

**BOKARO POWER SUPPLY COMPANY LTD.
BOKARO STEEL CITY**

**INSTALLATION OF SIDE STREAM FILTRATION SYSTEM
IN COOLING WATER CIRCUIT OF RCPH**

TENDER SPECIFICATION



**STEEL AUTHORITY OF INDIA LIMITED
CENTRE FOR ENGINEERING & TECHNOLOGY
RANCHI**

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CET/23/RN/4060/TS/UT/01/R=0

CONTENTS - CHAPTERS

Chapter no.	Description	Page no.
1.	Introduction	1.1
2.	Scope of Work	2.1 – 2.11
3.	Technical Specifications	3.1 – 3.36
4.	Performance Guarantee	4.1 – 4.2
5.	Special Instructions to Bidders	5.1 – 5.3
	Annexures	
	Schedules	
	Drawings	

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CONTENTS – ANNEXURES

Annexure - No.	Description	No. of pages
2.1.13-1	List of Acceptable Makes of Equipment & Supplies	29

CONTENTS – SCHEDULES

Schedule- No.	Description	No. of pages
2.1.2-1	Declaration for Site Visit	1
2.1.6-1	List of Recommended Spares for two years Operation and Maintenance	1
2.1.8-1	List of Consumables	1
2.1.9-1	List of Initial Fill	1
2.1.10-1	List of Special Tools and Tackles	1
2.1.11-1	List of Exclusions	1
2.1.11-2	List of Deviations	1

CONTENTS - DRAWINGS

S. No.	Drawing No.	Description
1	CET RN 4060 UT2 00 001, R=0	Proposed Layout of Filtration System in Recirculating Water Circuit
2	CET RN 4060 UT2 00 002, R=0	Proposed Location of Filtration System in Recirculating Water Circuit

1.0 INTRODUCTION

1.1 Bokaro Power Supply Company Limited (BPSCL) is located in the premises of Bokaro Steel Limited (BSL) of Steel Authority of India Limited (SAIL) at Bokaro Steel City, in the heart of coal belt region of Jharkhand.

1.2 BPSCL is a JV company of SAIL and DVC and has an aggregate installed capacity to generate 338 MW of power besides 2180 tph steam.

1.3 BPSCL is having a Re-circulating Pump House (RCPH) for supplying cooling water to condensers of its TG unit nos. 6, 7 & 8. The recirculating cooling water volume is 30000 m³/h capacity. The total system make-up requirement is around 500 m³/h, which is met from pump house no. 1 of BSL. Presently, there is no filtration system in the recirculating cooling water circuit.

1.4 BPSCL is facing problem of frequent condenser tube choking of its TG units. This in turn results in low vacuum generation in condensers impacting steam consumption / MW generation and decreases efficiency. This necessitates frequent cleaning of the condenser tubes by high pressure jet cleaning increasing turbine downtime.

Due to increased concentration of total suspended solids (TSS), deposits are formed in seats of the isolation valves in the circuit thus creating improper valve operation during isolation. Also, the nozzles in the cooling towers get choked affecting its performance.

Accordingly, it is proposed to install a filtration system in the recirculating cooling water circuit at RCPH on **turn-key basis**.

1.5 INTENT OF SPECIFICATION

1.5.1 The intent of this Tender Specification is to furnish required details for enabling the Bidder to submit their best offers (technical & techno-commercial) for “Installation of Filtration System in RCPH Cooling Water Circuit”, as per the scope of work mentioned at Chapter 2.0, technical specifications at Chapter 3.0, performance guarantee at Chapter 4.0 and special instructions to Bidder at Chapter 5.0.

1.5.2 This Tender Specification shall be read in conjunction with Standard Bidding Document (SBD) along with other documents enclosed with the Tender.

2.0 SCOPE OF WORK

2.1 GENERAL

2.1.1 The scope of work for this package shall cover design, engineering, preparation of fabrication / erection drawings, fabrication, manufacturing / procurement, inspection, supply and transportation of plant and equipment to site, dismantling, necessary insurance, handling, painting, erection, testing, commissioning and performance guarantee test for mechanical, electrical, structural, civil and instrumentation & automation areas of the project including all auxiliaries, technological structures, electrics etc. as elaborated in the subsequent clauses to be executed on **Turnkey basis**.

2.1.2 The Bidder shall survey the site, study available drawings / documents and discuss with the Employer/ Consultant, if required, regarding any further technical clarification and satisfy himself with respect to the nature and extent of work involved. The Bidder shall also obtain first hand information regarding location, work terrain, climatic condition, railways, roads, airports, communication etc. The Bidder shall confirm the visit to the site by filling the **Schedule-2.1.2-1**.

2.1.3 The Successful Bidder shall submit drawings / documents for approval and reference of the Employer / Consultant as detailed in subsequent clauses. Engineering meetings are to be routinely held every 2 to 4 weeks for clearing of drawings across the table for sorting out issues between the Contractor/Vendor, plant and CET. These regular meetings are to be held during the entire engineering phase of a project.

2.1.4 The technical specifications covering the details of equipment and drawings of this specification shall be taken for the purpose of tendering and basic design concept and shall not be taken as final and firm for the completion of the project. However, rated capacity of different equipment including other technical parameters shall be as per TS. In the event, ratings of machine furnished in the TS are not falling in the standard product range of the manufacturer, next higher size of machine shall be offered.

2.1.5 Any item / services, which might not have been specifically mentioned in this document but are necessary for the design, engineering, erection, successful commissioning, performance guarantee and/ or completeness of the work, shall be provided by the Bidder without any extra cost to the Employer and within the time schedule.

2.1.6 Spares, Consumables

The Bidder shall furnish item wise list of spares for two years normal operation & maintenance of the offered equipment as per **Schedule- 2.1.6-1**. Price of such spares shall be quoted separately.

2.1.7 Commissioning Spares

The Bidder shall, within the Contract Price, supply adequate commissioning spares required during start up and commissioning along with the plant & equipment

2.1.8 Consumables



The Bidder shall confirm supply of all consumables required for erection, testing and successful commissioning of the system. List shall be furnished as per **Schedule- 2.1.8-1**.

2.1.9 **Initial Fill**

The Bidder shall confirm the supply of all initial fill required for the equipment supplied for successful commissioning of the equipment. The Bidder shall also furnish information with respect to initial fill as per **Schedule- 2.1.9-1**.

2.1.10 **Special Tools & Tackles**

The Bidder shall confirm the supply of all special tools and tackles required for operation and maintenance of the equipment. List of special tools and tackles for the operation and maintenance of the equipment shall be furnished as per **Schedule- 2.1.10-1**.

2.1.11 **Exclusions & Deviations**

Exclusions as well as deviations from the Tender Specification, if any, shall be clearly stated under separate heads marked as “List of Exclusions” as per **Schedule- 2.1.11-1** and “List of Deviations” as per **Schedule- 2.1.11-2** respectively quoting the index and serial reference of Tender Specification.

2.1.12 Any statutory approval, wherever required, shall be taken by the Successful Bidder for the equipment being supplied by them from relevant state / central authorities.

2.1.13 All bought out items shall be procured from the manufacturers as per the “List of Acceptable Makes of Equipment & Supplies” furnished in the **Annexure- 2.1.13-1** of this document. For items not listed in this, prior approval from Employer / Consultant shall be taken before order placement.

2.2 **MECHANICAL & UTILITIES**

The scope of work for the Bidder regarding mechanical and utility works consists of the following facilities/equipment:

2.2.1 Tapping of return water from the existing 2 nos DN 1800 headers alongwith isolation valves and laying of supply water header to filters.

2.2.2 Supply and installation of automatic backwash valve less gravity type filters (NW+1S) alongwith all piping, valves, fittings, accessories and instrumentation.

2.2.3 Construction of civil drain pits and drain channel from the backwash outlet of the filters to existing nearest drain line in the area.

2.2.4 Supply and laying of filtered water pipeline to existing 2 nos. sumps of RCPH alongwith isolation valves.

2.2.5 Clearing of site before and after completion of work.

2.2.6 The proposed layout and location of side stream filtration system are shown in **Drg. Nos. CET RN 4060 UT2 00 001 and CET RN 4060 UT2 00 001**.

2.3 **ELECTRICAL**

2.3.1 The scope of work of the Bidder shall cover the following:

- Tapping of power from existing lighting distribution board with new, 415

V, 3 phase LT cable.

- Provision of 1 no. new SLDB.
- Area illumination through pole mounted 250 W HPSV lamps.
- Earthing system.

2.3.2 **BATTERY LIMIT**

The scope of work for electrical system under this Tender Specification starts with tapping of power supply from LT substation transformer approx. 100 m from electrical room.

Onward scope of work for power supply, distribution, cabling, earthing as explained in the various clauses of this TS shall be within the scope of work of the Bidder.

2.4 **INSTRUMENTATION & AUTOMATION**

2.4.1 The scope of work for Instrumentation & Control System shall include design & engineering, manufacture & procurement, assembly, inspection, supply, transportation to site, unloading, storage, insurance, handling, calibration, erection, testing, trial run and commissioning of the Instrumentation & control systems along with all associated equipment and facilities within battery limit in a fully coordinated & integrated manner on turnkey basis.

2.4.2 The system will be provided with latest Instrumentation & Control system adequate for efficient monitoring of the process parameter.

2.4.3 Minor civil works such as chipping / cutting of floor for making grooves or laying pipes / cables, making holes / openings through walls, ceilings or floors, drilling of holes through steel structures and frames, grouting of frames, hooks on walls / ceiling etc. required for execution of work shall be included in the scope. After erection the surfaces shall be made good by plastering / painting to their original shapes and finish.

2.4.4 The scope of engineering, supply, erection, testing, commissioning, etc. shall include but not limited to the following:

- 1) The instrumentation & Control system will be field mounted system consisting of pressure gauge, DP pressure transmitter, digital indicator and flow meter/flow transmitter. All digital display shall be installed in wall mounted panel located at pump house preferably
- 2) Provision of required power supply for instrumentation & Control system shall be in the scope of bidder. Purchaser shall only provide suitable feeder.
- 3) Power and control cables (FRLS), cable laying accessories like trays, G.I. protection pipes, supporting structures, clamps and other cable laying accessories, identification ferrules, etc.
- 4) Supply, laying and termination of all cables. The Bidder shall include in his scope, any excavation work required for laying of cables, etc. All cables shall be of FRLS grade.

- 5) Provision of maintenance platforms with suitable approach / approach ladder for all instruments / sensors / tapping points, etc., at inaccessible locations.
- 6) System engineering, configuration complete with detailed engineering, drawing preparation and documentation.
- 7) Erection, testing, calibration and commissioning of overall instrumentation & Control system, handing over of the same to the satisfaction of plant after successful guarantee tests, PAT and FAT. Successful Bidder shall arrange tools, tackles, and consumables as may be required for erection, testing, calibration and commissioning activities.
- 8) Arrangement of and participation in inspection of Instrumentation & Control equipment with Purchaser (if required). Inspection and Testing shall be carried out in compliance with Quality Assurance Plans, to be approved during detail engineering stage.
- 9) Insurance spares, commissioning spares, etc., required during commissioning.
- 10) List of two years maintenance spares.
- 11) List of commissioning spares and consumables..

2.4.5 The Bidder shall submit along with the tender the drawings/ documents/ data as per the following details:

- 1) List of measurements & Schedule of quantity of equipment
- 2) Technical literature, Catalogues, application note, etc., for all items.

2.5 **CIVIL**

2.5.1 **General**

The scope of work for the Bidder covers design, engineering, supply of labour & materials, transportation, construction and commissioning of the civil engineering works detailed under the clauses below, complete on **Turnkey Basis**.

2.5.1.1 The following are major civil engineering jobs pertaining to the project:

- a) Construction of RCC foundations for the equipments as per technology and process requirement.
- b) Construction of RCC supports for water pipelines.
- c) Construction of RCC supports for structural walkovers, platforms etc as per technology, process and serviceability requirement.
- d) Construction of floor around the filters as per technology, process & serviceability requirement.
- e) Providing Adequate drainage facility for the area
- f) Protection of nearby existing underground and over ground units and structures

- g) Dismantling of exiting floor and making good the same to its original condition, as per requirement.
- h) Other Miscellaneous jobs like dismantling of RCC / PCC / Brickwork at various places, excavation in earth and cleaning etc., as per requirement.
- 2.5.2 The scope also includes necessary geodetic surveying work for transferring reference lines & bench marks from the established reference lines and bench marks inside the plant & fixing the same to the location of proposed works to facilitate set up of layout. Further, construction / erection works shall also be part of the scope.
- 2.5.3 The scope of work will also include sampling & testing of construction material on the specimens taken during execution of the work. The testing shall be performed by a separate agency, approved by the Purchaser and the cost towards the same shall be borne by the successful Bidder.
- 2.5.4 During the course of execution of the job, transportation of dismantled serviceable items to the designated storage area, as per the instructions of the site engineer, will also be under the scope of work. Further, the transportation and disposal of dismantled waste materials and debris up to a distance of 1 km, as per the instructions of the site engineer will also be under the scope of work.
- 2.5.5 The bidder shall be responsible for protection and diversion of all existing underground services, wherever required and / or diversion of the underground services which are indicated in the drawings made available to the bidder. In case there are underground services which need to be protected and / or diverted but are not shown in the drawing, the bidder shall be responsible to execute the same at extra price, if any, to be mutually agreed in advance between the bidder and the employer.
- 2.5.6 Temporary approach road, site office, cement & other construction material storage go-downs and fabrication yard for reinforcement, inserts etc. shall be constructed by the successful Bidder at his cost. Only land area will be shown by Purchaser.

