	Thermo-well for both TC and RTD	2(Two) nos. for each type and rating/length used in the system
8.04.06	Solenoid Valve	
(i)	Complete Solenoid Valve Assembly	2Nos. for each type and rating used in the system
(ii)	Coil (single or double coil type)	10% of total nos. used in the system or minimum 5(five) Nos. whichever is more for each type and rating.
8.04.07	Different types of Gauge	10% of total nos. used in the system or minimum 1(one) no. whichever is more for each type and range.
(i)	Pressure Gauge	10% of total nos. used in the system or minimum 1(one) no. whichever is more for each type and range.
(ii)	Differential Pressure Gauge	10% of total nos. used in the system or minimum 1(one) no. whichever is more for each type and range.
(iii)	Temperature Gauge	10% of total nos. used in the system or minimum 1(one) no. whichever is more for each type and range.

Sl. No.	Equipment/Package Name	Quantity to be supplied for the Package
(iv)	Magnetic Level Gauge	10% of total nos. used in the system or minimum 1(one) no. whichever is more for each type and range.
8.04.08	Air Filter Regulator including moisture separator complete set with pressure gauges	10Nos.
8.04.09	Rotameter	10% of total nos. used in the system or minimum 2(Two) nos. whichever is more for each type, rating,/model and size used in the system.
8.04.10	Gauge Glass	1No. for each type and size
8.04.11	Erection Hardware	
(i)	Transmitter's Manifold	10% of total nos. used in the system or minimum 2(Two) nos. whichever is more for each type, rating,/model and size used in the system.
(ii)	Impulse Line Root/Source valve	10% of total nos. used in the system or minimum 4(four) nos. whichever is more for each type, rating,/model and size used in the system.
(iii)	Impulse Line Isolation valve	10% of total nos. used in the system or minimum 4(four) nos. whichever is more for each type, rating,/model and size used in the system.
(iv)	Impulse Line Drain valve	10% of total nos. used in the system or minimum 4(four) nos. whichever is more for each type, rating,/model and size used in the system.
(v)	Impulse Line fittings	Each type/size 25Nos.
(vi)	Impulse Pipe	Each type/size 100Mtrs.
(vii)	Copper/SS Tube	Each type/size 100Mtrs.
(viii)	Fittings for Copper/SS Tube	Each type/size 100Nos.
8.04.13	Conductivity Type Level Switch	
(i)	Conductivity Ttype level Probes	10% of total nos. used in the system or minimum 4(four) nos. whichever is more.
(ii)	Complete Electronics unit	1Set
(iii)	Isolating/Root Valve	2Nos.
8.04.14	Cable This particulat items shall be common for BTG , CHP and AHP areas.	
(i)	Thermocouple Cable	3(three)Kms. of each type, size & rating of Cables
(ii)	Control & Instrumentation Cable	3(three)Kms. of each type, size & rating of Cables
8.04.15	Cold Junction Compensation Boxes	10% of total nos. used in the system or minimum 2(two) nos. for each type/size whichever is more.
8.04.16	Current/Voltage Transducers	1(one) no. each type/rating used in the system
8.04.17	MWatt/MVAR Transducer	1(one) no. each type/rating used in the system
8.04.18	Chlorine Leak Detector System	
(i)	Sensor Unit (complete)	2No.
(ii)	Transmitter/Processing Unit (complete)	2No.
8.05.00	SWAS	
8.05.01	Conductivity	
(i)	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.
(ii)	Conductivity Transmitter Complete Set	20% of the total no. used in the system or

Sl. No.	Equipment/Package Name	Quantity to be supplied for the Package
		minimum 2(two) nos. whichever is higher.
8.05.02	pH	
(i)	pH Sensor	20% of the total no. used in the system or minimum 2(two) nos. whichever is higher.
(ii)	pH Transmitter Complete Set	20% of the total no. used in the system or minimum 2(two) nos. whichever is higher.
(iii)	Sensor recharger	20% of the total no. used in the system or minimum 2(two) nos. whichever is higher.
8.05.03	Sodium Analyser	
(i)	Sodium Analyser Electrode	1(one) no.
(ii)	Critical Electronic spare part for Sodium Analyser/Monitor	1(one) no. each type
(iii)	Reagent container	1 no.
(iv)	Refurbishment kit for sodium analyser	1 no.
(v)	Consumable kit/ Chemical Reagent for Sodium Analyser	For maintaining the system for 1(one) Year continuous operation
8.05.04	Silica Analyser	
(i)	Critical Electronic spare part for Silica Analyser/Monitor	1(one) no. each type
(ii)	Reagent container	1 no.
(iii)	Cuvette assy for silica	1 no.
(iv)	Pump motor for silica	1 no.
(v)	Tube replacement kit	1 set
(vi)	Fuses of each type	2nos. each
(vii)	Consumable kit/ Chemical Reagent for Silica Analyser	For maintaining the system for 1(one) Year continuous operation
8.05.05	Hydrazine Analyser	
(i)	Critical Electronic spare part for Hydrazine Analyser/Monitor	1(one) no. each type
(ii)	Cell Recharge kit	1 no.
(iii)	Porus Disc	1 no.
(iv)	Seal rings	1 set
(v)	Fuses of each type	2nos. each
(vi)	Consumable kit/ Chemical Reagent for Hydrazine Analyser	For maintaining the system for 1(one) Year continuous operation
8.05.06	Dissolve Oxygen	
(i)	Dissolve Oxygen Sensor Complete Set	1(one) no.
(ii)	Dissolve Oxygen Analyser Complete Set	1(one) no.
8.05.07	Phosphate Analyser	
(i)	Critical Electronic spare part for Phosphate Analyser/Monitor	1(one) no. each type
(ii)	Flow Chamber	1 no.
(iii)	Calibration Kit	1 no.
(iv)	Reagent Container	1(one) no. each type
(v)	Consumable kit/ Chemical Reagent for phosphate Analyser	For maintaining the system for 1(one) Year continuous operation
8.05.08	Chloride Analyser	
(i)	Chloride Cell/Electrode	1(one) no.
(ii)	Critical Electronic spare part for Chloride Analyser/Monitor	1(one) no. each type

Sl. No.	Equipment/Package Name	Quantity to be supplied for the Package
(iii)	Reagent container (if required)	1(one) no. each type
(iv)	Refurbishment kit for Chloride analyser	1 no.
(v)	Consumable kit/ Chemical Reagent for Chloride Analyser	For maintaining the system for 1(one) Year continuous operation
8.05.09	Other Hardware	
(i)	Stainer each type	2(two) nos.
(ii)	Sample Cooler	2(two) nos.
(iii)	High Pressure Reducing Valve	5(five) nos.
(iv)	Cation column	5(five) nos.
(v)	Pressure Gauge, Pressure Switch, Temperature Gauge, Temperature Switch,Isolating Valve, Solenoid Valve, Temperature Shut-Off 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.
(vi)	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.
(vii)	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.
8.05.10	Chiller Unit	
(i)	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.
(ii)	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.
8.06.00	On Line Flue Gas Analysis	
8.06.01	Particulate Matter/ Dust Density Monitor	
(i)	IR Source/Transmitter unit	1No.
(ii)	Sink/Receiver Unit	1No.
(iii)	Air Purge Assembly	1Set
(iv)	Pltier Cooler Assembly	1Set
(v)	Air Drying Filter Assembly	1Set
(vi)	Regulator Assembly	1Set
(vii)	LED Card	
(viii)	Detector Card	
8.06.02	CO, NOx, SOx Analyser (Insitu Probe Type)	
(i)	Filter Element of Air Dryer	1No. each
(ii)	IR Source unit	1No.
(iii)	Reflector Unit	1No.
(iv)	Gas Diffuser Window Unit	1No.
(v)	Complete Set of Gasket	1Set
(vi)	Probe Measurement Chamber	1No.
(vii)	Optical Kit	1Set
(viii)	Thermocouple for the probe	1No.
(ix)	Power supply Module	1No.

Sl. No.	Equipment/Package Name	Quantity to be supplied for the Package
(x)	Regulator & Gauge Assembly	1Set
8.06.03	Oxygen Analyser	
(i)	Field Sensor	4Nos. complete unit
(ii)	Field Transmitter/complete Electronic unit	2Nos. complete unit
(iii)	Power supply Card	2Nos.
(iv)	Instrumentation Hardware (viz, isolation valve, solenoid valve etc.)	2Nos. each items/type
8.07.00	Pneumatic Control Valve & Power Cylinder (Applicable for all Modulating Type & On-Off/Isolating Type)	
8.07.01	Control Valve	
(i)	Pneumatic Diaghragm for Diaghragm actuated valve	2(two) nos. for each type of Actuator
(ii)	Actuator Seal Kit for Pneumatic Cylinder actuated valve	2(two) nos. for each type of Actuator
(iii)	Gland Packing	1(one) set for each type of Control Valve
(iv)	Stem	1(one) No. for each type of Control Valve
(v)	Plug	1(one) No. for each type of Control Valve
(vi)	Seat	1(one) No. for each type of Control Valve
(vii)	Cage	1(one) No. for each type of Control Valve
(viii)	Retainer Ring	1(one) set for each type of Control Valve
(ix)	Seal Ring	1(one) set for each type of Control Valve
(x)	Gasket	2(two) Sets. for each type of Control Valve
(xi)	Smart Positioner of the Valve	10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.
(xii)	Seal Kit for the Positioner	2(two) Sets. for each type of Positioner
(xiii)	Position Feedback Transmitter (applicable if it is not integral with the Smart Positioner)	10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.
(xiv)	Complete Set of Solenoid Valve for Pneumatic type On/Off Valve	2Nos. for each type & ratings
(xv)	Solenoid Coil for Pneumatic type On/Off Valve	5Nos. for each type & ratings
8.07.02	Power Cylinder	
(i)	Actuator Seal Kit	2(two) nos. for each type of Power Cylinder
(ii)	Gasket	2(two) Sets. for each type of Power Cylinder
(iii)	Complete Set of Power Cylinder	1(one) no. each type for all application
(iv)	Smart Positioner of the Valve	10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.
(v)	Seal Kit for the Positioner	2(two) Sets. for each type of Positioner
(vi)	Position Feedback Transmitter (applicable if it is not integral with the Smart Positioner)	10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.
(vii)	Complete Set of Solenoid Valve for Pneumatic type On/Off Power Cylinder	2Nos. for each type & ratings
(viii)	Solenoid Coil for Pneumatic type On/Off Power Cylinder	5Nos. for each type & ratings
(ix)	Position Limit Switch for Pneumatic type On/Off Power Cylinder	10Nos. for each type & ratings

Sl. No.	Equipment/Package Name	Quantity to be supplied for the Package
8.07.03	I/P Converter for Control Valve/Power Cylinder (if applicable)	10% of total quantity used in the system or minimum 5(five) nos. whichever is more for each type and model.
8.07.04	Air Lock Relay	10Nos. for each type
8.07.05	Signal Air Booster Unit	2Nos. for each type
8.08.00	Turbine Supervisory Instruments & Plant Rotating Machinary Monitoring System	
8.08.01	Probes with extension cable	10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.
8.08.02	Signal Converter/Proximitor for Transducer system	10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.
8.08.03	Rack Mounted Monitors for Transducer system	10% of total quantity used in the system or minimum 1(one) no. whichever is more for each type and model.
8.08.04	Rack Interface Modules	10% of total quantity used in the system or minimum 1(one) no. whichever is more for each type and model.
8.08.05	Configurable type Relay Output Modules	10% of total quantity used in the system or minimum 1(one) no. whichever is more for each type and model.
8.08.06	Communication/Gateway Modules	10% of total quantity used in the system or minimum 1(one) no. whichever is more for each type and model.
8.08.07	Rack Mounted Power Supply Modules	10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.
8.09.00	Closed Circuit Television System	
8.09.01	Complete Camera Unit	Each type 1(one) no.
8.10.00	Control Panel And Local/Remote Control Desk	
8.10.01	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.
8.10.02	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.
8.10.03	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.
8.10.04	Simaphore Indicator	2(two)Nos. each type
8.10.05	Annunciation System	
(i)	Each type of PCB (for non-PLC driven system)	1(one) No. each
(ii)	Lamp Box with Facia & Lamps (LED type)	10(ten)Nos.
(iii)	Hooter	1(one) No.
8.11.00	Thermocouple for Furnace Temperature Probes	2Nos.
8.12.00	Mill and Air Heater Fire Detection System	
8.12.01	Thermocouple	10% or 1 no. whichever is more
8.12.02	Process Actuator Switches	10% or 1 no. whichever is more

Sl. No.	Equipment/Package Name	Quantity to be supplied for the Package
7.11.06	UPS Battery (Ni-Cad Type)	
(i)	Battery Cell (Uncharged, Dry)	10Nos. each type
(ii)	Inter connecting cell strips	10Nos. each type
(iii)	Vent cap	10Nos. each type
(iv)	Hydrometer	1No.
(v)	Rubber gloves	1Pair
(vi)	Voltmeter for measuring cell voltage (Center zero type)	1No.
(vii)	Funnel	1No.
(viii)	Jug	1No.
(ix)	Appron & Goggles	1Set
(x)	Cell lifting puller	1No.
(xi)	Insulated socket spanner with handle	1No.
(xii)	Terminal screw with Belleville washer	5% of total quantity used
(xiii)	Plastic filling bottle	1No.
(xiv)	Thermometer	1No.
7.11.06	Other Electrical Items	For other applicable items Sl No.7.12.00 & 7.08.00 of this document shall be followed.
7.12.00	Control Panel/Desk Mounted Items	
7.12.01	Push Button Complete assembly	10Nos for each colour
7.12.02	Push Button Contact Element (1NO + 1NC) Block	20Nos.
7.12.03	Selector Switch	10Nos. for each type and rating
7.12.04	Meter (Analog and Digital)	
(i)	Ammeter	2Nos. for each type and range
(ii)	Voltmeter	2Nos. for each type and range
(iii)	Frequency	2Nos. for each type and range
(iv)	MW	2Nos. for each type and range
(v)	MVAR	2Nos. for each type and range
(vi)	Power Factor	2Nos. for each type and range
(vii)	Synchroscope	1No. for each type and range
(viii)	Synchrocheck Relay complete set	1No. for each type and range
(ix)	Transducer	1No. for each type and range
7.12.05	Indicating Lamps complete assembly	20Nos. for each Colour and type
7.12.06	Mimic Lamps	10Nos. for each Colour and type
7.12.07	MCB	5Nos. for each type and rating
7.12.08	Door Limit Switch	5Nos.
7.12.09	Annunciation system	
(i)	Lamp Box with Facia & Lamps (LED type)	25Nos.
(ii)	Hooter	1No.
(iii)	Each type of PCB (for non-PLC driven system)	1(one) no.
7.13.00	Actuator	
7.13.01	Complete set of Actuator	2Nos. for each type, make and rating, 1 no. for H2 cooler Temperature controller and 1 no. for stator water temperature controller
7.13.02	Power Unit for Modulating Actuator	4Nos. of each type