2.6 SCOPE OF SERVICES

2.6.1 Scope of work shall also include the following services, from issue of Letter of Acceptance (LOA) up to installation and commissioning of the project:

- 1) Design, Engineering and supply of drawings, documents including pipes, cables etc. and getting Purchaser's approval. Approval of drawings by Purchaser / Consultant shall not relieve the Supplier of his contractual obligation and responsibility for correct engineering, design, workmanship and materials.

All necessary site measurements and study of available existing drawings as may be required for developing the aforesaid design and drawings shall also be deemed to be under the Scope of the Successful Bidder. The available existing drawings are to be collected from the Purchaser.

- 2) Liaisoning with local authorities and government bodies and getting all statutory approval from statutory authority as per requirement. However, necessary fees and assistance shall be given by BPSCL.



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- 3) Shop testing, shop painting, pre shipment inspection. To offer the equipment to Purchaser or his authorized representative for inspection before shipment from the shop. To provide all the material test certificate, inspection reports.
- 4) To take necessary safety clearance from plant authorities / government bodies before starting of erection work.
- 5) Two coats of final painting.
- 6) All packing & transportation.
- 7) Storage and handling at site.
- 8) Erection.
- 9) Final painting at site.
- 10) Testing and Commissioning.
- 11) Performance guarantee test.
- 12) Administering first fill of oils/lubricants/coolant and thereafter another fill of oil/lubricants/coolant after commissioning /PG Test.

2.6.2 The Successful Bidder shall have to provide his own personnel, labour, equipment, consumables, tools & tackles for timely implementation of the job. He has to arrange for any statutory approval, if required, from Governmental Agencies.

2.6.3 The Successful Bidder shall arrange on-site training for Employers' personnel in Operation and Maintenance of the system in 2 batches (minimum 10 persons / batch) for one day each before handing over the system to the Employer. Successful Bidder shall provide adequate training manuals, handouts, etc., to each participant.

2.7 **GENERAL WORKS**

2.7.1 Supply and application of all paints, primers and finish paints to the equipment and other services as per IS 5:2007.

2.7.2 Conducting performance guarantee tests to establish the operating parameters for the individual equipment and in combination.

2.7.3 Any rectification / modification required for interface work during erection of equipment / technological structures shall be within the scope of work of the Bidder.

2.7.4 Supply of all holding down bolts and nuts for all equipment, blank plates, hangers, etc. and other services.

2.7.5 Supply of all other fasteners, washers, screws, packing plates, machined packing plates, shims, etc. required for fabrication and erection.

2.7.6 Supply of all erection consumables like oil, kerosene, cotton waste, oxygen and acetylene gas cylinders, electrodes, asbestos sheets, asbestos ropes, sealing compounds, etc.

2.7.7 Loading and unloading of equipment at site, storage, transportation, erection of all items including connecting up and completion at site including supervision, labour, materials, consumables, construction equipment and tools.

2.8 REQUIREMENT OF DRAWINGS AND TECHNICAL DOCUMENT

2.8.1 Following drawings/ data/ documents shall be submitted in 10 (ten) copies and in soft to the Employer for approval / reference by the Successful Bidder after placement of order and prior to commencement of manufacturing /fabrication:

- 1) General arrangement drawing showing sections of equipment and systems with overall dimension along with valves, drives and other items as applicable.
- 2) Detailed Drawings/ calculations / technical specifications/ data sheets/ characteristic curves of important components / equipment, weight and mounting arrangement of equipment, equipment with part list, safety interlocks, etc.
- 3) Equipment schedule with Billing Schedule.
- 4) Manufacturer's technical catalogues.
- 5) Test & calibration certificates for individual equipment.
- 6) Operation, Instruction & Maintenance Manuals, etc.

2.8.2 In addition to the above, the Employer reserve the right to insist on submission of calculation/ drawings/ data of any item as required.

2.8.3 General arrangement drawings shall be submitted for approval. The Bidder shall not make any change in the approved design/drawings without the prior approval of the Employer.

2.8.4 The Bidder shall prepare fabrication/manufacturing drawings based on approved design drawings by the Employer or its authorized representatives.

2.8.5 The fabrication, supply, testing, inspection and erection shall be carried out only in accordance with the drawings / details finally approved by the Employer.

2.8.6 Existing available drawings shall be collected by the Bidder from plant archives after taking necessary permissions from competent authorities of plant.

2.8.7 If required, across table discussion and clearance of drawings shall be done at CET Ranchi.

2.9 QUALITY ASSURANCE

2.9.1 The Bidder shall furnish a Quality Assurance Plan (QAP) both in respect of site work as well as manufacture of equipment, which he proposes to follow for the purpose of ensuring the quality of equipment and workmanship at various stages.

2.9.2 The QAP shall include details of all tests proposed during manufacturing, assembly at works & at site and after erection for all offered items. QAP shall be approved by the Employer.



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2.10 INSPECTION AND TESTING

2.10.1 Inspection and testing of all offered items shall be in the scope of the Successful Bidder and shall be carried out as detailed in subsequent clauses of this TS/ approved QAP.

2.10.2 Erection & Site Testing

2.10.2.1 Successful Bidder shall submit a detail site erection plan along with checklist for approval by the Employer. The site erection plan should clearly spell out the duration of shutdown, if required, for erection and commissioning of equipment.

2.10.2.2 The successful Bidder shall have to arrange all tools, tackles, instruments, accessories, etc. and qualified personnel required for erection and testing.

2.10.2.3 The successful Bidder shall take note of the working conditions, practices and arrangements prevailing in the area. The erection work shall be carried out in such a manner that normal operation of the shop/unit is not hampered.

2.10.2.4 After erection, the storage room, if any, constructed during erection by the successful Bidder in the premises of plant shall be removed and the place shall be left clean.

2.10.2.5 Site Testing

Bidder shall furnish all procedures & details of tests to be carried out at site, which are necessary for testing and successful commissioning of the equipment after installation. Special tools and accessories if any required, for these tests shall be indicated and provided by the successful Bidder

2.10.3 Preliminary Acceptance Test (PAT)

2.10.3.1 As soon as the erection of section of plants / equipment / machineries is completed with auxiliary facilities the successful Bidder shall conduct trial runs for individual equipment / units to prove that the facilities have been supplied and erected as per contract and after erection, facilities are fit for start-up and commissioning.

2.10.3.2 The successful Bidder shall then give notice for Preliminary Acceptance Test (PAT) to the Employer and the Employer jointly with the Bidder's representative shall proceed with the preliminary acceptance tests. The successful Bidder shall carry out Preliminary Acceptance Test on the system as per standard test procedures to establish functioning of the system as whole and independent equipment as part of the system.

2.10.3.3 Acceptance test shall include testing of the system in no-load condition and all other tests as necessary to avoid any failure in the operation of the system, during integrated mode of trial run and commissioning.

2.10.3.4 Employer shall issue the Preliminary Acceptance Certificate (PAC) after completion of above tests. In case of any defects / deficiencies arising during PAT, the same shall be complied by the Bidder within a jointly agreed time frame, before issue of PAC.

2.10.4 System Commissioning

2.10.4.1 After the issue of PAC, the successful Bidder shall start up and commission the installed facilities. The successful Bidder shall give a notice to the Employer in

this regard. System commissioning shall be carried out during 3 consecutive general shifts in the plant/office.

- 2.10.4.2 The successful Bidder shall actively participate in all commissioning activities by providing necessary manpower to ensure reliable and trouble free performance of the system supplied by him.
- 2.10.4.3 The system shall be considered successfully commissioned when trouble free performance of the system in integrated mode under load condition is established during entire commissioning period. During operations of the equipment at no load and at load, performance of all the drive shall be checked in respect of current drawn by the motors, vibrations, noise, etc. with respective rated values. During the test, the entire system shall be checked for dimensional accuracy, workmanship and alignment.
- 2.10.4.4 In case of any defects / deficiencies arising in system during commissioning, the same shall be successfully complied by the Bidder within a jointly agreed time frame.
- 2.10.4.5 If during the test runs, there is an interruption exceeding 2 hours due to any cause other than power failure, the commissioning activities shall be discontinued and fresh date for system commissioning shall be decided mutually by both the parties.
- 2.10.4.6 Employer shall issue the Commissioning Certificate after successful completion of above tests. In case of any defects / deficiencies arising during commissioning, the same shall be successfully complied by the Bidder within a jointly agreed time frame, before issue of Commissioning Certificate.
- 2.10.5 **Performance Guarantee (P.G) Test**
P.G. Test shall be conducted as detailed in Chapter 4.0
- 2.10.6 **Final Acceptance Certificate (FAC)**
- 2.10.6.1 Final Acceptance Certificate (FAC) shall be issued by the Employer after completion of the following by the Successful Bidder:
- 1) Successful completion of commissioning and PG. test by compliance of all defects / deficiencies of the tests and the meeting of designed PG parameter.
 - 2) Submission of final / as-built drawings, operation and maintenance manuals of the installed system and completion of site training as per contract.
 - 3) Successful fulfillment of all other contractual agreements.



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2.11 IMPLEMENTATION PERIOD

- 2.11.1 The Successful Bidder shall be required to complete the whole work including commissioning of the system within **09 months** from the effective date of contract.
- 2.11.2 The Bidder shall submit the overall implementation schedule of the project in the form of a bar chart along with his offer. The implementation schedule shall cover major activities like:
- 1) Design & Engineering
 - 2) Shop Inspection and Testing
 - 3) Transportation and Supply of equipment
 - 4) Erection, Testing & Integrated Trial
 - 5) Final Testing & Commissioning
- 2.11.3 Successful Bidder shall be required to submit Level-1 PERT Network (Activity on Arrow Diagram) based on the agreed Overall Implementation Schedule as well as Milestones within three weeks of placement of order for the approval of the Employer.
- 2.11.4 PERT Network, mutually agreed to between the Employer and the Successful Bidder shall form a part of the contract and shall not be arbitrarily changed.
- 2.11.5 The entire job is to be carried out in phased manner with proper shut down planning. The implementation strategy and shutdown planning is to be made after discussion with ISP for smooth execution of the job without hampering the normal working.

2.12 BATTERY LIMIT

Refer **Dr. Nos. CET RN 4060 UT2 00 001** and **CET RN 4060 UT2 00 001** for battery limit of the proposed system:

Inlet water	From the return water header of the Cooling towers of RCPH (at approx. 30 m from the proposed location)
Outlet filtered water	To individual sumps of RCPH (at approx. 100 m from the proposed location)
Backwash Water	To nearest drain to cooling pond (at approx. 40 m from the proposed location)

2.13 EMPLOYER'S OBLIGATION

- 2.13.1 The Employer shall provide tapping within 250 m of proposed work site for electricity and water for construction job to the Successful Bidder as per the terms and conditions indicated in the commercial part of the Tender Document / SBD. The successful Bidder shall make his own arrangement to lay and maintain necessary distribution lines and wiring at his own cost.
- 2.13.2 The Employer shall also provide site shutdown for installation / erection of equipment as per mutually agreed date so as to enable completion of the facility within the shortest possible time.

2.13.3 The Employer will provide the following:

- 1) Required drawing / data of the existing equipment to the extent available with the Employer, on request of the Successful Bidder.

(Note: Where drawings/data are not available, the necessary site measurements shall be taken by the Bidder.)

3.0 TECHNICAL SPECIFICATION

3.1 BASIC DESIGN AND SITE CONDITIONS

BPSCL is situated in state of Jharkhand. The nearest railway station is Bokaro on the Gomoh – Tata broad gauge line. The plant site is about 5 km from Bokaro Steel City Railway Station.

The nearest airport is Ranchi, which is about 125 km from the plant site.

3.1.2 General Climatic Condition

- 1) Ambient temperature
 - i) Maximum : 50°C
 - ii) Minimum : 4°C
- 2) Relative Humidity
 - i) Maximum : 100 %
 - ii) Minimum : 25 %

Maximum temperature and maximum humidity do not occur simultaneously.

3.1.3 Standards & Codes

3.1.3.1 Equipment materials to be used in the construction of this package shall conform to relevant Indian Standard specifications.

3.1.3.2 All equipment and their associated system, accessories covered under this specification shall comply with all currently applicable statutory regulations and safety codes. All equipment and its components shall be designed and tested in accordance with the latest Indian Standard specification/ other International Standards established to be equivalent or superior to the Indian Standard codes unless stated otherwise/ agreed to.

3.1.3.3 The basic design and site conditions described above are aimed to appraise the Bidder about the consideration and criteria adopted while designing the proposed system.

3.1.4 Proposed System

It is proposed to install an automatic backwash, valve-less, gravity type filter system complete with accessories, piping, valves, etc. in the recirculation cooling water circuit of RCPH to reduce the TSS levels in the recirculating water.