Sl. No.	Equipment/Package Name	Quantity to be supplied for the Package
7.13.03	DC-DC Power Pack Unit	4Nos. of each type
7.13.04	Electronic cards	4Nos. of each type
7.13.05	Position Feed Back Transmitters	4Nos. of each type
7.13.06	Control Unit	4Nos. of each type
7.13.07	Limit Switch Assembly	2 Nos each type and rating
7.13.08	Torque Switch Assembly	2 Nos each type and rating
7.13.09	Power Contactor	5Nos. for each type and rating
7.13.10	Auxiliary Contactor	5Nos. for each type and rating
7.13.11	Thermal Over Load Relay	2Nos. for each type and rating
7.13.12	Motor	1No. each type and rating
7.13.13	Complete Seal kit	2Sets for each type and rating
7.13.14	Complete O-Ring Set	2Sets for each type and rating
7.14.00	Illumination	
7.14.01	Lighting fixtures without light	20 Sets for each make, type and rating
7.14.02	MCCB	5 Nos for each make, type and rating .
7.14.03	MCB	20 Nos for each make, type and rating .
7.14.04	Power and Control Contactor	5 Nos for each make, type and rating
7.14.05	Switches	5 Nos for each make, type and rating .
7.14.06	Receptacles with plug	5 Nos for each make, type and rating
7.14.07	Rotary switches	2 Nos for each make, type and rating .
7.14.08	LED light	50 nos for each make, type and rating .
7.14.09	Clock switch type Time Switch	2 nos for each make, type and rating .
7.14.10	Lighting Transformer	1 no for each make, type and rating .
7.15.00	Cable	
7.15.01	11KV Grade HT Power Cable	2 (Two) Kms. of each type, size & rating of Cables
7.15.02	3.3KV Grade HT Power Cable	2 (Two) Kms. of each type, size & rating of Cables
7.15.03	LT Power Cable	2(Two)Kms of each type, size & rating of Cables
7.15.04	Control Cable	2(Two)Kms. of each type, size & rating of Cables
7.15.05	Fire Survival Cable	1(One)Km of each type, size & rating of Cables
7.16.00	Neutral Grounding Registor	
7.16.01	NGR complete with all accessories	1 set of each make, type and rating
7.16.02	Insulator	2 nos for each make, type, rating and size
7.16.03	Neutral CT(if applicable)	1 no of each type and rating
7.17.00	DG Set	
7.17.01	Diesel Engine	
(i)	Element Corrosion Resistor	8Nos.
(ii)	Element lub oil Filter	8Nos.
(iii)	Element lub oil by pass Filter	8Nos.
(iv)	Element Fuel Filter	16Nos.
(v)	Plate corrosion Resistor	16Nos.
(vi)	Element Air cleaner outer	2Nos.
(vii)	Element Air cleaner Inner	2Nos.
(viii)	Fuel Oil Pump	1No.

Sl. No.	Equipment/Package Name	Quantity to be supplied for the Package
	motors covered in mechanical spare items need not to be included here again)	number whichever be higher
(ii)	Neutral End Terminal Bushing with Fasteners	1 no. for each type and rating of Motor
(iii)	Bearing Temperature Gauge Driving & Non-Driving End	1 set for each type and rating of Motor
(iv)	Phase segregated terminal boxes	2 Nos. for each type and rating of Motor
(v)	Heaters	2 sets for each type and rating of Motor
(vi)	Complete Set of Coupling	1 set for each type and rating of Motor
(vii)	Bearings (DE) for each type and rating of motors	2 sets for each type and rating of Motor
(viii)	Bearings (NDE) for each type and rating of motors	2 sets for each type and rating of Motor
(ix)	Cooling Fan Internal & External	1 set for each type and rating of Motor
(x)	Neutral CT for differential protection (For motor rating >1000 KW)	2 no of each type and rating.
(xi)	End Termination kits	2 Nos. of each type and rating
(xii)	Indicating Instruments/gauges other then Bearing temperature gauge (as applicable)	1 set for each type and rating of Motor
(xiii)	Phase side Bushing and Insulator	1Set for each type and rating of Motor
(xiv)	Oil Seal Ring (as applicable)	1Set for each type and rating of Motor
7.21.02	415 Volt Motor	
(i)	Motor of each type and rating (Note : motors covered in mechanical spare items need not to be included here again) 10% of the installed quantity or minimum 1 number whichever be higher	10% of the installed quantity or minimum 1 number whichever be higher
(ii)	End Shield Cover Driving & Non-Driving End	1 set for each type and rating of Motor
(iii)	Heaters	2 sets for each type and rating of motor
(iv)	Bearings (DE and NDE) for each type and rating of motor	2 sets
(v)	Cooling Fan for all type and rating of LT motors	One (1) set
(vi)	Dust seals and gaskets for each type of motors	1 Set
(vii)	Motor Terminal Block	1 no. for each type and rating of Motor
(viii)	Complete Set of Coupling	1 set for each type and rating
7.21.04	DC Motor	
(i)	Motor of each type and rating (Note : motors covered in mechanical spare items need not to be included here again)	10% of the installed quantity or minimum 1 number whichever be higher
(ii)	Carbon brushes	2 sets for each type and rating of Motor
(iii)	Brush assemblies	2 sets for each type and rating of Motor
(iv)	Terminal blocks	1 set for each type and rating of Motor
(v)	Heaters	1 set for each type and rating of Motor
(vi)	Complete Set of Coupling	1 set for each type and rating of Motor
(vii)	Bearings (DE and NDE) for each type and rating of motor	1 set for each type and rating of Motor
(viii)	Cooling Fan	1 set for each type and rating of Motor
7.22.00	Local Control Station	

ANNEXURE VII

DRAWING / DOCUMENTS SUBMISSION SCHEDULE

After award of LOI, following minimum drawing/documents shall be submitted by the bidder for BHEL/ 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 number of drawing/ documents to be submitted by the bidder shall be as per enclosed Sub-Section IA/ ANNEXURE-IV. The submission of soft copy or hard copy of the document whichever is later will be considered as final date of submission of the document. 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.

The numbers of soft copies & hard copies of drawing/documents to be submitted by the bidder shall be as per enclosed Sub-Section IA Annexure-IV.

Bidder to note that drawings submitted shall be complete in all respects with revised drawing submitted incorporating all comments. Any incomplete drawing submitted shall be treated as non-submission with delays attributable to bidder's account. Engineering meeting shall be held fort nightly, for which the bidder shall depute his concerned engineers along with project manager to PEM office or at customer office without fail.

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

List and schedule of drawings/documents to be submitted after award of contract: -

MASTER DRAWING LIST(MDL)				
S. No.	**Drawing/ document No.**	**Drawing/ document title**	**No. of weeks for drawing/ document submission after placing LOI/PO**	**Paper Size of Dwg/Docs.**
1.0	PE-V0-417-155-A001	QAP FOR PRESSURE VESSELS FOR CONDENSATE POLISHING UNIT	10	A4
2.0	PE-V0-417-155-A002	QAP FOR SERVICE VESSEL FOR CONDENSATE POLISHING UNIT	10	A4
3.0	PE-V0-417-155-A003	QAP FOR ATMOSPHERIC TANKS FOR CONDENSATE POLISHING UNIT	10	A4
4.0	PE-V0-417-155-A004	QAP FOR BLOWERS WITH MOTOR FOR CONDENSATE POLISHING UNIT	10	A4
5.0	PE-V0-417-155-A005	QAP FOR METERING PUMPS WITH MOTOR FOR CONDENSATE POLISHING UNIT	10	A4
6.0	PE-V0-417-155-A006	QAP FOR HORIZONTAL / VERTICAL CENTRIFUGALPUMPS WITH MOTOR FOR CONDENSATE POLISHING UNIT	10	A4
7.0	PE-V0-417-155-A008	QAP FOR VALVES FOR CONDENSATE POLISHING UNIT	10	A4
8.0	PE-V0-417-155-A009 *	OPERATION & CONTROL PHILOSOPHY FOR CPU ALONG WITH CONTROL SYSTEM CONFIGURATION DIAGRAM	6	A4
9.0	PE-V0-417-155-A010 *	PROCESS DESIGN & SIZING CALCULATIONS, DS OF RESIN, VESSEL THICKNESS & PR. DROP CALCULATIONS FOR CPU	4	A4
10.0	PE-V0-417-155-A011	TECHNICAL DATA SHEET FOR HEATER FOR CONDENSATE POLISHING UNIT	10	A4