The raw water quality is given as follows:

Table 3.1.4-1: Raw Water Quality

S. No.	Parameter	Unit	Present Value
1.	pH	-	7.8-8.57
2.	Conductivity	μS /cm	202-469
3.	Chloride	ppm	34
4.	Total Hardness	ppm as CaCO ₃	158

S. No.	Parameter	Unit	Present Value
5.	Ca Hardness	ppm as CaCO ₃	82
6.	Mg Hardness	ppm as CaCO ₃	76
7.	M-Alkalinity	ppm as CaCO ₃	87
8.	Total Iron	ppm as Fe	0.55
9.	Silica	ppm as SiO ₂	Not measured
10.	FRC	ppm	Not measured
11.	Turbidity	NTU	16
12.	*TSS	mg/L	Present case - 30.0-35.0 Worst case – 50.0
13.	Total SRB	Counts/100ml	Not measured
14.	Total TBC	Counts/ml	Not measured
* Only this parameter is envisaged to be controlled by the proposed filtration system			

3.2 MECHANICAL & UTILITIES

The technical specifications of the main equipment, related mechanical and utility systems are as follows:

3.2.1 Filters

1	Filter Type	Automatic backwash valve less gravity type
2	Filter Capacity	1500 m ³ /h for total system
3	Quantity required	NW + 1S
4	Surface filtration velocity	10.0 m ³ / m ² /h (maximum)
5	Supply water Pressure	1.5 kg/cm ² (Approx.)
6	Input Water Quality	As provided in Table 3.1.4-1
7	Outlet water TSS level	5.0 ppm (maximum)
8	MOC & thickness (minimum)	Base plate – IS 2062:2011, 10 mm thk Shell – IS 2062:2011, 08 mm thk Dish – IS 2062:2011, 08 mm thk Strainer – Polypropylene
9	Others	Standard accessories, instrumentations, maintenance approach & safety components

		including facility for manual backwash
10	Design Codes & Standards	Designed generally as per IS 803:1976. Backwash interval – 24 hrs (minimum)

Filter media shall be graded sand and gravel of approved size and quality. The filter body will be fabricated from Tubular section/ plate conforming to IS 2062: 2011. Inside surface of filter shall be Tar-Epoxy based anticorrosive paint. Bidder shall provide flanged nozzles for connecting various fittings. Instruments shall be provided as per approved drawings. Inspection manhole of adequate size, tray for inlet water distribution and collector system for filtered water shall be provided. Empty space below the filtered water collector shall be filled with concrete.

3.2.2 Valves and Piping

3.2.2.1 Valves and Other Fittings

All the valves provided in water system shall be carefully selected considering the application, working pressure and type of fluid handled.

Additional manually operated gate valves shall be provided for maintenance of each electrically/pneumatically operated valves.

The valves which may require rare operation may be butterfly valve. The Butterfly valves shall be with metallic seat and double/triple eccentric design. All valves shall be of reputed make and MOC duly approved by the employer.

Following criterion will be followed for selection of valves for water service and utilities. All valves shall be designed for a pressure rating of 10 kg/cm² or higher, if required.

S. No.	Description	Size	Standard/Specs
1.	Isolation Valves	All sizes	CI gate valves as per IS 14846: 2000, Flanged end, Body - CI as per IS 210:2009 & Stem - SS
2.	Air release valve	All sizes	Single and double ball type ARV in C.I. construction. Separate isolation valve to be provided before each air release valve.
3.	Drain and Flush Valve	All sizes	Same specifications as applicable for isolation valve
4.	Strainer	DN 50 & below	Y type strainer with GM body and brass net
5.	Strainer	DN65 & above	Automatic self-cleaning filter with MS body and SS net

General Notes for all Valves:

- Valve testing shall be as per DIN: 3230, Pt.3. Leak Rate 2.
- Bolting for companion flanges shall be as per IS 1364 (Part-1): 2002.
- Flanges shall be raised faced type.
- Valves shall be painted with two coats of primer and two coats of finish paint. The dry film thickness shall not be less than 50 μ per coat.
- Marking shall be as per manufacturing standard.

3.2.2.2 Technical Specification for Pipelines

Detailed Engineering of piping for the water facilities shall be done by the Successful Bidder with the consideration of following specific points:

i) MS pipe shall be as per details given below:

Pipe upto DN150	: ERW, Heavy duty, as per IS 1239, Pt.-I:2004	
Pipe above DN 150 and above	: As per IS 3589: 2001. Minimum thickness as given below:	
	Upto DN 500	8.0 mm
	Above DN 500 and above	10.0 mm
Pipe fittings for MS	: As per IS 1239, Pt.-II: 2011 upto DN 150 and will have thickness corresponding to heavy duty. For above DN 150, fabricated fittings of the same thickness as of pipe shall be used.	
Flanges for MS	: Plate flanges as per IS 6392: 1971.	
Bolting	: IS 1367: 2002	

ii) Piping system shall be designed as per prevailing best industrial practices and Indian/ International codes

iii) Due to site constraint, it may not be possible to provide pipe supports at required intervals and the span may cross the permissible limit. In such situations provision of a beam of suitable size welded below the pipe shall be considered. In case found necessary pipe bridge shall be provided.

iv) All the pipe lines/ headers shall be provided with air release valves and drain valves as per standard norm.

3.2.3 **Technical Condition for Erection of Equipment**

1. Alignment & Leveling

The levels and alignment of all installed equipment shall be ensured to be within allowable tolerances as recommended in the respective

manufacturer's instructions or as specified in the manufacturer's drawings. The levels, alignment of equipment shall be carefully re-checked jointly with the Employer after trial operation. All required adjustments shall be made by the Bidder as directed by the Employer.

After the Equipment has been installed, leveled and aligned, the foundation bolts shall be tightened and the equipment shall be grouted. When the grout has thoroughly cured, the alignment shall be rechecked.

2. Clean up and Painting

Bidder shall do cleaning and painting of all equipment which shall include all connection materials and devices such as piping, exposed conduits, etc. Items, which have been supplied with, finish coat before delivery but surfaces have damaged then these surfaces shall be cleaned, primed and finish coated to match to original color. The painting shall be inclusive of the cost of paint.

3. Erection Drawings

Approved erection drawings and general arrangement drawings, specifications or instructions accompanying them shall be followed in erecting fabricated items and bought out equipment items throughout the project.

Erection marks as shown in erection drawings shall appear on the fabricated items and these shall be erected with marks in the same relative positions as shown on the plan or elevation.

4. Tolerance and surface finish in workmanship

Relevant tolerances and surface finish in the fabrication work shall be followed as per relevant Indian Standard unless otherwise shown in approved detail drawings.

3.2.3.1 Erection of Valves

Before erection of valves, Bidder shall ensure that:

All grit and foreign materials are removed from the inside of the valves.

All machined faces are thoroughly cleaned and coated with a thin layer of mineral grease before erection.

Installation of valve shall be carried out as per drawing. Clearance between the top of stuffing box and underside of gland shall be uniform on all the sides.

Gland shall not be tightened hard. Hemp packing shall be adequately soaked in grease and shall not be allowed to remain dry (except valves for oxygen service).

The valves shall be tightly closed when being installed, as this keeps the valve rigid and prevents any foreign material from getting in between the working parts of the valves.

While installing flanged valves, diametrically opposite nuts shall be tightened slowly and proper care shall be taken to tighten them alternately. The practice of fully tightening the nuts one after another is not permitted.

After installation of the valves, the pipeline shall be flushed with water/

compressed air/ nitrogen, as the case may be, to remove any foreign material that may be present in them. If any leak is detected at the valve-seat, the same shall be examined and rectified by scrapping or replacing wherever necessary.

All valves shall be operated a few times to check free movement and operation of various limit switches/ inter locks.

3.2.3.2 Erection, Testing and Commissioning of Pipelines

All pipelines shall be laid by the Bidder as per detailed drawings and instruction to be given by the Employer. The interfacing and joining of the proposed pipeline with the existing pipeline/equipment /facility are in the scope of work. Following technical condition apply for erection, testing and commissioning of all pipe work:

1. Mitre fittings and shaped parts shall be fabricated from the pipes of same specifications as that of pipes. All bends will be provided with bend radius of 1.5d unless specified otherwise in detailed engineering drawing.
2. Before erection, pipes, valves, fittings etc. shall be thoroughly cleaned and scales, rust, dirt, oil, grease etc. shall be completely removed from inside as well as outside. The Bidder shall provide all cleaning materials required for this purpose.
3. Contacting surfaces of flanges shall be strictly perpendicular to pipes and shaped parts axes. Insertion of gaskets of unusual thickness shall not be allowed.
4. In case of pipes running horizontally, all the flanges and flanged fittings, etc. shall be installed in such a way that top bolt holes are displaced by half pitch from the vertical axis.
5. Flanges shall be fabricated from steel plates and shall be machined. Un machined flanges shall not be used.
Rotary flanges shall freely rotate without any jamming and closely fit with flange rings.
6. While laying several pipelines parallel to each other, flanged joints shall be staggered suitably.
7. Gasket materials and dimensions shall conform to the instructions given in the relevant working / erection drawings, unless specified otherwise.
8. Slope of pipelines, drainage, vents, and arrangement of pipe-connections for inlet and outlet of various services etc. shall be in conformity with the drawings.
9. Valves with spindles, location of that is not provided in the erection drawings shall be installed in such a way as to ensure easy access from the ground level or nearest working platform.

3.2.3.3 Joining

All pipes shall be butt-welded, socket welded, flanged or other type of joints as specified in detailed engineering drawings.

Construction materials of flanges for pipelines shall conform to the standards indicated in the drawings.

For mitre bends on the pipelines, welded butts shall be located at a distance

equal to the pipelines' diameters but not less than 100 mm from the beginning of the curve.

Tapping and re-tapping of pipeline threads shall be carried out wherever necessary.

3.2.3.4 Welding

General welding shall conform to IS 816:1969, IS 9595:1996. However, the followings are to be followed.

Assembly of elements shall be carried out with devices that ensure correct mutual location of such elements. Assembled elements are kept fixed during welding by the use of suitable clamps.

Clamps shall not be considered as secondary butt elements. They shall be made, if possible, by the same welders who weld butt joints or by welders of the same skill. Electrodes and welding wires shall also be of the same quality as used for butt-welding.

Pipeline welding shall be carried out by using horizontal, vertical or overhead welding positions.

As a rule, butt-welding shall be carried out without interruptions. No interruption shall be allowed until at least 50% of welding thickness is completed.

If there is an unscheduled interruption in such work, it is necessary to ensure slow and uniform cooling of material by covering it with asbestos or other similar material for eliminating the possibility of sharp zone cooling of metal. Before starting the welding work again, it is necessary to heat the butt weld up to required temperature and maintain this temperature until the end of welding.

Welding of flanges, tees and other shaped parts to pipes shall be carried out under the same conditions as specified for welding of pipes.

Following material shall be used for welding of steel pipelines.

- a) For gas welding – welding wire as per IS 1278:1972.
- b) For arc welding – Electrode as per IS 814:2004.

Welding Quality

All field welding of carbon steel shall be executed by qualified welders using standard welding procedure.

- a) Besides systematic operational control in the process of pipeline erection, the quality of welded joints shall also be checked by visual inspection and non-destructive testing.
- b) All the welded joints shall be subjected to visual inspection with the aim of detecting the following possible defects.

Cracks that come out on the joint surface of base metal located in the zone of thermal influence of welding.

Weld fuses or cuts in spots where joint passes over the parent metal.

Sponginess and porosity of the other surface of the joint.

Irregular width and height of a joint and its possible deviation from axis.

Deviation from joint-dimensions shown in the drawing or in the specification.

- c) Defective spots found by such visual inspection shall be chipped off and re-welded.
- d) Non-destructive test shall be carried out by radiographic method as specified elsewhere in the TS.

3.2.3.5 Erection of Underground Pipelines

- i) Pipes shall be laid 2m (top of pipe) below ground level (± 0.00).
- ii) Unless otherwise specified in the layout drawings, laying of pipelines shall be as per IS: 5822: 1994.
- ii) Buried steel pipes shall be wrapped with protective wrappings as per IS 10221:2008. The anticorrosive protection of pipelines shall consist of the application of one coat of tar primer (cold), application of one flood coat of coal tar enamel, one wrap of fibre glass resin polyester tissue, impregnated with coal tar enamel conforming to IS : 7193 -1994, application of final coat of a water resistant white wash. The total thickness of the complete coating shall not be less than 4.5 mm.
- iii) All wrapped pipe shall be carefully handled at all times with equipment such as wide belt slings and wide padded skids, designed to prevent damage to the wrapping. The underside of the pipe should be inspected while lowering and any damage shall be repaired before the wrapped pipe is laid in position. All wrapped pipes shall be tested by flaw detector for any insulation damage prior to erection.
- iv) 100 mm thick sand cushion shall be provided under pipes upto DN 300 and 150 mm thick under pipes above DN 300.
- v) Back filling of trenches shall be carried out with the excavated earth in layers of 150 mm thoroughly watered and compacted. Earth used for backfilling shall not have any hard pieces of debris like stone, brick or metal.
- vi) Hume pipe class NP3 of suitable size or as shown in detailed engineering drawing should be provided as casing pipe for each pipeline crossing the road and hume pipe class NP4 should be used for pipeline under railway tracks.

3.2.3.6 Inspection, Testing and Acceptance of Pipelines

- i) General
 - a) Manufactured / Fabricated pipelines/ducts or details shall be presented for acceptance in unpainted and non-insulated state.
 - b) Testing of pipelines and ducts shall be carried out in presence of the Employer.
 - c) Prior to testing, pipes shall be cleaned up by metal swab in order to remove the grit, sand and other solids deposited on the inner pipe surfaces followed by blowing air through pipes.
- ii) Acceptance:

Acceptance shall be carried out as follows

 - a) Documentary checking of the materials according to the drawings / specifications / contract.