11.0	PE-V0-417-155-A012	TECHNICAL DATA SHEET OF BLOWERS FOR CONDENSATE POLISHING UNIT	10	A4
12.0	PE-V0-417-155-A013	TECHNICAL DATA SHEET FOR MOTOR FOR CONDENSATE POLISHING UNIT	10	A4
13.0	PE-V0-417-155-A014	TECHNICAL DATA SHEET FOR ANALYSERS FOR CONDENSATE POLISHING UNIT	10	A4
14.0	PE-V0-417-155-A015	TECHNICAL DATA SHEET FOR HIGH PRESSURE VALVES FOR CONDENSATE POLISHING UNIT	10	A4
15.0	PE-V0-417-155-A017	PAINTING SCHEDULE FOR CPU	10	A4
16.0	PE-V0-417-155-A018	TECHNICAL DATA SHEET FOR METERING PUMPS FOR CONDENSATE POLISHING UNIT	10	A4
17.0	PE-V0-417-155-A019	DATASHEET OF RESIN TRAP, CARBON TRAP, ACF, AGITATOR FOR CONDENSATE POLISHING UNIT	12	A4
18.0	PE-V0-417-155-A020	TECHNICAL DATA SHEET FOR INSTRUMENTS FOR CONDENSATE POLISHING UNIT	10	A4
19.0	PE-V0-417-155-A021	TECHNICAL DATA SHEET OF HORIZONTAL / VERTICAL CENTRIFUGALPUMPS FOR CONDENSATE POLISHING UNIT	10	A4
20.0	PE-V0-417-155-A022	TECHNICAL DATA SHEET FOR LOW PRESSURE VALVES FOR CONDENSATE POLISHING UNIT	10	A4
21.0	PE-V0-417-155-A023	QAP / ICL FOR CPU (FOR BALANCE OF ITEMS)	12	A4
22.0	PE-V0-417-155-A024	ELECTRICAL LOAD DATA FOR CONDENSATE POLISHING UNIT	10	A4
23.0	PE-V0-417-155-A025	GA DRAWING OF SERVICE VESSELS FOR CPU	10	A1
24.0	PE-V0-417-155-A026	GA DRAWING OF PRESSURE VESSELS FOR CPU	10	A1
25.0	PE-V0-417-155-A027	GA DRAWING OF ATMOSPHERIC TANKS FOR CPU	10	A1
26.0	PE-V0-417-155-A028	CONTROL SCHEME FOR CONDENSATE POLISHING UNIT	14	A4
27.0	PE-V0-417-155-A029	CIVIL ASSIGNMENT DRAWING OF CONDENSATE POLISHING UNIT (SERVICE VESSEL AREA)	8	A1
28.0	PE-V0-417-155-A030	CIVIL ASSIGNMENT DRAWING OF CONDENSATE POLISHING UNITREGENERATION AREA)	8	A1
29.0	PE-V0-417-155-A031*	P&I DIAGRAM FOR CONDENSATE POLISHING UNIT	4	A1
30.0	PE-V0-417-155-A032 *	EQUIPMENT LAYOUT OF CONDENSATE POLISHING UNIT (SERVICE VESSEL AREA)	4	A1
31.0	PE-V0-417-155-A033 *	EQUIPMENT LAYOUT OF CONDENSATE POLISHING UNIT (REGENERATION AREA)	4	A1
32.0	PE-V0-417-155-A034	PIPING LAYOUT (REGENERATION AREA) FOR CONDENSATE POLISHING UNIT	10	A1
33.0	PE-V0-417-155-A035	YARD PIPING LAYOUT FOR CONDENSATE POLISHING UNIT	16	A1
36.0	PE-V0-417-155-A036	PG TEST PROCEDURE FOR CONDENSATE POLISHING UNIT	20	A4
37.0	PE-V0-417-155-A037	PIPING LAYOUT (SERVICE VESSEL AREA) FOR CONDENSATE POLISHING UNIT	10	A1
38.0	PE-V0-417-155-A038	VALVE SCHEDULE FOR CONDENSATE POLISHING UNIT	12	A3
39.0	PE-V0-417-155-A039	INSTRUMENT SCHEDULE FOR CONDENSATE POLISHING UNIT	12	A3

40.0	PE-V0-417-155-A040	VALVE SEQUENCE CHART FOR CONDENSATE POLISHING UNIT	10	A3
41.0	PE-V0-417-155-A041 *	SUB-VENDOR LIST AND INSPECTION CRITERIA	4	A4
42.0	PE-V0-417-155-A042	I/O LIST FOR CONDENSATE POLISHING UNIT	10	A4
43.0	PE-V0-417-155-A043	DRIVE LIST FOR CONDENSATE POLISHING UNIT	12	A4
44.0	PE-V0-417-155-A044	CABLE TRAY/TRENCH & CONDUIT ROUTING AND EARTHING LAYOUT DIAGRAM FOR CPU(REGENERATION AREA)	12	A1
45.0	PE-V0-417-155-A045	CABLE TRAY/TRENCH & CONDUIT ROUTING AND EARTHING LAYOUT DIAGRAM FOR CPU(SERVICE VESSEL AREA)	12	A1
46.0	PE-V0-417-155-A046	CABLE SCHEDULE FOR CONDENSATE POLISHING UNIT	16	A3
47.0	PE-V0-417-155-A047	O&M MANUAL FOR CONDENSATE POLISHING UNIT	24	A4

Note- The drawing/ document marked as (*) shall be considered as basic drawings/ documents. In addition to above bidder to refer Sub Section- IA, IB, IC, IIB & IIC for documents related to Electrical & Control & instrumentation respectively.

Notes:

1. The above drawing list is tentative and shall be finalized with the successful bidder after placement of order. While some of the drawings indicated above may not be applicable, some additional drawings may also be required based on scope of work.

2. Drawings shall be prepared in Auto-Cad latest edition. Required no. of hard and soft copies (editable) of the drawings shall be furnished as per requirement specified elsewhere in the specification.

3. Only manual calculation with authentic supporting literature (e.g. extracts of hand Book/ standard/codes) shall be acceptable. All design calculations and drawings shall be in SI system only.

4. All the drawings and documents including general arrangement drawing, data sheet, calculation etc. to be furnished to the customer during detailed engineering stage shall include / indicate the following details for clarity w.r.t. Inspection, construction, erection and maintenance etc.: -

   a) All drawings and documents shall indicate the list of all reference drawings including general arrangement.

   b) All drawings shall include / show plan, elevation, side view, cross - section, skin section, blow - up view; all major self-manufactured and bought out items shall be labeled and included in BOQ / BOM in tabular form.

   c) Painting schedule shall also be made as a part of general arrangement drawing of each equipment / items indicating at least 3 trade names.

   d) All the drawings required to be furnished to customer during detailed engineering stage shall include technical parameters, details of paints and lubrication, hardness and BOQ/ BOM in tabular form indicating all major components including bought out items and their quantity, material of construction indicating its applicable code/ standard, weight, make etc.

   e) Drawings/ documents to be submitted for purchaser's review/ approval shall be under Revision A, B, C…etc. while drawings/ documents to be submitted thereafter for customer's approval after purchaser's approval shall be under R-0, 1, 2, 3…. etc.

f) Drawings and documents not covered above but required to check safety of machines/ system, shall be submitted during detailed engineering stage without any commercial implication.

g) All drawings shall include "B.O.M" and indicate quantity, material of construction, make along with IS/ BS No., Technical parameters, dimensions, hardness, machining symbol and tolerance, requirement of radiography and hydraulic tests, painting details, elevation, side view, plan, skin section and blow-up view for clarity.

h) All drawings shall be prepared as per BHEL's title block and shall bear BHEL's drawing no.

ANNEXURE VIII

WATER ANALYSIS

DESIGN RAW WATER ANALYSIS

SL.NO.	Different Characteristic	Results
1.	Calcium (Ca^{++}) as $CaCO_3$	86
2.	Magnesium (Mg^{++}) as $CaCO_3$	52
3.	Sodium & Potassium (Na^{+} & K^{+}) as $CaCO_3$	138
	Total Cations	**276**
4.	Bicarbonates (HCO_3) as $CaCO_3$	200
5.	Carbonates (CO_3) as $CaCO_3$	-
6.	Hydroxyde (OH) as $CaCO_3$	-
7.	Sulphate (SO_4) as $CaCO_3$	35
8.	Chloride (Cl) as $CaCO_3$	41
9.	Nitrate (NO_3) as $CaCO_3$	-
10.	Phosphate (PO_4) as $CaCO_3$	-
	Total Anions	**276**
11.	Total Hardness (as $CaCO_3$)	138
12.	Permanent Hardness (as $CaCO_3$)	-
13.	Temporary Hardness (as $CaCO_3$)	138
14.	Methyl Orange Alkalinity (as $CaCO_3$)	200
15.	Phenolphthalein Alkalinity (as $CaCO_3$)	-
16.	Iron (Original) (as Fe)	-
17.	Iron (in solution) (as Fe)	1.0
18.	Manganese (as Mn)	-
19.	Ammonia, free (as NH_3)	-
20.	Carbon Dioxide free (as CO_2)	-
21.	Silica (in solution (as SiO_2)	20.0
22.	Dissolved Oxygen (O_2)	-
23.	Suspended Solids	-
24.	Dissolved Solids	438
25.	pH at 25 °C	7.5 – 8.0
26.	Organic Matter (in terms of Oxygen absorbed from acid permanganate solution in 4 hours)	2.0
27.	Appearance	Turbid
28.	Odour	Nil
29.	Turbidity	500 NTU

DESIGN CLARIFIED WATER ANALYSIS

CONSTITUENTS	As	CONTENT
Calcium	$CaCO_3$	105 ppm
Magnesium	$CaCO_3$	52 ppm
Sodium and Potassium	$CaCO_3$	138 ppm
Hydrogen (FMA)	$CaCO_3$	--
TOTAL CATIONS	$CaCO_3$	295 ppm
Bicarbonate	$CaCO_3$	196.5 ppm
Carbonate	$CaCO_3$	-
Chloride	$CaCO_3$	41 ppm
Sulphate	$CaCO_3$	57.5 ppm
Nitrate	$CaCO_3$	-
TOTAL ANIONS	$CaCO_3$	295 ppm
M.O. Alkalinity	$CaCO_3$	196.5 ppm
P. Alkalinity	$CaCO_3$	
Total Hardness	$CaCO_3$	157 ppm
Carbon-di-oxide	CO_2	3.5
Dissolved Silica	SiO_2	20 ppm
Total Iron	Fe	1 ppm
pH Value	-	7.9 – 8.0
Turbidity, NTU	-	20
Organic Matter Content in terms of Oxygen in absorbed from ($KMnO_4$ (4 Hrs.)		5 ppm

Note:
The analysis of the clarified water is exhibited here, shall be multiplied with 5.0 COC to derive the circulating water analysis.

ANNEXURE IX

LIST OF TOOLS & TACKLES (AS APPLICABLE)

Bidder to consider necessary tools and tackles for mechanical, electrical and control & instrument as per their system requirement. In addition, bidder to adhere relevant clauses of tender specification also.

ANNEXURE - X

FORMAT FOR OPERATION AND MAINTENANCE MANUAL

TITLE: 1 X 660 MW SAGARDIGHI TPS UNIT NO.5 PHASE III	SPECIFICATION NO. PE-TS-445-155A-A001	
	SECTION : I	
TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT	SUB-SECTION: IA	
	REV. NO. 01	DATE : 13.07.2021

Bidder to submit operation and Maintenance manual with minimum information as listed in below check list during contract stage.

CHECK LIST FOR OPERATION & MAINTENANCE MANUAL

Project name :
Project number :
Package Name :
PO reference :
Document number :
Revision number :

S. No. & Sections	Description	Tick (√)if included in Manual			Remarks
		Yes	No	Not Applicable	
1.	**Cover page**				
1.1	Project Name				
1.2	Customer/consultant Name				
1.3	Name of Package				
1.4	Supplier details with phone, FAX, email address, Emergency Contact number				
1.5	Name and sign of prepared by, checked by & approved by				
1.6	Revision history with approval Details				
2.0	**Index**				
2.1	Showing the sections & related page nos. All the pages should be numbered section wise				
3.0	**Description of Plant/System**				
3.1	Description / write up of operating principle of system equipment/ associated sub-systems & accessories/ controls system, operating conditions, performance parameters under normal , start up and special cases				
3.2	Equipment list and basic parameter with Tag numbers				
3.3	Data sheets approved by Customer/ for information and catalogues provided by original manufacturer				
3.4	Associated other packages and Interface/ terminal points				
3.5	P&ID & Process Diagrams				
3.6	GA Layout drawings, As-built drawings, Actual photograph of items/ system (Drawings of A2 & bigger sizes are to be attached in the last)				
3.7	Single line/ wiring diagrams				
3.8	Control philosophy / control write-ups				
4.0	Commissioning Activities (if not covered in separate document i.e. erection manual, commissioning manual)				
4.1	Pre-Commissioning Checks				
4.2	handling of items at site				
4.3	Storage at site				
4.4	Unpacking & Installation procedure				
5.0	**Operation Guidelines for plant/ personal/**				

	user/ operator				
5. 1	Interlock & Protection logic along with the limiting values of protection settings for the equipment along with brief philosophy behind the logic, drawings etc. to be provided.				
5. 2	Start up, normal operation and shut down procedure for equipments along with the associated systems in step by step mode. Valve sequence chart, step list, interlocks etc. with Equipment isolating procedures to be mentioned.				
5. 3	Do's & Don't of the equipments.				
5. 4	Safety precautions to be taken during normal operation. Safety symbols, Emergency instructions on total power failure condition/lubrication failure/any other condition				
5. 5	Parameters to be monitored with normal values and limiting values				
5. 6	Trouble shooting with causes and remedial measures				
5. 7	Routine operational checks, recommended logs & records				
5. 8	Changeover schedule if more than one auxiliary for the same purpose is given				
5. 9	Painting requirement and schedule				
5. 10	Inspection, repair , Testing and calibration procedures				
6.0	**Maintenance guidelines for plant personal**				
6.1	List of Special Tools and Tackles required for Overhaul/ Trouble shooting including special testing equipment required for calibration etc.				
6.2	Stepwise dismantling and re-assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained, clearances etc. to be mentioned. Tolerances for fitment of various components to be given.				
6.3	Preventive Maintenance & Overhauling schedules linked with running hours/ calendar period along with checks to be given				
6.4	Long term maintenance schedules especially for structural, foundations etc.				
6.5	Consumable list along with the estimated quantity required during commissioning, normal running and during maintenance like Preventive Maintenances and Overhaul. Storage/ handling requirement of consumables/ self-life.				
6.6	List of lubricants with their Indian equivalent, Lubrication Schedule, Quantity required for each equipment for complete replacement is to be given.				
6.7	List of vendors & Sub-vendors with their latest addresses, service centers, Telephone Nos., Fax Nos., Mobile Nos., e-mail IDs etc.				
6.8	List of mandatory and recommended spare				

	parts list				
6.9	Tentative Lead time required for ordering of spares from the equipment supplier				
6.10	Guarantee and warranty clauses				
7.0	**Statutory and other specific requirements considerations.**				
8.0	**List of reference documents**				
9.0	**Binding as per requirement**				

ANNEXURE XI

SITE STORAGE AND PRESERVATION

CONTENT

1. SCOPE OF THE DOCUMENT

This guideline is prepared in intent to provide proper site storage and preservation of the Mechanical, Electrical and C & I items / equipment supplied under various bought out packages/items. This storage procedure shall be followed at different power plant sites by concerned agency for storage and preservation from the date of equipment received at site until the same are erected and handed over to the customer.