- b) Checking of documents attesting the satisfactory results of mechanical tests.
 - c) Visual examination of the welding quality and checking of the result of radiographic tests (wherever carried out).
 - d) Checking of the dimensions and other technical details as per the project drawings & specifications.
- iii) Ultrasound Weld Test
- a) Ultrasound test for 10% of butt welds of CO gas pipeline shall be carried out.
- iv) Unless otherwise specified in the working drawings, the hydrostatic test pressure for water and slurry pipelines shall be as follows:
- a) For working pressure up to 6 kg/cm^2 test pressure shall be equal to 1.5 times the working pressure, but not less than 2 kg/cm^2 .
 - b) For working pressure above 6 kg/cm^2 , test pressure shall be equal to 1.25 times the working pressure.
 - c) Hydrostatic test pressure shall be maintained for 30 minutes. At this pressure, the pipelines shall be inspected for leakage etc. Welded joints shall be tapped by 1.5-kg hand hammer. Hydrostatic test results are considered satisfactory, if during tests, manometric pressure does not decrease and leakage or mist is not observed on the welded joints, fittings, body etc.
 - d) The hydrostatic test shall be repeated after elimination of defects.
 - e) Hydrostatic tests of Steam Lines shall be carried out strictly in accordance with IBR.
- v) Pneumatic Test
- All Gas pipelines shall be tested with dry Compressed Air at a test pressure of 1.5 times the designed pressure for duration of 2 hrs, if not specified otherwise in the detailed drawings
- vi) Retest
- a) Should the result of random weld and leakage tests above, indicate any doubt about the quality of weld, then additional tests shall be conducted as per the instructions of Employer.
 - b) Defective spots on welded joints shall be chipped off and re-welded. Caulking is not allowed for repairing leaky spot in welded joints. Any other defects including leakage in connections shall be eliminated. After rectification the joint will be retested.
- vii) Special Requirements of Testing
- a) The Bidder shall furnish the result of all ultrasound test for all the pipelines to the Employer along with the certificates of acceptance / approval of the experts who conducted the tests. All the testing materials and equipment shall be provided by Bidder and a set of drawings/schemes duly identifying the joint locations shall be maintained. All costs to this account shall be borne by the Bidder.

- b) Equipment shall be disconnected before the test. Combined test of the pipelines with equipment is not allowed.
- c) Details in which same defects are found during repeated tests (after rectification) shall be rejected and replaced by new ones. The hydrostatic test shall be conducted again in such cases.
- d) Representatives of the Employer and the erecting Bidder shall make a statement regarding the pipeline acceptance mentioning defects found during tests, nature of the defects and method of their elimination. Pipelines shall be identified in the statement as per the project drawings.

3.2.3.7 Painting

- i) After testing and acceptance all the outside surfaces of M.S. pipes, fittings and ducts including supports shall be cleared of loose substance and foreign material i.e. dirt, rust, oil, grease, slag etc so that primer coat adheres to the original metal surface. Thereafter Red Oxide Zinc Chromate as per IS 2074:1992 shall be applied in two coats and dry final paint with synthetic enamel of approved quality shall be applied in two coats with dry film thickness of each coat of 50 micron.
- ii) The scheme for painting shall be submitted by the Bidder for the approval of the Employer.
- iii) The painting shall be done in accordance with manufacturer's recommendations in respect of application of primer and/ or paints with the approval of the Employer.
- iv) Paint may be applied by brush. Spray painting is however preferred.
- v) For paints, which dry by chemical reaction, the temperature requirements specified by the manufacturer shall be met with.
- vi) Paint shall not be applied in rain, wind, and fog and when the surface temperature is below 10°C resulting in condensation of moisture.
- vii) Each coat of paint shall be continuous, free of pores and of even film thickness.
- viii) After satisfactory erection and commissioning, all spots on the pipelines, ducts, supply structural or equipment where the painting is damaged during commissioning shall be touched up with same type of primer / finish paint as that already used.

3.3 **ELECTRICAL**

3.3.1 **Sub Lighting Distribution Board (SLDB)**

SLDB shall receive power at 415 V, 3 phase, 4 wire from Employers' LDB and distribute it into 240 V, 1 phase circuits for connection to the lighting fixtures. SLDB shall be located in the existing MCC rooms (to be indicated by employer). It shall be steel clad, dust & vermin proof design. It shall have Day light features.

1.0	Type	- Metal clad - Shall be suitable for 415/240V, 3 phase and neutral.
2.0	Construction	- Totally enclosed.

		<ul style="list-style-type: none"> - Dust & vermin proof. - Welded back and sides .
3.0	Enclosure class	IP54 . IP 55 (with canopy) for outdoor installation .
4.0	Type of execution	Single front.
5.0	Mounting	Wall mounting .
6.0	Installation	Indoor / Outdoor (with canopy).
B. Constructional Features :-		
1.0	Sheet steel CRCA	
	Thickness	2 mm .
2.0	Cable entry	<ul style="list-style-type: none"> - Incomer :- Bottom cable entry. - Outgoing :-Top / Bottom cable entry.
3.0	Design	<ul style="list-style-type: none"> - One Incomer and outgoing. - All the components shall be accessible from front. - Access to the operating handle of the incoming isolating switch shall be from the front of the cubicle without opening the front door. - Operating knobs of outgoing MCBs shall be accessible only after opening the front door of the cubicle. - Protective insulated cover plate (3 mm thick bakelite sheet) shall be provided inside the cubicle to shroud all the live parts .
4.0	Gland plate	Undrilled detachable gland plates (3 mm thick) shall be provided at the top and bottom with suitable gaskets for cable entry.
5.0	Miscellaneous	<ul style="list-style-type: none"> - Neoprene rubber gasket shall be provided for all the doors , removable covers & between adjacent covers . - Suitable locking devices. - Doors shall have concealed hinges .
6.0	Labelling	<p>Clear legible identification labels (anodized aluminium with white letters engraved on black background) with letter sizes of :-</p> <ul style="list-style-type: none"> - 5 mm for components and module name plates. - Danger board on front and rear sides in English, Hindi and local language .
7.0	Earthing	Two separate earthing terminals will be provided.
8.0	Limiting dimensions	- Width of SLDB :- 800 mm
		- Depth of SLDB 300 mm
		- Height of SLDB :- 400 mm (min)
9.0	Paint shade	Shade No. 631 as per IS-5:1992.
C. Busbars		
1.0	Arrangement	Three phase & neutral.

2.0	Material	High conductivity electrolytic aluminium alloy confirming to grade E91E as per IS-5082 –1981.
3.0	Phase Busbar Rating	- Shall be able to carry continuously the connected load (considering all derating factors) plus a 25% margin . - Max. current density shall be - 1.0 A/sq.mm for Aluminium - 1.5 A/sq.mm for Copper .
4.0	Neutral Busbar Rating	50 % of phase busbar rating
5.0	Short circuit rating	50 KA for 1 sec.
6.0	Busbar configuration	Red-yellow-blue , black for neutral .
7.0	Busbar insulation	Heat shrinkable PVC - R,Y,B coloured sleeves for phases - Black for neutral.
8.0	Busbar supporting insulators	- Non-hygroscopic - Flame retarded - Track resistant - High strength - Sheet moulded compound or equivalent polyester fibre glass moulded type .
9.0	Air clearance for bare busbar	Phase to phase :- 25.4 mm (minimum) Phase to earth :- 19.0 mm (minimum)
F. Feeder arrangement		
Incomer		
1.0	Isolating Equipment	3 pole ELCB ELCB shall be of AC 23 duty category conforming to IS: 13947-1993 having fully shrouded contacts.
2.0	Quantity	One
3.0	Indication Lamps	LED type indicating lamps for :- - Power ON R / Y / B .
Outgoing feeder arrangements		
1.0	Circuit breaker	DP MCB
G. Panel wiring		
1.0	Power / current transformer circuit	1.1kV grade single core , black colour PVC insulated , stranded copper conductor of minimum size 2.5 sq.mm.
2.0	Ferrules	- Numbered plastic/ceramic ferrules. - Self locking type.
3.0	Marking	- Wiring will be properly marked as per relevant IS.
4.0	Terminals	- Power & control terminals shall be segregated by insulating material like hylam / bakelite sheet. - Terminals shall be ELMEX type suitable for connecting two cores of 2.5 sq.mm wires. - Minimum 20 % spare terminals will be provided.

		- The minimum rating of control terminal shall be 10 Amps.
5.0	Cable glands	Double compression cable glands for receiving cables.

3.3.2 Miniature Circuit Breakers (MCBs)

1.0	Type	Heat resistant plastic moulded type
2.0	Ref. Standard	IS: 8828 –1978
3.0	Protections	MCBs shall be provided with quick break trip-free mechanism and direct acting thermal overload and short circuit trip elements.
4.0	Short circuit capacity	Not less than 9kA/1 sec
5.0	Mounting	DIN Channel mounting. Single phase MCBs mounted adjacent to each other and connected to different phases will be provided with adequate insulated phase barriers.
6.0	Current Rating	The MCBs shall be selected from standard current ratings MCB shall confirm to curve C.

3.3.3 LT Power Cables

	Specific aspect of Cable	Employer's Specification
1.	Grade	1.1 kV earthed for aluminium and copper power cable.
2.	Type	Heavy duty PVC
3.	Conductor	Circular conductor made of stranded and compacted electrical grade aluminium/copper wires as per IS 8130-1984
4.	Maximum conductor temperature with rated current	70 ^o C
5.	Insulation	Extruded XLPE as per IS 5831- 1984
6.	Inner Sheath	Extruded PVC inner sheath with non-

		hygroscopic fillers for suitably holding the cores in circular configuration as per table 4, in IS 1554 (Part-I,-1988)
7.	Armouring	Armoured as per table 5, in IS 1554 (Part-I,-1988).
8.	Outer Sheath	Extruded type/ PVC outer sheath (type ST2 as per IS 5831-1984) as per table 7, in IS 1554 (Part-I,-1988)
9.	Maximum conductor temperature withstanding ability during short circuit.	160°C

3.3.4 Termination and jointing

Termination and jointing of aluminium conductor power cables shall be by means of compression type aluminium lugs. Alternatively, tinned copper compression type lugs may also be used with application of corrosion inhibiting compound.

The jointing and end sealing kits shall be complete with stress relief system and all accessories, straight through joint for direct burial installations shall be provided with cast resin enclosure for protection against water and corrosion.

Straight-through joints for 1100 V grade PVC insulated cables shall be with epoxy resin compound for direct burial cables. Cable glands for terminating PVC insulated, armoured/ unarmoured cables shall be made of brass or aluminium alloy.

3.3.5 Light Fitting & Accessories

3.3.5.1 Street light fittings

These fittings shall be integral type and shall be suitable for 250W HPSV lamps. The fittings shall have cast aluminium housing, aluminium reflector, clear glass/ acrylic cover, control gears, capacitors, ballast etc. Street light fittings shall be erected on the street light poles. Necessary brackets etc. as required shall be supplied by the Bidder.

No. of light fittings that shall be selected to meet illumination level must be 20 Lux.

3.3.5.2 Lighting poles

Lighting poles shall be 9 m-11 m high, swaged and welded steel poles (IS type designation 410 SP-54) as per IS-2713 1980 complete with fixing brackets, weatherproof junction box and all other accessories.

The pole shall be coated with bituminous preservative paint on inside as well as embedded outside surface. Exposed surface shall be coated with two (2) coats of metal primer (comprising of red oxide and zinc chromate in synthetic

medium).

Each street light pole shall be provided with two nos ground pads with two nos tapped holes, M10 GS bolts and spring washers for connection to 50 x 6 mm GS earthing flats.

3.3.6 **Point Wiring for 2 nos. 250 W HPSV street light**

Point wiring shall start from SLDB upto the light fittings through junction box at the bottom of the light pole with 2 nos. single core 1.5 sq.mm. copper conductor 650 /1100 V grade PVC insulated cable run in 25 mm dia GI conduit along with 14 SWG GI wire as ECC from SLDB upto the fittings. Looping shall be done from one fitting to the other and wiring of two nos. of fittings shall be considered as one point wiring

3.3.7 **Earthing System**

The method adopted for system as well as equipment earthing shall be in accordance with the code of practice for earthing in IS: 3043-1987 and shall also comply with the relevant clauses of Indian Electricity rules.

The main earthing ring shall be further cross connected and mesh formed depending on the layout and location of the equipment.

3.3.8 **Testing & Commissioning**

All the equipment, installation shall be tested as per the relevant IS and IE rules.

Routine test shall be done for the distribution boards and test certificates shall be submitted. Manufacturers test certificates shall be submitted for cables, wire, light fixtures etc.

At site, the complete installation shall be tested for insulation value. All the wiring system shall be tested for insulation resistance, continuity the phase circuits and the number of fittings have been connected in circuit as specified. All the tests shall be carried out in the presence of Purchaser's site engineer.