2. PURPOSE OF STORAGE & PRESERVATION

Many of the items may be required to be kept in stores for long period. It shall therefore be essential that proper methods of storage and preservation be applied so that items do not deteriorate, loose some of their properties and become unusable due to atmospheric conditions and biological elements.

3. MEASURES TO BE TAKEN FOR STORAGE, HANDLING & PRESERVATION

a) GENERAL STORAGE REQUIREMENTS

1. To the extent feasible, materials should be stored near the point of erection. The storage areas should have adequate unloading and handling facilities with adequate passage space for movement of material handling equipment such as cranes, fork lift trucks, etc. The storage of materials shall be properly planned to minimise time loss during retrieval of items required for erection.
2. The outdoor storage areas as well as semi-closed stores shall be provided with adequate drainage facilities to prevent water logging. Adequacy of these facilities shall be checked prior to monsoon.
3. The storage sheds shall be built in conformity with fire safety requirements. The stores shall be provided with adequate lights and fire extinguishers. 'No smoking' signs shall be placed at strategic locations. Safety precautions shall be strictly enforced.
4. Adequate lighting facility shall be provided in storage areas and storage sheds and security personnel positioned to ensure enforcement of security measures to prevent theft and loss of materials.
5. Adequate number of competent stores personnel and security staff shall be deployed to efficiently store and maintain the equipment / material.
7. The equipment shall be stored in an orderly manner, preserving their identification slips, tags and instruction booklets, etc., required during erection. The storage of materials shall be equipment-wise. Loose parts shall be stored in sheds on racks,

preserving the identification marks and tags in good condition. The group codes shall be displayed on the racks

6. At no time shall any materials be stored directly on ground. All materials shall be stored minimum 200 mm above the ground preferably on wooden sleepers

b) GENERAL PRESERVATION REQUIREMENTS

1. All special measures to prevent corrosion shall be taken like keeping material in dry condition, avoiding the equipment coming in contact with corrosive fluid like water, acid etc.
2. Materials which carry protective coating shall not be wrapped in paper, cloth, etc., as these are liable to absorb and retain moisture. The material shall be inspected and in case of signs of wear or damages to protective coating, that portion shall be cleaned with approved solution and coated with an approved protective paint. Complete record of all such observations and protective measures taken shall be maintained.
3. Generally equipment supplied at site are properly greased or rust protective oil is applied on machined/ fabricated components. However periodic inspection shall be carried out to ensure that protection offered is intact.
4. While handling the equipment, no dragging on the ground is permitted. Avoid using wire rope for lifting coated components. Use polyester slings (if possible) otherwise protective material (e.g. clothes, wood block etc.) should be used while handling the components with rope / slings
5. For Equipment supplied with finished paint, touch paint shall be done in case any surface paint gets peeled off during handling. Otherwise such surfaces shall necessarily be wrapped with polythene to avoid any corrosion. Further for equipment wherein finish coat is to be applied at site, site to ensure that equipment is received with primer coat applied.
6. It shall be ensured by periodic inspection that plastic inserts are intact in tapped holes, wherever applicable.
7. Pipes shall be blown with air periodically and it shall be ensured that there is no obstruction.
8. Silica gel or approved equivalent moisture absorbing material in small cotton bags shall be placed and tied at various points on the equipment, wherever necessary.
9. Heavy rotating parts in assembled conditions shall be periodically rotated to prevent corrosion/jamming due to prolonged storage.

10. All the electrical equipment such as motors, generators, etc. shall be tested for insulation resistance at least once in three months and a record of such measured insulation values shall be maintained.

11. Following preservatives/preservation methods can be used depending upon type of equipment

    a. Rust preventive fluid (RPF)

    b. Rust protective paints

    c. Tarpaulin covers, in case of outdoor storage

    d. De-oxy aluminate for weld-ments

c) **GENERAL INSPECTION REQUIREMENTS**

1. Period inspection of materials with specific reference to –

   - Ingress of moisture and corrosion damages.
   - Damage to protective coating.
   - Open ends in pipes, vessels and equipment -
     - In case any open ends are noticed, same shall be capped.

2. Any damages to equipment / materials.

   - In case of any damages, these shall be promptly notified and in all cases, the repairs / rectification shall be carried out.
   - Any items found damaged or not suitable as per project requirements shall be removed from site. If required to store temporarily, they shall be clearly marked and stored separately to prevent any inadvertent use.

4. TYPE OF STORAGE FOR VARIOUS EQUIPMENT

The types of storage are broadly classified under the following heads:

i **Closed storage with dry and dust free atmosphere**. (C)

The closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated asbestos sheets / galvanised iron sheets for roofing. Brick walls / asbestos sheets can be used to cover all the sides. The floor of the shed can be finished with plain cement concrete suitably glazed. The shed shall be provided with proper ventilation and illumination.

ii **Semi-closed storage**. (S)

The semi closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated / asbestos sheets for roofing. The floor shall be brick paved. If required a small portion of sides can be covered to protect components from rainwater splashing onto the components.

iii Open storage (O)

The open yard shall be levelled, well consolidated to achieve raised ground with the provision of feeder roads for crane approach along with access roads running all sides. One part of the open yard shall be stone pitched, levelled and consolidated with raised ground suitable for storing / stacking heavier and critical components with due space to handle them by cranes etc . Adequate number of sleepers, concrete block etc. to be provided to make raised platforms to stack critical materials.

A separate yard to be identified as "scrap yard" slightly away from main open yard to store wooden/steel scraps, which are to be disposed off. This is required to avoid mix up with regular components as well as to avoid fire hazard.

Some of the components, which are having both machined & un-machined surfaces and are bulky, shall be stored in open storage area on a raised ground and suitably covered with water proof / fire retardant tarpaulin.

The equipment listed below shall be stored and inspected as per requirement mentioned in the table below.