3.4 **INSTRUMENTATION & AUTOMATION**

3.4.1 **Design Condition for Instrumentation System**

1. Applicable Design Standards

IS / BS No.	Title
IS 1554:1988	PVC insulated electric cables for working voltages up to and including 1100v
IS 9858 : 1981	Safety requirements for electronic measuring apparatus.
IS 13947 : 1993	Degrees of protection of enclosed equipment.
BS-1042 sec 1.1 & Sec 1.4 (1992) / ISO-5167	Flow element design calculation

2. Design Conditions

- i) Planning, design, manufacture, supply, installation, testing inspection and commissioning of the electrical equipment and facilities shall comply with latest versions of IEEE/ IEC/ IPSS/ IS, Indian Electricity Rules, laws and regulations in force in the state of Jharkhand.
- ii) If relevant IPSS/ IS is not available for a particular application, the IEC (International Electro-technical Commission) standards shall be applicable.
- iii) All plans, design, manufacture, installation and cabling work shall be based on the ISO metric system.
- iv) System shall be designed with inbuilt safety system for operating and maintenance personnel. Facilities for inspection, testing, maintenance and adjustment at site shall be provided without disrupting process.
- v) All the instrumentation & control equipment shall be brand new & supplied from the latest product ranges of reputed manufacturers as per the List of Preferred Makes. The instrumentation equipment shall be generally sourced from India. For imported equipment, if any, availability of spares & service facility from India shall be ensured by the Bidder.
- vi) System shall be of modular design for future expandability / modification. Necessary redundancy shall be considered, as spelled out in this T.S, for reducing extent of abnormality and Mean Time To Repair (MTTR).
- vii) All field instruments and equipments shall be suitable for hazardous area application and intrinsically safe design as per classification IEC Zone viz. Zone 1, Group IIA & IIB as applicable. All field instruments & accessories also shall be weather and corrosion proof and suitable for Chemical Plant application.
- viii) Wetted parts of the instrumentation equipment shall be selected so as to withstand physical and chemical properties of the service fluid coming in direct contact with the instrument.
- ix) Whenever corrosive atmosphere is present, all instruments and associated equipment exposed to such a medium shall be designed & protected to withstand the adverse effects
- x) Equipment noise limitation shall be as per IEC-179 (generally not exceeding 85 dB at 1-meter distance).
- xi) All pressure gauges will be provided with built-in diaphragm separator.
- xii) All orifice plates / nozzle/ venturi tubes will be provided with two sets of tapping assembly.
- xiii) For local flow rate indication, generally rotameter / by-pass rotameter type instruments will be used with fluid flowing in vertically upwards direction. For line sizes up to 50 mm line size, direct on line

rotameters will be used. For line size above 50 mm and up to 400 mm line size, by-pass type rotameter with built-in orifice plate will be used.

- xiv) Power supply to individual instrument with AC power supply will be through individual MCB of adequate rating.
- xv) The instrumentation items shall be supplied by the Bidder based on the finalized specification data sheets as will be approved during detailed engineering stage. These specification sheets shall be in standard format (e.g. ISA) or approved format.
- xvi) For corrosive fluid application wetted parts of all field instruments shall be made of corrosive resistant material.
- xvii) All instruments / transmitters shall have local display facility. All transmitters shall have suitable lightning protection device.
- xviii) Guidelines for selection of erection materials: SS tube Compression Fittings & Fittings shall be as per ISA RP 42.1.

3. Proposed System

The proposed Instrumentation & control system shall consist of primary sensor & field instruments for efficient monitoring of process parameters. Suitable digital display shall be considered for differential pressure measurement across filter sand bed and flow measurement at outlet of each filter shall be housed in a wall mount panel located preferably in the existing pump house. All the transmitters shall have external surge protection.

Major measurement parameters considered are as per the following:

- i) Flow measurement at filter inlet header.
- ii) Flow measurement at filter outlet header.
- iii) Differential pressure measurement across filter sand bed.
- iv) Pressure measurement at inlet and outlet of filter.
- v) Flow measurement at outlet of each filter.

3.4.2 Technical Specifications

1. Pressure / Flow transmitter

The pressure / flow transmitters shall be of smart type with variable capacitance / solid state type sensor. Transmitters shall be with built in local indicator, two / three way manifold and mounting accessories etc. For flow transmitters square root extractor shall be provided. One set of Hand Held Calibrator shall be provided for calibration. The transmitters shall have the following specifications:

Range	As required
Electronics	Microprocessor based smart
Power Supply	12-48 VDC
Output	4-20 mA & superimposed digital signal on HART

	protocol
Accuracy	± 0.25% of span
Load limit	600 Ohms
Over pressure limit	200% of upper range limit
Linearity	± 0.1% of span
Repeatability	± 0.05% of span
Sensitivity	± 0.05% of span
Dead band	± 0.05% of span
Zero adjustment	Continuously adjustable
Transient protection	Inbuilt lightning protection shall be provided
Damping	Shall be step or continuously adjustable, so that the time constant varies from 0-3 sec or 0-6 sec.

2. Digital Indicator

Display	Red LED seven segment digits in 3 1/2 digital display.
Accuracy	0.5 %
Alarm	High and low alarm indicator and selectable for each channel
Alarm setting	0-100 % range
Alarm output	2 points/input
Digit Height	15 mm
Input	4-20 m A dc analog, isolated Impedance - 1Mohm
Output	Alarm output of 0.1 A at 220V ac , isolated dry contact with NO or NC contact selectable internally.
Power supply	24 DC

3. Pressure / Differential Pressure Gauge

Type	Bourdon Tube
Application	Gauge pressure
Sensing element	Diaphragm + Bourdon Tube
Sensing element material	AISI 316 L
Socket/adaptor material	AISI 316 SS
Case material	Cast Aluminium
Bazel ring material	AISI 304 SS
Window	Shatterproof glass
Dial	AISI 316 SS
Pointer	AISI 316 SS
Dial size	150 mm
Dial colour	White
Scale	Black lettering on white background
Housing Enclosure	IP 67
Mounting	Installation on the post
Over range	125% of full scale

Ambient temperature limit	60 deg C
Humidity limit	Maximum
Zero adjustment	Micrometer
Process connection	Diaphragm seal
Diaphragm Maximum pressure	Class 150
Hydraulic filling	Silicon oil
Diaphragm material	AISI SS 316L
Isolation gauge cock (3 way)	Required
Socket for gauge cock mounting with PG	Required

4. Orifice Plate

The orifice plate shall specifically be designed as per B.S. 1042 section 1.1: 1981, 1.2 & 1.4: 1992. The orifice plate shall in general be of square edge concentric type with flange tapping. All orifice plates shall be supplied with matching flanges of suitable rating not less than three times the maximum line pressure. All tapping arrangements shall be complete with a piece of impulse pipe line and a shut off valve of adequate pressure rating.

Material of orifice plate assembly shall be of SS 316. The matching flange shall be of carbon steel. For line sizes above 50 mm the diameter ratio (d/D ratio) shall preferably be selected between 0.548 to 0.775. Base of the orifice plate shall be parallel within 0.5 degree. Other details as well as design guidelines will be as per BS 1042 section 1.1: 1981, 1.2 & 1.4: 1992.

5. Cables and Cable laying

- i) All control cables shall be conforming to IS:1554, 1988 or relevant Indian Standards as applicable.
- ii) The power wiring within the cubicles shall be done with minimum 2.5 Sq. mm Copper Conductor.
- iii) Cable entry to the panels / junction boxes shall be through suitable removable gland plates and glands.
- iv) Parallel run of instrument cables and power cables shall normally be avoided but where parallel run must be made, suitable cable spacing shall be provided.
- v) Crossing of power and control cables shall be done at right angles. All cables must be laid on GI trays mounted on rigid supports at suitable interval to avoid sagging.
- vi) Signal, power and compensating cables shall be laid on separate G.I. trays with minimum separation as per relevant standard.
- vii) G.I. trays shall be mounted with their breadth in Vertical plane to protect cables from falling objects, accumulation of dust. If plates are provided horizontally these shall be provided with removable covers and shall be supported to avoid sagging.

- viii) Multicore cables shall not be bent to radius less than manufacturer's recommendation. Intermediate joints shall be avoided.
- ix) Clips and saddles securing cables to steelworks or tray shall preferably be plastic covered materials and shall be spaced at 0.5 mtr interval.
- x) All cables shall be suitably identified with their tag numbers duly clamped at an interval of 5 meters.
- xi) Unarmoured or flexible cables shall be laid in conduits, individually or in groups with removable plates and tag identification at an interval of 5 meters.
- xii) All cables shall be FRLS type.

6. General

- i) The equipment shall conform to the safety requirements of IS 8495-1977-specification for electrical instruments for hazardous atmospheres, IS:9858-1981-Safety requirements for electronic measuring apparatus etc. Wherever Indian Standards do not exist, ISA, IEEE or NEEMA Standards or the ones laid down hereafter be followed. Devices should be intrinsically safe.
- ii) All instrumentation power supply system shall be through isolation transformers and system voltage shall be 220 V + 10%; -15%, 50 Hz ± 4%. Instrumentation system working on unified current signal of 4 - 20 mA DC only shall be used.
- iii) All instrument cut outs and drilling shall be straight and through. All panels shall be supported on suitably sized vibration isolators, designed for bolting to panel frame and flooring. Access doors on enclosed panels shall be 750 mm wide by 1800 mm high, single sheet with suitable latch, hooks, knobs on inside and outside and shall open forward.
- v) The panels shall be free standing type and of welded / bolted construction. All welds shall be ground smooth, all corners be rounded and all weld spatters shall be cleared. Surface of panels shall be free from all marks & defects. The finished panel shall be flat within 2 mm in any 2 meter radius and shall be smooth. Removable eye-bolt lifting lugs shall be furnished and installed in all panels.
- vi) Power supply to individual instrument having A.C. power supply shall be through separate MCB. Power supply to transmitters having 24V DC supply shall be through two nos. 24 V regulated power supply units connected in parallel (Each having capacity to supply all transmitters) with diode protection against each loop current flow. A 24 V DC bus will be drawn at the output side of regulated DC power supply units. Individual transmitters shall be connected to the DC bus through MCB and LEDs
- viii) Any signal duplicated to more than one point will be through signal isolator only.

3.4.3 Schedule of Equipment:

i)	Field instruments comprising of pressure gauge, pressure/flow transmitter, orifice, digital indicator, zener barrier etc.	1 Lot
ii)	Power / signal cables, cable laying accessories like trays, G.I. protection pipes, supporting structures, clamps etc.	1 Lot
iii)	Corrosion proof wall mounted instrument panels, junction boxes etc.	1 Lot
iv)	Erection hardware	1 Lot

3.5 CIVIL WORKS

3.5.1 Design Specification

3.5.1.1 General

- 1) This specification covers the design criteria for Civil Engineering works pertaining to the project. The term 'design criteria' includes loading standards, permissible stresses, functional requirements and quality standards to be adopted as a basis for preparation of designs and drawings by the successful Bidder. The designs and drawings will cover foundations for buildings and equipment, drains, flooring and other miscellaneous civil engineering items of work to be provided and/or to be modified / rectified by the successful Bidder, if any.
- 2) The designs prepared by the Contractor will not only provide for the requirements indicated in this specification but also consider the overall process requirements, and service conditions. The new facilities shall be planned in such a manner that the existing structures in the vicinity shall be in anyway adversely affected. The designs will be compatible with the existing and proposed structures.
- 3) Standards and unification shall be carried out to the maximum extent possible and in the interest of standardization. The Purchaser reserves the right of selecting particular makes of materials and components. The successful Bidder shall supply materials/components of the particular make, if so required.

3.5.1.2 Standards

- 1) The design criteria for civil engineering work will be in accordance with this specification. Detailed instructions on such aspects as are not indicated herein will be as per the latest standards, codes. In the absence of suitable is specification and codes of practices other recognized international standards and codes may be followed with the prior approval from Purchaser.
- 2) This specification covers design of major Civil Engineering items of work. Other items of work will be designed according to the relevant standards, recommendations and stipulations referred above.

- 3) In case anything mentioned in this specification is at variance with IS or other codes of specification mentioned herein, the provisions of this specification will prevail.

3.5.1.3 Setting Out and Leveling

The Bidder shall set out and level the work and shall be responsible for the accuracy of the same. He has to provide all instruments and qualified staffs with labour for getting his work checked by Engineer-in-Charge, if so desired by the Purchaser. Such checking, if any, shall not, however, relieve the Bidder in anyway, of his responsibility for correct setting out.

3.5.1.4 Safety

The Bidder shall take adequate precautions to ensure complete safety and prevention of accidents at site and shall be responsible for the same. The safety precautions shall conform to the safety regulations prescribed by the safety code for constructions and relevant Indian Standard Codes, some of which are listed below:

- IS: 3764-1992 : Safety code for excavation work.
IS: 4014-1967 : Safety regulations for scaffolding work.
IS: 4081-1986 : Safety code for drilling and blasting operations.
IS: 4138-1977 : Safety code for working with compressed air.
IS: 7923-1985 : Safety code for working with construction machinery.

3.5.1.5 Keeping Work free from Water

The Bidder shall provide and maintain at his cost, pumps and other equipments to keep the works free from water and shall continue to do so until the handing over of the works.

3.5.1.6 Cleaning of Site

The Bidder shall keep the site clear on a continuous basis, from muck, rubbish etc., which may arise out of the work executed by him and dispose them suitably in allotted areas.

3.5.1.7 Bench Marks, Reference Pillars etc.

The Bidder shall protect all benchmarks, and reference pillars /lines including ground water gauges from damage or movement during working. In case of any damage the Bidder shall have to restore the same to its original condition at his own cost.

3.5.2 **Concrete & Reinforced Concrete for Structures & Foundations**

3.5.2.1 General

- (i) Concrete work shall secure a dense, homogeneous, smooth mass including required finishes, possessing required strength and resistance to weathering and abrasion for the structures and foundations.
- (ii) Design of all reinforced concrete structures shall be as per IS: 456-2000.

The structural safety of all foundations on soil shall, in general be based on IS: 1904-1986.

- (iii) All reinforced cement concrete including those for water retaining structures shall be in minimum grade of M-25 (with 20 mm and downgraded aggregates).
- (iv) Plain cement concrete shall be M-10B (with 40 mm and downgraded aggregates). However, for mass filling plain cement concrete of grade M-5B shall be used.
- (v) Grouting below machine/equipment bases and pockets shall be of ready-mix non-shrinking grout (SHRINKOMP-30 or equivalent) of adequate thickness and strength. Grouting below structural column bases shall be with concrete of minimum grade M-30 (with 10 mm and downgraded aggregates).
- (vi) For calculations purpose ‘**Limit State Design**’ methods shall be adopted.
- (vii) The minimum grade of RCC shall be M25 and PCC shall be M10.

3.5.2.2 Permissible Stresses

Allowable stresses for all reinforced concrete structures shall be as per IS: 456 – 2000.

3.5.2.3 Foundations

- (i) Selection of type of foundation shall be based on the recommendations of soil investigation & survey report, supported loads, system requirements and site constraints.
- (ii) Open foundations for structures and equipment shall be proportioned to resist the worst conditions of loading and shall be generally designed as per the provisions of IS:1904-1986.
- (iii) The depth of foundation shall be determined based on loading on foundations and bearing capacity at the founding level, constructional and technological requirements. The maximum allowable bearing pressure for design of foundation shall correspond to values indicated in detailed soil investigation report taking into account limits of allowable settlement considered for design of structures. However, in no case shall be the foundation is taken down to less than 600 mm below natural ground level in case of soil and 200 mm in case of rocky strata. In no case foundation shall be placed on the filled up soil and the depth of the foundation shall be taken upto the depths where the virgin soil strata is found and extra depth shall be filled with PCC 1:5:10 (cement: sand: aggregate).
- (iv) The foundation of the new structure /facility shall be taken at least to the depth of the foundation of adjoining existing structure/ facility, if any. In no case the loads from the new foundations shall be transferred to the existing foundation. However in exceptional circumstances, if it is required to be done, then the existing foundation shall be checked for

the additional load transferred and shall be supported with design calculation.

- (v) All faces of concrete or plastered surfaces in contact with earth shall be provided with two coats of bituminous protective coatings of approved make. Ground floor slab shall be cast on a layer of building paper of approved make on boulder/ Blast Furnace slag soling with moorum binding.

3.5.2.4 Soil Conditions

- (i) The net allowable bearing capacity shall be considered as 15 Ton/m² which is likely to be at 2 m below ground level.
- (ii) Less important foundations of minor structures carrying low loads can be laid on backfilled soil with 250mm thick compacted boulder soling, and the allowable bearing capacity shall be considered as 5 Ton/m².
- (iii) During execution, in case of any doubt regarding the reported bearing capacity & actual site condition by Engineer-In-Charge, the scope of Successful Contractors also include the collection of soil samples, performing tri-axial test and sieve analysis on samples and calculating safe bearing capacity of founding strata to confirm the assumed bearing capacity in design. The water table will be assumed at existing ground level and correction factors will be applied accordingly.

3.5.3 **Floors**

3.5.3.1 In general, all floors on ground for the production buildings, including pump houses, stores and electrical buildings shall be made of minimum M20 RCC of 150mm minimum thickness. The design of floor shall be done taking into consideration technological requirements, imposed loading and other service conditions etc.

3.5.3.2 For areas where the loading is high (more than 5T/Sqm), like Mill floor, SMS floor etc, the floor shall be designed for actual loads. The computation of edge and corner stress can be done using IRC 58:1988 or other accepted analysis procedures including finite element modeling of the structure in Structural analysis software. The design of RCC floor shall be done as per IS:456-2000.

3.5.3.3 The sub-grade below the floor slab shall be minimum 250 mm thick stone boulder soling blinded with moorum. Building paper shall be provided on top of sub-grade before casting the concrete slab.

3.5.3.4 All sub-grade shall be laid on compacted soil.

In specific areas of production buildings where concrete floor is not required at ground floor level, the flooring shall consist of minimum 250mm thick stone boulder soiling blinded with moorum and compacted.

3.5.3.5 Floor Finishes

Floor finishes for the rooms and buildings shall be according to the technological, process and functional requirements and service conditions.

3.5.4 Storm Water Drainage

3.5.4.1 The design of storm water drainage system shall be based on maximum hourly precipitation for a storm of duration of 20 minutes. Roof drainage system shall be designed on the basis of an hourly precipitation for storm duration of 5 minutes.

3.5.4.2 Gully, traps, inspection pits, junction pits, collecting pits etc. As well as other facilities shall be located suitably and designed considering easy access, maintenance and safety.

3.5.4.3 For the purpose of calculation of run-off from catchments area of any drainage line, the contractor shall estimate areas of buildings, paved area, roadways, parking areas and open areas within tree catchments area. Run-off coefficients for design shall be as follows:

- 1) Open areas : 0.50
- 2) Roads and paved/parking areas : 0.70
- 3) Roof surface : 1.00

3.5.4.4 The pipes shall be so designed as to give a velocity of flow not less than one metre per second when running half full. The maximum velocity shall not exceed 2.5m per second.

3.5.5 Design Calculations, Drawings and Documents

3.5.5.1 Design Calculations /data sheet

The design calculations to be submitted by successful Bidder for approval, prior to submission of construction drawings shall include, but not be limited to, the following:

(i) Architectural design

The successful Bidder shall follow the norms and basic schemes indicated in the Technical Specification. The successful Bidder shall submit all catalogues/ specifications for various floor and wall finishes, painting, sanitary and plumbing fixtures and fittings, doors and windows, etc.

(ii) Structures and foundations design

The design calculations for all the buildings and foundations including storage, underground foundations, tunnels, miscellaneous structures, all equipment foundations etc. shall include static design calculations for all structures and foundations.

Building data sheet showing specifications of materials, design standards followed, loading norms adopted, including the loading on roof, walkways, different floors, bulk material density, crane and hoist loading, wind and seismic loading, wind thrusts and vibration considerations, deflection, rainfall and run-off data assumed and type of framework, etc. Also, type of flooring, roofing & sheeting and type of construction shall be indicated. The loading combinations and other design assumptions made in design are to be furnished.

3.5.5.2 Drawings

The Successful Bidder shall prepare general layout drawings giving salient levels and dimensions of the whole area showing all over ground and underground services and facilities, buildings, roadways, railways etc., provided for co-ordination with the other areas of the Steel Plant. Detailed working drawings shall be prepared on the basis of the general layout drawings considering overall foundation layout for the equipment, building, services, etc., space requirement and clearances as necessary. The Successful Bidder shall ensure that no further drawing shall be required by any other agency for successful implementation of the project. The successful Bidder shall submit a comprehensive and complete unit wise classified list of drawings in reproducible form.

The Successful Bidder shall submit for approval of the Purchaser/Consultant General Arrangement and detailed working drawings for all concrete, reinforced concrete and other civil works, as follows:

- i. Architectural drawings for office / rest room / stores, toilets etc.
- ii. Excavation drawings.
- iii. Foundation plans and sections for building columns and equipment incorporating services, utility tunnels, trenches, pipes, etc.
- iv. Loading drawings indicating superstructure loading, equipment loading, floor loading, etc.
- v. Comprehensive anchor hole plan along with complete details of anchor bolts and anchor pockets for foundation for building columns and equipment, etc., including schedule for bolts and anchor plates. Design of anchor bolts should be such that it should be possible for any replacement of the same in case they get damaged.
- vi. Detailed structural drawings for floors Reinforcement details with bar bending schedules for all reinforced concrete works.
- vii. Drawings for all types of bolts, inserts, embedments, covers, miscellaneous steelworks, etc.
- viii. All drawings for masonry work, flooring, floor finishes, false ceiling, false floor, wall panelling, etc.
- ix. Underground storm water drainage drawings for areas and buildings within the battery limit.
- x. Drawings/catalogues for doors, windows, ventilators, louvres, and miscellaneous equipments
- xi. Drawings for outdoor utility service lines
- xii. Detailed bill of materials of all items of work.

3.5.6 Material & Workmanship Specifications

3.5.6.1. General

a. Local conditions

The Bidder, before submitting his tender, shall visit the site and ascertain the local conditions, labour rules, availability of construction materials, traffic restrictions, all obstructions in the area and also ascertain all site conditions including the sub-soil conditions and shall allow for any extras likely to be incurred due to all such conditions in his quoted prices. After the award of work no additional claims will be entertained on these accounts under any circumstances, whatsoever, from the successful Bidder.

b. Setting out and levelling

The successful Bidder shall set out and level the work and will be responsible for the accuracy of the same. He is to provide all instruments and proper qualified staff with labour for getting his work checked by Engineer, if so desired by the Engineer. Such checking, if any, shall not, however, relieve the successful Bidder in any way, of his responsibility for correct setting out.

c. Safety

The Bidder shall take adequate precautions to ensure complete safety and preventions of accidents at site and shall be responsible for the same. The safety precautions shall conform to the safety regulations prescribed by the Safety Code for constructions and relevant Indian Standard Codes, some of which are slated below:

IS 4081-1986	:	Safety Code for drilling and blasting operations
IS 4138-1977	:	Safety Code for working with compressed air
IS 7923-1985	:	Safety Code for working with Constructions machinery

d. Keeping work free from water

The Bidder shall provide and maintained at his own cost, pumps and other equipments to keep the works free from water and continued to do so until the handing over of the works

e. Rubbish

The successful Bidder shall keep the site clear on a continuous basis of all rubbish etc. which may arise out of the work executed by him and dispose them suitably in allotted areas.

f. Bench Marks, Reference Pillars etc.

The successful Bidder shall protect all bench marks and reference pillars /lines including ground water gauges from damage or movement during working. In case of any damage the Bidder shall have to restore the same to its original condition at his own cost.

g. Standards

Unless otherwise mentioned in the specifications, all applicable codes /standards as published by the Bureau of Indian Standards on the date of award of contract shall govern the work in respect of design, workmanship, quality and properties of materials, method of testing and other pertinent features. In case of variance between this specifications and IS Codes /Standards, the provisions of this specification shall prevail upto the extent of such variance.

3.5.6.2. Dismantling

- a. The dismantling of civil works shall be carried out with utmost care so that the adjacent structures, which are not to be dismantled, do not get damaged. However, if any existing structures get damaged during dismantling, the successful Bidder shall carry out the rectification and restoring of the entire structures without any extra cost.
- b. The successful Bidder shall assess the entire dismantling work and decide accordingly the resource to be employed by him so that the work can be executed in the stipulated time frame.
- c. The successful Bidder shall obtain the necessary clearance certificates from Safety department of BSL for the arrangement of dismantling work at every stage.
- d. The dismantled material shall be first stacked near site within a lead of 100 m and thereafter disposed off up to 5 Km within the Plant boundary.
- e. Dismantling shall be done preferably in such piece size length as will facilitate easy transportation and disposal of those items to dumping yard /storage yard.
- f. Dismantling of all RCC and PCC work shall be done as per detailed dismantling drawing.
- g. Pneumatic hammer / breaker in general shall be used for dismantling of RCC slabs, beams, columns, foundations etc.
- h. Earthwork required for exposing the foundations for expediting the dismantling of the foundations shall be measured separately and paid under relevant items.

3.5.6.3. Excavation and Back Filling

a. Stripping

The successful Bidder shall strip the surface of the site prior to the commencement of excavation to remove vegetable soil and carry such soil to separate spoil dumps in the allotted site/areas.

b. Excavation for foundations and Trenches

- i. The successful Bidder shall grub roots of bushes, shrubs etc. and excavate at various levels including hard rock to remove materials of any nature or description, which may be encountered including steel plant waste, slag, fly ash, cinders, iron ore fines etc. Side slopes, benching and/or shoring/strutting for excavation work shall be as directed by the Engineer-in-Charge and prior approval from him shall be obtained for a suitable method of protection before excavation work commences. The bed of the excavation shall be properly dressed and made level. All mud and slush shall be removed before taking up concreting work. The last 150 mm of excavation shall be done just prior to laying of concrete. The excavated materials shall not be placed within 5.0 m from the edge of any excavation. The successful Bidder shall take suitable precautions to prevent ingress of water into the excavated pit / trenches during construction.
- ii. The successful Bidder shall account for all excavated rock, if any. He shall stack excavated rock and if the successful Bidder for his works requires serviceable boulders, it may be issued based on stack measurement less 40% for voids at the rate to be decided by the Employer.
- iii. The surplus excavated materials and excavated unserviceable materials from rock excavation shall be transported and disposed off by the successful Bidder in spoil dumps or fill areas as directed by the Engineer-in-Charge within a lead upto 5 km.
- iv. Should the bottom of any excavation appear to be soft, unsound or unstable, the successful Bidder shall excavate the same to required depths and the extra depth shall be filled up by the successful Bidder with lean concrete of grade M-5B or such other materials as in writing.
- v. Every precaution shall be taken by the successful Bidder against slips and falls in the excavation. No extra payment will be made for removal of slips and falls and for back filling the space with the materials as directed by the purchaser.
- vi. The excavation shall be kept free from water by pumping. Water may be bailed out from small pits with buckets. However, pumping of water shall be carried out from bigger excavation pits either directly from the excavation or from sumps made outside the excavation as directed. Adequate care shall be taken to prevent movement of water through freshly laid concrete or masonry work.