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
Raw material /mechanical items like pipes, plates, structure sections etc.)				
1.	Steel pipes (lined/unlined)	S	Damage , paint, corrosion, rubber lining peeling	Provide end cap
2.	MS Plates	S	Damage, paint, corrosion	
3.	SS Plates	S	Damage	
4.	Non-metallic pipes	S	Damage, cracks	Provide end cap
5.	Stainless steel pipes	S	Damage ,	Provide end cap
6.	MS sections, beams	S	Damage, paint, corrosion	
7.	Cable trays	S	Damage, condition of preservations	
8.	Insulation sheets	S	Damage	
9.	Insulation	C	Damage, packing	
10.	Hangers Rods	S	Damage, paint, packing	
11.	Tubes	S	Damage, paint , packing	Provide end cap
12.	Hume pipes	O	Damage	
13.	Castings	O	Damage, paint, corrosion	
Fabricated mechanical items (pressure vessels, tanks etc.)				
14.	Pressure vessels (unlined)	O	Damage, paint, corrosion,	Covered nozzles
15.	Atmospheric storage tanks (unlined)	O	Damage, paint, corrosion	Covered nozzles

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
16.	Pressure vessels (lined)	S	Damage, paint, corrosion, rubber lining	
17.	Atmospheric storage tanks(lined)	S	Damage, paint, corrosion, rubber lining	
18.	Support structures	O	Damage , paint, corrosion	
19.	Flanges	C	Damage , paint, corrosion	
20.	Fabricated pipes	S	Damage , paint, corrosion	Provide end cap
21.	Vessels internals	C	Damage , paint, corrosion ,packing	
22.	Grills	S	Damage , paint, corrosion	
23.	Angles	S	Damage , paint, corrosion	
24.	Bridge mechanism/clarifier mechanism	O	Damage , paint, corrosion	
25.	Cranes, rails	S	Damage , paint, corrosion	
26.	Stair cases	O	Damage , paint, corrosion	
27.	Ladders/handrails	O	Damage , paint, corrosion	
28.	Fabricated ducts	S	Damage , paint, corrosion	
29.	Isolation Gates	O	Damage , paint, corrosion	
30.	Fabricated boxes/panels	S	Damage , paint, corrosion	
Mechanical components like valves, fittings, cables glands, spares etc.)				
31.	Valves	S	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
32.	Fittings	S	Damage , packing	Provide end cap
33.	Cable glands	C	Damage , packing	
34.	Tools & tackles	C	Damage , packing	
35.	Nut , bolts, washers,	C	Damage , packing	
36.	Gasket & Packings	C	Damage , packing	
37.	Copper tubes	C	Damage , packing, corrosion	Provide end cap
38.	SS tubing	C	Damage , packing	Provide end cap
Rotating assemblies (pumps, blowers, stirrers, fans, compressors etc.)				
39.	Pumps	S	Damage , packing, corrosion	Shaft rotation
40.	Blowers/Compressors	S	Damage , packing, corrosion	Shaft rotation
41.	Agitators/stirrers/radial launders	C	Damage , packing, corrosion	Shaft rotation
42.	Rollers for chlorine tonner mounting	C	Damage , packing, corrosion	
43.	Centrifuge	S	Damage , packing,	
44.	Gear box	C	Damage , packing, corrosion	
45.	Bearings	C	Damage , packing, corrosion	
46.	Fans	S	Damage , packing, corrosion	
47.	Dosing skids	S	Damage , packing, corrosion	
48.	Pump assemblies	S	Damage , packing, corrosion	
49.	Air washers(INTERNALS)	S	Damage , packing	
50.	Air conditioners (split)	C	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
51.	Elevators(CONTAINERIZED)	O	Damage , packing, corrosion	
52.	Chillers/VA machines	S	Damage , packing	
53.	Air handling Unit/Package unit	S	Damage , packing	
54.	Chlorinators & Evaporators	C	Damage , packing	
55.	Ejectors	C	Damage , packing	
56.	Electrolyser	C	Damage , packing	
Miscellaneous items like chain pulley blocks, hoists etc.				
57.	Chain pulley blocks	S	Damage, Packing	
58.	Electric hoists	S	Damage, Packing	
59.	Fire extinguishers	C	Damage, expiry date	
60.	Fork Lift Truck	S	Damage, Packing	
61.	Hydraulic Mobile Crane	O	Damage, Packing	
62.	Mobile Pick Up & Carry Crane	O	Damage, Packing	
63.	Motor boats	O	Damage, Packing	
64.	Safety showers	S	Damage, Packing	
65.	Diffusers/dampers	S	Damage, Packing	
Chemicals and consumables (acid, alkali, paints, oils, reagents and special chemicals)				
66.	Hydro Chloric Acid (HCl)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical
67.	Sulphuric acid (H_2SO_4)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
68.	Sodium hydroxide (NaOH)	Store in canes/ storage tank in dyke area	Date of production/ leakage/ fumes/ breather	hazardous chemical ,breather to be checked for air ingress
69.	Sodium hypo chlorite	To be stored under shed	Date of production/ leakage/ fumes	hazardous chemical ,self-life normally 15-30 days after which strength of chemical decays
70.	Ammonia	S	Date of production/ leakage/ fumes	Store in closed storage tanks, hazardous chemical
71.	CW treatment chemicals	S	Date of production , Self-life	Store in closed canes
72.	RO/UF cleaning chemicals	S	Date of production , Self-life	Store in closed canes
73.	Lime	C	Damage to packing , seepage	Prevent moisture, rain
74.	Alum bricks	C	Damage to packing	Prevent moisture, rain
75.	Poly electrolyte	S		Store in closed storage tanks
76.	Laboratory chemicals(powder)	C	Damage, Packing self-life	
77.	Laboratory chemicals(liquid)	C	Damage, Packing self-life	
78.	Lubrication oils	C	Leakage	
79.	Paints	S	Leakage ,air tightness	
80.	Sand	O	Damage of packing	No hooks
81.	Salt (NaCl)	C	Damage of packing, water ingress	Prevent moisture, rain
82.	Anthracite	S	Damage of packing	
83.	Activated carbon	S	Damage of packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
84.	Thermal insulation	S	Damage of packing	
85.	Cement	C	Damage of packing	Prevent moisture, rain
86.	Gravels	O	Damage of packing	
87.	ION exchange resins	C	Damage , packing	Refer manufacturer guidelines
88.	RO membranes	C	Damage , packing	Refer manufacturer guidelines
89.	UF membranes	C	Damage , packing	Refer manufacturer guidelines
90.	Cleaning chemicals	C	Damage , packing	Refer manufacturer guidelines
91.	Chemicals for analysers/calibration	C	Damage , packing	Refer manufacturer guidelines
Electrical and C & I items (motors, cables etc.)				
92.	Motors	C	Damage , packing	
93.	Cable drums	O	Damage	
94.	Control Panel /control desk, UPS ,JB	S	Damage, Packing	
95.	Instruments(gauges/analysers)	C	Damage	
Special items		As per Manufacturer's item, like Hydrogen cylinders, Ozonator, Analyser, Chlorine dioxide generators etc.		

5. CONCLUSION

Concerned storage agency at site should make sure that loss in equipment performance and wear & tear are minimised through proper storage and preservation. The above are broad guidelines and cover major equipment / materials. However specific storage practices shall be followed as per manufacturer recommendation. All the necessary measures even in addition to the ones mentioned above, if found necessary, should be taken to achieve the objective.