- vii. If any excavation for foundation gets filled up with water due to rain, seepage or for any reason, the water shall be removed and bottom of the excavation shall be completely cleared of all silt/slush by the Bidder at his own expense.
- viii. All water pumped or bailed out during de-watering of pits and trenches shall be disposed off suitably through properly laid channels or pipes. Disposal of water shall be carried out in such a way that no inconvenience or nuisance is caused to the work in progress in the area or to other agencies working in the area or cause damage to property and structures nearby.

c. Back Filling

i. Materials

Suitable materials obtained from excavation of foundations shall be used as far as possible for back filling. If sufficient amount of suitable materials are not available at site to complete filling work, then earth shall be brought to site from outside by the successful Bidder as directed by the Engineer-in-Charge.

ii. Filling around foundations with earth

Before commencement of back filling, the successful Bidder shall remove from the space around foundations all accumulated water and slush, shoring and formwork, all debris, brickbats, bits of timber, cement bags and all other foreign materials. Filling shall be carried out in uniform horizontal layers, each layer not exceeding 200 mm in thickness. Each layer shall be watered, rammed, and thoroughly compacted before the next layer is deposited.

iii. Plinth filling and special compaction with earth

Plinth filling or filling where special compaction is required shall be carried out in uniform horizontal layers, each layer not exceeding 150 mm in thickness. Each layer shall be well watered and compacted by mechanical means. The successful Bidder shall take core samples for each layer, determine the dry density and maintain logs. The minimum dry density to be achieved shall be 95% of maximum dry density as obtained by Standard Proctor Test. Tests shall be conducted by the successful Bidder as directed by the Engineer-in-Charge at his own cost.

iv. Removal of heaps & Mounds

Immediately upon completion of each phase of work, the successful Bidder shall at his own cost clear the mounds or heaps of earth which may have been raised or made and remove all earth and rubbish which may have become surplus in the execution of works, as directed.

v. Filling with sand

Filling with sand shall be carried out in uniform horizontal layers, each layer not exceeding 200 mm in thickness with approved river sand and each layer to be watered and compacted mechanically to a well compacted

mass.

3.5.6.4. Plain And Reinforced Concrete Work

a. Materials

i. Cement

Ordinary Portland cement shall conform to IS:8112-1989 and Portland blast furnace slag cement shall conform to IS:455-1989. Soundness test is to be carried out on cement samples from time to time. Frequency of these tests shall be increased during monsoon period as per direction of engineers.

ii. Aggregates

All aggregates shall conform to IS: 383-1970. Fine aggregates shall be approved river or pit sand. Coarse aggregates shall be approved crushed stone. Aggregates shall be clean and free from any foreign material. Test on aggregate shall be carried out from time to time to ascertain the suitability of the aggregates. The frequency of such test shall be as per direction of engineer.

iii. Reinforcement

Reinforcement in general shall be of tested quality. Thermo-mechanically treated steel bars conforming to IS: 1786-1985 shall be free from oil paint and rust coatings. The binding wire shall be 20 SWG approved annealed iron wire.

iv. Jointing materials

All rubber and PVC water stops joint fillers, sealing materials etc. used in concrete work shall be of standard manufacture as per relevant IS codes and/or as approved by the Engineer. Usage of these materials shall be in accordance with the manufacturer's instructions.

v. Admixtures

Admixtures, if permitted to be used, shall be of approved quality and make and shall conform to relevant IS codes. The extent, type, method of use and control shall be subject to approval of the Engineer-in-Charge in all cases.

vi. Water

Water shall be clean and of potable quality as per provisions of IS: 456-2000.

b. Workmanship

i. Concrete

Production and control of concrete shall be as per IS: 456-2000. The grades of concrete shall be as indicated in the drawing. The successful Bidder shall at his own cost, grade the aggregates and control the water cement ratio, design the different mixes to required strength and workability, and obtain Engineer's approval for the same. The designed

mix shall conform to the requirement of IS: 456-2000 and recommended guidelines in SP: 23-1982. The minimum cement content and maximum water cement ratio of concrete work shall conform to the requirements of durability of concrete for moderate exposure as indicated in Table-5 of IS: 456-2000. All concrete shall be machine mixed, and no hand mixing shall be permitted.

The maximum size of aggregates used shall be as indicated in the drawings and IS: 456-2000. Where reinforcement is too closely spaced for the maximum size of stone in a range, the largest suitable range shall be used. Before commencement of work, the Bidder shall submit to the Purchaser for his approval complete details of the tests for design mixes together with the grading analysis and mix design calculations. No concrete shall be placed on site until the Purchaser has approved the mix design.

Where nominal mixed concrete as defined by IS: 456-2000 is permitted by the Engineer-in-Charge for any specific reason, the proportion of the materials shall be as indicated in IS:456-2000. The water cement ratio shall not exceed those specified in IS: 456-2000. If the quantity of water is required to be increased for better workability, the cement content also shall be increased proportionately so that the water cement ratio as specified in IS: 456-2000 is not exceeded.

ii. Mixing

Except where nominal mix concrete as defined in IS:456-2000 is permitted by the Engineer to be used, all components of concrete shall be proportioned by weight using weigh batches for each grade of concrete. Mixing shall be carried out in mechanical mixers and preferably a batch mixing plant shall be used. Batches shall not exceed the capacity which can be mixed efficiently as determined by the mixer efficiency test and peripheral speed shall conform to the manufacturer's recommended rate but should not vary by more than +10%. Mixing shall continue until the mass is uniform in colour and consistency but in no case net minimum mixing time shall be less than 1.5 minutes. Net minimum mixing time shall begin when all ingredients including water is in the mixer. Excessive mixing shall be avoided. Mixers shall be operated only by trained operators. Weigh batches shall be placed level during use and the hoppers shall be loaded evenly.

iii. Consistency

Consistency of concrete shall be controlled as per IS: 456-2000 and the successful Bidder shall carry out slump tests in accordance with IS: 1199-1959.

c. Work tests

Over the full period of construction, the successful Bidder shall carry out works tests of concrete cubes at his own cost. Sampling, making up, curing and testing of specimen shall conform to IS: 456-2000, IS: 516-1959 and IS:1199 -1959. The number of specimen to be tested and their criteria for

acceptance shall be according to IS: 456-2000. Frequency of work tests shall be as indicated below:

- d. Frequency of tests
 - i. The frequency of tests shall be as per IS:456-2000.
 - ii. The test cubes shall be taken in presence of the Engineer/Employer's representative, who will also sign the record of testing in a pro-forma to be agreed between purchaser & successful Bidder.
 - iii. For testing of cube specimens, successful Bidder shall transport the specimen to the testing laboratory and the cost of testing of cubes will be fully borne by him.
- e. Reinforcement
 - i. Workmanship shall conform to IS: 2502-1963. All reinforcement shall be free from loose mill scale, rust, oil, grease and paint, etc. Reinforcement shall not be bent or straightened in a manner that will injure the material, and all bars shall be bent cold.
 - ii. Reinforcement bars shall be placed and maintained accurately in the position as shown in the drawings. The correct cover to the reinforcement shall be maintained by use of pre-cast concrete blocks.
 - iii. All intersections of longitudinal and transverse bars of stirrups and all laps shall be securely tied together with approved binding wire. The binding wire shall be so placed that it touches all the four corners of the intersection and the two ends shall be looped with pliers and the end should be turned into the body of the concrete.
 - iv. Welded joints may be used with prior approval of the Engineer-in-Charge, but in all cases of important connections tests shall be made at the cost of the successful Bidder to prove that the joints have reached the strength of the bars connected. Welding shall be done in accordance with IS: 2751-1979 and special precautions shall be adopted for cold worked bars. Butt-welding between the ends of a rod in line, whereby stress is transferred across the section may be adopted only for mild steel bars. In case of tack welding for fixing reinforcements in their position, no special precautions need to be taken.
- f. Embedments
 - i. All embedment shall be accurately set and rigidly fastened. Anchor bolts shall be set to template and firmly secured in vertical and horizontal line at required positions. Water stops shall be secured against displacement during the placing of concrete. The joints for G.S. sheet water stops shall be soldered watertight and those of PVC and rubber shall be joined by cementing and vulcanizing. Expansion joint fillers shall be for the full depth of slabs or full width in walls and shall be cemented with bituminous cement against previously placed concrete. The ends shall be butted tight and the upper edge set flush with finished slabs.
 - ii. Anchor holes and anchor bolts shall be protected by covering suitably

with brickwork in lean cement mortar after thorough cleaning.

g. Placing of concrete

i. Transporting concrete

Concrete shall be transported from the mixing plant to the forms as rapidly as possible by means that will prevent segregation or flash set in the concrete during hot weather. The containers shall be such as to prevent large evaporation.

ii. Placing

Concrete shall be placed within a maximum period of 25 minutes of its removal from mixer.

iii. Curing

Curing of concrete with water shall comply with IS: 456-2000. The successful Bidder shall keep the exposed surfaces of concrete in a constantly wet condition for at least 7 days from the date of placing the concrete. Curing compound may be used subject to approval by the Engineer. Finished floor and concrete shall be protected carefully until completely set. Protection of concrete against extreme weather conditions shall comply with the Code.

h. Construction joints

Construction joints shall be located such that they do not impair the strength of the structure and prior approval of the Engineer shall be taken. In walls and columns, height of each lift shall not generally exceed 1.5 m unless otherwise specified in the drawings or directed by the Engineer. Method of forming all construction joints shall conform to the provision of IS: 456-2000. All construction joints in the underground structures shall be provided with rubber or PVC water bars. The surface of previously placed concrete at the construction joint shall be thoroughly hacked to expose the coarse aggregates of previously placed concrete and cleaned with wire brush and water to remove all laitance. Immediately before placing fresh concrete, such prepared surface shall be coated with a thin layer of cement slurry.

i. Expansion joints

Expansion joints shall be provided at locations as shown in drawings or as per IS code. Details of expansion joints shall be as shown in the drawing and all materials like bitumen impregnated fiber board, PVC water bar, aluminum foil etc. shall be of approved make and quality. The successful Bidder shall ensure that all expansion joints are 100% watertight.

j. Compaction

Concrete in general shall be consolidated by vibration using high frequency mechanically driven vibrators. Concrete shall be placed in layers at least 300 mm deep in walls and approximately 450 mm in mass pours. Vibrators shall not penetrate more than 50 mm into the surface of previously placed layer but shall completely vibrate the working layer. Care shall be taken not to over vibrate any concrete and especially those with higher slumps. Under

no circumstances vibrator shall be attached to or allowed to touch reinforcement. Spare vibrators in good operating condition shall be in hand during placing operations.

k. Grouting bases of machine, columns, foundation bolts, etc.

i. Level pads

For preparing the level pads, the top of the foundation concrete shall be chipped off to remove laitance formed on the concrete surface, and all loose materials shall be thoroughly cleaned and the surface wetted before the grouting. In case level pads are constructed they shall be of cement concrete with one grade higher than the mother concrete with 6mm nominal size stone aggregates in conformity with the grouting requirements with 6 mm size ballast. The top of the level pads shall be finished & fine and true to level.

ii. Grouting

Before placing the grout, the concrete surface shall be thoroughly cleaned, preferably with compressed air and the surface shall be thoroughly wetted with water for several hours. Grout concrete shall be of non-shrink stranded ready mixed cement based grout of approved make as per item of work/drawing. The grouting shall be prepared and placed as per manufacturers' instructions. Before placing the grout all free water shall be removed and the flat surface shall be coated with thin cement slurry.

The quantity of mixing water shall be minimum commensurate with the workability, compaction, and filling of the grout in all corners and crevices. The grout shall be evenly spread and compacted by rodding or a vibrator until the whole of the space is completely filled with concrete. The grout shall be carefully observed for initial settlement. If any settlement is observed, further grout is to be poured and rodded.

For base plate having ribs underside the base plate, proper care is to be taken to ensure filling of the cavities between the ribs.

In case of wide base plates or bedplates having ribs underside, it may be necessary to do pressure grouting.

iii. Curing

The grout must not dry out after it is placed in position. The surface shall be kept moist with wet sacks for at least seven days.

l. Repairing and patching

Pockets, honey combing and other defects which may be formed due to segregation, improper vibration and any other reason whatsoever shall be completely repaired to the satisfaction of the Engineer. The voids, if any, shall be properly keyed and reinforced, if necessary. The face shall be tightly formed and arranged for providing a head in the concrete. The cavities shall be filled with the same concrete as used for the structure and thoroughly rodded or vibrated where possible. The filled hopper shall be left

in place until shrinkage has taken place and the concrete sets sufficiently to stay in place. While still `alive', the upper part of form hopper shall be removed and excess concrete struck off and finished with wooden flat or trowel to match existing concrete. Any fins or unsightly grout runs or bulges shall be removed from the surfaces exposed to view. The rod holes shall be finished with cement or grouted to match the existing surface as closely as possible. No cement wash shall be used unless particularly called for in the drawings.

m. Tolerances

Tolerance is a specified permissible variation from lines, grades or dimensions given in drawings. No tolerances specified for horizontal or vertical building lines or footings shall be construed to permit encroachment beyond the legal boundaries. Unless otherwise specified, the tolerances as per IS:456-2000 shall be followed.

4.0 **PERFORMANCE GUARANTEE TEST**

4.1 **GENERAL**

The chapter should be read along with SBD (Standard Bidding Document), other tender documents and all relevant clauses in different chapters pertaining to Performance Guarantee.

4.2 **PERFORMANCE GUARANTEE TEST**

4.2.1 After successful commissioning, the Bidder shall give a notice to the Employer for conducting Performance Guarantee (PG) Tests. PG Tests shall be conducted after putting the integrated system into operation for at least 15 (fifteen) consecutive days for observing its performance for its capacity and trouble free operation.

4.2.2 In case there is no fault observed in the system operation during this period, PG tests will be conducted as stipulated in subsequent clauses of this tender document.

4.2.3 PG tests shall be carried out during 3 consecutive general shifts in the plant/unit.

4.2.4 **Pre-conditions**

4.2.4.1 The Successful Bidder will arrange necessary instruments, tools, tackles, consumables, personnel and other facilities required for conducting PG tests and supervise operations from the start until end of PG tests and shall take full responsibility of the operations.