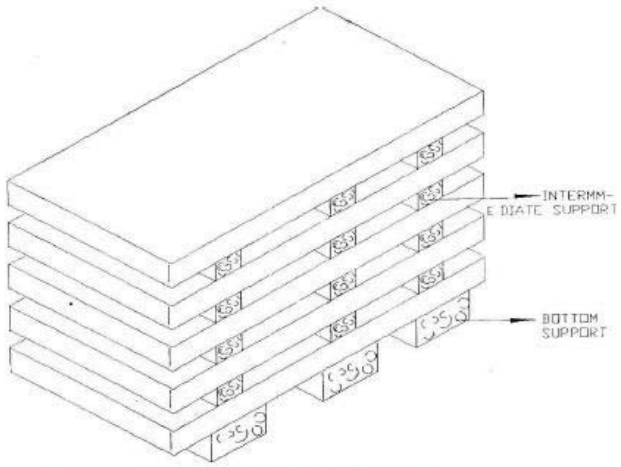

Figure – 1 – PLATE STACKING ARRANGEMENT

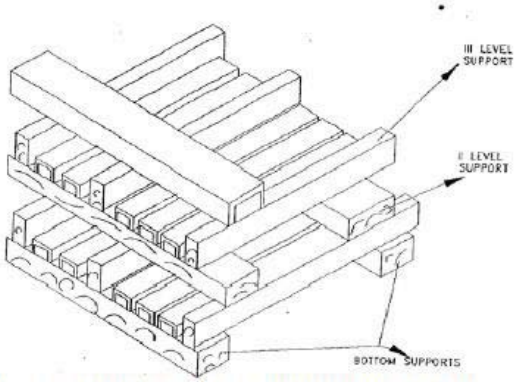

Figure – 2 – STRUCTURAL STEEL STACKING ARRANGEMENT

ANNEXURE - XII

GENERAL TECHNICAL REQUIREMENTS (GTR)

SECTION-V

GENERAL TECHNICAL REQUIREMENTS

1.00.00 CODES AND STANDARDS

1.01.00 Except where otherwise specified, the Plant shall comply with the appropriate Indian Standard or an agreed internationally accepted Standard Specification as listed in the annexure to this Section and mentioned in detailed specifications, each incorporating the latest revisions at the time of tendering. Where no internationally accepted standard is applicable, the Bidder shall give all particulars and details as necessary; to enable the Owner to identify all of the Plant in the same detail as would be possible had there been a Standard Specification.

1.02.00 Where the Bidder proposes alternative codes or standards he shall include in his tender one copy (in English) of each Standard Specification to which materials offered shall comply. In such case, the adopted alternative standard shall be equivalent or superior to the standards mentioned in the specification.

1.03.00 Wherever specified or required the Plant shall conform to various statutory regulations such as Indian Boiler Regulations, Indian Electricity Rules, Indian Explosives Act, Factories Act etc. Wherever required, approval for the plant supplied under the specification from statutory authorities shall be the responsibility of the Successful Bidder.

1.04.00 In the event of any conflict between the codes and standards referred above, and the requirements of this specification, the requirements, which are more stringent, shall govern.

1.05.00 In case of any change of code, standards and regulations between the date of purchase order and the date the Successful Bidder proceeds with manufacturing the Owner shall have the option to incorporate the changed requirements. It shall be the responsibility of the Successful Bidder to advise Owner of the resulting effect.

2.00.00 RESPONSIBILITY FOR DESIGN

2.01.00 The Bidder shall assume full responsibility for the design of the whole and every portion of the Plant, whether or not the design work was undertaken specifically in relation to the Contract and whether or not the Successful Bidder was directly involved in the design work.

2.02.00 Notwithstanding the Owner's wish to receive the benefits of new, advanced and improved technologies, a prime requirement is that all the systems and components proposed shall have been already adequately developed and shall have demonstrated good reliability under similar, or more arduous conditions elsewhere, at least for continuous 2 years in two different power station.

2.03.00 The Bidder shall carry out optimization studies for selection of pipe size and equipment wherever required. The result of such studies shall be included as part of bid proposal.

The successful Bidder shall have to carry out surge analysis and other transient condition studies as may be necessary and as required by the Owner as per proven engineering practice.

2.04.00 The Bid shall include a detailed discussion on the development status of and the reasons for any changes made in proposed systems or components for the Plant, as compared with similar items previously supplied in other installations cited by the bidder as reference plants.

2.05.00 The Bidder may also make alternate offers, provided such offers are superior in his opinion in which case adequate technical information, operating feedback, etc. are to be enclosed with the offer, to enable the Owner to assess the superiority and reliability of the alternatives offered. In case of each alternative offer, its implications on the performance, guaranteed efficiency, auxiliary power consumptions, etc. shall be clearly brought out to the Owner to make an overall assessment. In any case, the base offer shall necessarily be in line with the specifications i.e. Base offer shall be as per the technical specifications and the same will be considered for techno-commercial evaluation.

3.00.00 **NAME PLATES (RATING PLATES)**

3.01.00 Instruction plates, nameplates or labels shall be permanently attached to each main and auxiliary item of plant in a conspicuous position. These plates shall be engraved with the identifying name, type and manufacturers serial number, together with the loading conditions under which the item of plant has been designed to operate.

3.02.00 Items such as valves, etc. which are subject to hand operation, shall be provided with nameplates so constructed as to remain clearly legible throughout the life of the plant giving due consideration to the difficult climatic conditions to be encountered. Nameplates shall be securely mounted where they will not be obscured in service by insulation, cladding, actuators or other equipment. Direction of flow is also to be engraved.

3.03.00 All trade nameplates and labels shall be in English language. All measurements shall be in M.K.S. Units.

3.04.00 The size and location of nameplates shall be subject to Approval of the Owner/Owner's Engineer.

4.00.00 **SAFETY AND SECURITY**

4.01.00 The design shall incorporate every reasonable precaution and provision for the safety of all personnel and for the safety and security of all persons and property. The design shall comply with all appropriate statutory regulations relating to safety. All structures and equipment shall be designed and constructed to withstand every foreseeable static and dynamic loading condition, including loading under earthquake conditions, with an adequate margin of safety.

4.02.00 Ready and safe access with clear headroom shall be provided to all parts of the plant for operation, inspection, cleaning and maintenance.

4.03.00 Escape routes and clear ways shall be provided to allow speedy evacuation of the plant in the event of fire or explosion, and the plant layout shall allow for ease of access to all parts of the Works by rescue and fire fighting teams. The Plant layout shall be designed to localize and minimise the effects of any fire or explosion. The recommendations of NFPA, OSHA, and TAC etc. as necessary shall be followed in all respects.

4.04.00 The use of corrosive, explosive, toxic or otherwise hazardous materials shall be kept to a minimum during construction and the design of the plant shall minimise the requirement for such materials during operation and maintenance. Where such materials must be used, all necessary precautions shall be taken in the design, manufacture and layout of equipment to minimise the resulting hazard, and all equipment necessary for the protection and first-aid treatment of personnel in the event of accidents shall be provided. Particular attention is drawn to avoid the use of materials containing asbestos in any form.

5.00.00 **GUARDS**

5.01.00 Effective guards and fences must be provided to prevent injury to operators through accident or malpractice.

5.02.00 Mesh guards which allow visual inspection of equipment with the guard in place are generally preferable. The guards shall be constructed of mesh attached to a rigid framework of mild steel rod, tube, or angle and the whole galvanised to prevent loss of strength by rusting or corrosion. The guards shall be designed to facilitate removal and replacement during maintenance.

5.03.00 All drive belts, couplings, gears, sharp metallic edges and chains must be safely guarded. Any lubricating nipple requiring attention during normal running must be positioned where they can be reached without moving the guards.

5.04.00 Guards for couplings and rotating shafts shall be in accordance with BS 5304-1975 or similar approved standard. All rotating shafts and parts of shafts must be covered.

5.05.00 Suitable fencing shall be provided to enclose all openings or doorways used for the hoisting and lowering of machinery etc. This fencing must be securely fixed but quickly detachable when required. A secure handhold must be provided on each side of the opening or doorway.

6.00.00 **LOCATION AND LAYOUT REQUIREMENTS**

The majority of plant and equipment shall all be of indoor installation. A broad list of buildings housing such equipment is given In Vol-II-G2 Section I. Layout shall facilitate access for operation-maintenance and inspection of any one or more equipment/components at a time without disturbing the operation or installation of rest of the plant. Further, Bidder should comply with the criteria given under the various equipment and system specifications as well as those stipulated in Annexure-II attached to this section.

Enclosed General Layout and other tender layout drawings enclosed in Vol-II-L show the location of major installations and auxiliary buildings. The Bidder