4.2.4.2 The Employer shall make available necessary utility, power, etc. for conduction of P.G Test.

4.2.5 **Test Methodology & Performance Guarantee Values**

4.2.5.1 Protocol for conducting the PG test shall be prepared by the Successful Bidder in consultation with Employer and approval of the same shall be obtained before start of the PG test.

4.2.5.2 The Successful Bidder shall provide, install and calibrate all measuring instruments required for checking the PG parameters except those which are included among the permanent measuring instruments of the unit / sub-units. Evaluation report shall be prepared jointly in the agreed format and signed by the Employer and the Bidder.

4.2.5.3 The Successful Bidder shall demonstrate and achieve the performance guarantee (technological) parameters as specified in subsequent clauses.

4.2.5.4 The performance values to be guaranteed, maximum deviations from guaranteed values acceptable with LD and the percentage of LD in case of applicability are indicated in the table below:

S. No	PG Parameter	PG value	Acceptable limit with LD	Rate of LD (% of contract value)
1.	TSS level in filtered water	5.0 ppm	N/a. Plant will be rejected if PG value exceeds 5.0 ppm	N/A

4.2.6 Evaluation of PG parameters

PG parameters, as listed in the table above, shall be measured during the PG test. The data shall be compiled and analyzed for calculating actual values. These values shall be obtained from 3 consecutive shifts and the average of them taken which shall be compared with the PG values given as in **Clause No. 4.2.5.4.**

The methodology of measurement and calculation of actual values shall be agreed upon beforehand between the Successful Bidder and Employer.

Non achievement of PG parameters shall be dealt with as per contract provisions stipulated in SBD and this tender document.

4.2.7 The points which have not been covered in this chapter, but found necessary to conduct PGT, shall be mutually agreed before start of the PGT between Employer and Successful Bidder.

4.2.8 If for reasons for which the Successful Bidder is responsible and is unable to achieve the PG parameters as a whole or in part during the performance test, the test will be repeated. Before repeating the test, the Successful Bidder shall take any and all measures as may be needed at his own cost in order that the PG parameters can be achieved.

4.2.9 All the defects noticed during PGT shall be rectified by the Successful Bidder to the full satisfaction of the Employer without any extra cost to the Employer. The work shall not be taken to be finally accepted till all the defects are rectified by the Successful Bidder within one month to the satisfaction of the Employer.

4.2.10 If, even with repetitive tests and if necessary, by using additional operating personnel from the Bidder at his own expense, the PG parameters are not achieved for reasons within the Bidder's scope / responsibility, the Bidder shall undertake at his own cost such modification or replacement as are considered necessary to achieve the PG parameters. The responsibility to achieve PG parameters shall continue to remain with the Bidder till these are established. For carrying out rectification work for achieving the PG parameters, the Bidder shall do so without hampering the normal production/work. The rectification work will be carried out on a mutually agreed basis.

5.0 SPECIAL INSTRUCTIONS TO BIDDERS

5.1 GENERAL

- 5.1.1 1 no. soft copy of complete offer shall be submitted alongwith hard copies of the Bid.
- 5.1.2 All materials / equipment / machinery / fabricated items used in the subject package shall be according to the specification given herein and any deviation should be clearly brought-out in the offer. No mention of deviation will mean that the Bidder has accepted the specification given herein.
- 5.1.3 The Bidder shall include in his supply a complete new and unused set of all special tools & tackles required for operation and maintenance of the plant/equipment offered.
- 5.1.4 The equipment broadly described under the scope of work shall be located generally as per Drawing enclosed with the bid. The scope of TS as described in Chapter 2 & 3 covers mainly principal items for the guidance of the Bidder. The specifications given in Chapter-3 are for indicative purposes only.
- 5.1.5 The plant and equipment supplied shall be new and best of its kind and of latest technology. All materials and equipment shall comply with latest codes and standards, applicable nationally / internationally. A consolidated list of all codes and standards followed or adopted for design, manufacture and testing shall be submitted. Preferably, all equipment and accessories shall conform to the latest Indian Standards and IPSS wherever applicable. All electrical equipment supplied shall be designed, manufactured, tested & erected as per the latest revision of Indian Electricity Rules, Statutory requirements of the Govt. of India, Govt. of State. In the event of requirement of TS exceeding the requirement of corresponding standards, regulations & safety codes, the specification provided in the TS shall govern. In the event of conflict between standard regulation & TS, the most stringent shall be applied.
- 5.1.6 All equipment as may be necessary shall conform to the provision of Statutory and other Regulations in force such as Indian explosives Act, Indian Factories Act, Indian Boiler Regulation, State Factories Act, Central Pollution Control Board, Indian Weights & Measures Act, etc. The Successful Bidder shall take necessary steps to get all the installations within his scope of supply approved by the concerned legal authorities.
- 5.1.7 The Bidder shall use new, good and tested quality materials. The workmanship shall be of high quality.
- 5.1.8 Layout of plant and equipment shall have provision for easy and safe movement of operation / maintenance personnel for operation / inspection of the running plant. Adequate space for dismantling / removal of equipment / parts for repair shall also be built in the layout. All working parts of the equipment shall be easily accessible and maintainable. There should be a proper arrangement for convenience of operation, inspection, maintenance, replacement & repair. Fast wearing parts shall be accessible for replacement/maintenance without necessitating removal of other parts. All like parts of the equipment supplied shall be inter-changeable.
- 5.1.9 After erection, all equipment, pipes, structures, etc., shall be thoroughly cleaned and painted with one coat of primer and two coats of approved colour

paints. Paints shall be of good quality and shall be strictly as per instructions and recommendations of the paint manufacturer and to the approval of Employer. Painting in damp or foggy weather shall not be resorted to. Painting specification and procedure shall be subject to the Employer's approval.

- 5.1.10 Execution of entire work shall be carried out in such a manner that normal working of the existing plant is not interrupted. Shut downs, for mutually agreed periods shall be arranged by the Employer for interconnections / modifications / extensions of existing facilities.
- 5.1.11 Testing shall be done as per relevant latest Indian Standards/ International codes or practices and shall include electrical, mechanical and chemical tests including performance tests and test certificates for the same shall be submitted for Employer's approval prior to dispatch.
- 5.1.12 The Successful Bidder shall obtain written approval/clearance from the Employer at each stage or before start of the next stage of site work. The Bidder with the approval of the Employer shall decide the stages.
- 5.1.13 The Successful Bidder shall ensure deputation of well experienced engineers and technical staff from various disciplines including mechanical, technology, refractory electrical, instrumentation, automation and process control (as per requirement) for erection, testing and commissioning of plant and equipment.
- 5.1.14 All the manufacturing / fabrication works shall be carried out only on the basis of approved drawings and arrangements or as directed by the Employer. It is solely the responsibility of the Successful Bidder to ensure that all working drawings prepared by him bear the stamp of approval of the Employer / his consultants prior to start of work. All other drawings shall bear the acceptance stamp of Employer / his consultant for execution of the project.

5.2 **DRAWING/DOCUMENTS/DATA TO BE FURNISHED**

- 5.2.1 The offer shall be accompanied with various layout drawings showing the major equipment and auxiliaries, details of services & facilities.
- 5.2.2 The Bidder shall submit along with the bid, 10 sets of the drawings / documents / data and 1 no. soft copy as per the following details:
- 1 General arrangement drawings of all units, equipment and systems showing sections of equipment and systems with overall and relevant dimensions.
 - 2 All schedules duly filled in as mentioned in this TS and enclosed herewith
 - 3 Manufacturers' catalogues/ brief technical descriptions of offered equipment and bought-out items.
 - 4 Delivery/ commissioning schedule (Bar chart/PERT Network).
 - 5 Details of technical capability of Bidder.
 - 6 SLD of LT power distribution giving full details of drive list, connected load and maximum demand of offered system.
 - 7 Any other details which may be felt necessary.
 - 8 The Bidder shall note that above drawings & documents listed are minimum requirement only. The Bidder shall ensure that all other necessary write-ups, graphs and information, required to fully describe the equipment and system offered, are submitted with this offer.

- 5.2.3 The drawings/ document submitted by the Successful Bidder shall be reviewed & commented (or approved) by Employer within 15 days of receipt of such drawings/ document. Successful Bidder shall incorporate all the comments and resubmit in 10 copies to the Employer within 10 days time from the date of Employer's comments.
- 5.2.4 Approval given by the Employer shall not relieve the Bidder of his obligations under the contract.
- 5.2.5 Drawings/Document submitted by the Successful Bidder shall be thoroughly checked and signed by him before submission. All reference drawing numbers, including Employer's existing drawing number if any, must be mentioned in each drawing submitted for approval. The drawings shall be complete with Bill of Material.
- 5.2.6 Editable format soft copies on CD/DVD of all approved drawings, “**As-Built**” drawings and manufacturing drawings of critical parts, spares and fast wearing parts shall be supplied.
- 5.3 **TIME SCHEDULE/PROJECT COMPLETION**
- Level-II Network (to be submitted as activity on arrow) shall be updated by the Successful Bidder every month and detail status/ delay analysis shall be submitted to the Employer along with the Monthly Progress Report. The software for preparation of network shall be discussed and decided mutually.

STEEL AUTHORITY OF INDIA LIMITED

CENTRE FOR ENGINEERING & TECHNOLOGY

**LIST OF ACCEPTABLE MAKES
OF EQUIPMENT & SUPPLIES**



**STEEL AUTHORITY OF INDIA LIMITED
CENTRE FOR ENGINEERING & TECHNOLOGY
RANCHI - 834002**

SEPTEMBER 2014

PREAMBLE

This document “ACCEPTABLE MAKES OF EQUIPMENT AND SUPPLIES” is only for **indigenous supplies only** and is a part of the Tender Specification for various packages.

The ‘Makes’ of various equipment and supplies are listed out in this document. It is essential that the equipment/component/materials to be supplied indigenously by the Bidder will be of any one of the makes listed against that particular equipment/component/material in this document.

A. ELECTRICAL

SL.NO.	ITEMS	MAKE
I	HIGH VOLTAGE (33 kV & above)	
1.	33 kV Indoor Switchgear	ABB, SIEMENS, SCHNEIDER(ALSTOM), CGL
2.	33 kV/ 132 kV/ 220 kV Gas Insulated Switchgear	ABB, SIEMENS, ALSTOM, CGL
3.	33kV/ 132kV/ 220 kV outdoor Isolator/ Disconnecting Switch	CGL, HIVELM, SIEMENS (ELPRO), AREVA, ALLIANCE, GR POWER
4.	33kV/ 132kV/ 220 kV outdoor Switchgear	ABB, SIEMENS, BHEL, SCHNEIDER(ALSTOM), CGL
5.	33kV/ 132kV/ 220 kV outdoor CT/ PT	BHEL, AREVA, CGL, SIEMENS, ABB, MEHRU(AE), ECS
6.	33kV/ 132kV/ 220 kV outdoor Lightning Arrestor	AREVA, BHEL, CGL, SIEMENS (ELPRO), OBLUM
7.	33kV/ 132kV/ 220 kV outdoor Insulator & Bushing	WSI, MODERN, AREVA, BHEL, CGL, ADITYA-NUO, CJI
8.	33kV/ 132kV/ 220 kV ACSR Conductor	APAR, CABCON, STERLITE
9.	33kV/66kV/132kV/ 220 kV cable XLPE	KEC (RPG), KEI, CCI (Cable Corporation of India), UNIVERSAL, GLOSTER (only 33 kV), NICCO (only 33 kV)
10.	33kV/ 132kV/ 220 kV STJ/ Termination kit	RAYCHEM, CCI (Cable Corporation of India), KABELDON
II	MEDIUM VOLTAGE – INDOOR (3.3 kV to 11kV)	
1.	Switchgear	ABB, ANDREW YULE, AREVA, BHEL, CGL, JYOTI, SIEMENS
2.	CT & PT	ABB, AEL, INTRAVIDYUT, JYOTI, KAPPA, PRAGATI, PRAYOG, PRAGATI, SIEMENS, A BONDSTRAND, ABB, DRESCHER PANICKER, SIEMENS
3.	Isolator	A BONDSTRAND, ABB, DRESCHER PANICKER SIEMENS, MEGAWIN
4.	Vacuum Contactor	AB B, SCHNEIDER(ALSTOM), ANDREW YULE, GE, JYOTI, SIEMENS
5.	Peterson coil/ Earth fault monitoring system	E BEARLEY, TRENCH

SL.NO.	ITEMS	MAKE
6.	HT Bus duct	ECC, STAR DRIVE, L&T
III	PROTECTION & METERING	
1	Protective Relays with SCADA	ABB, SCHNEIDER(ALSTOM), SIEMENS, GE
IV	LT SWITCHGEAR	
1.	Power control centre (PCC):	ABB, GE, L&T, SCHNEIDER, SIEMENS
2.	Motor control centre (MCC) up to 1000 a	ABB, GE, L&T, SCHNEIDER, SIEMENS, BCH, C&S, MEDITRON, SEN & SINGH, SWITCHING CIRCUITS HAVELLS
3.	Motor control centre (MCC) above 1000 a	ABB, GE, L&T, SCHNEIDER, SIEMENS, C&S, BCH
4.	Air circuit breaker (ACB):	ABB, GE, L&T, SCHNEIDER, SIEMENS
5.	Moulded case circuit breaker (MCCB): (with positive isolation)	ABB, BCH, GE, L&T, SCHNEIDER, SIEMENS, C&S, HAVELLS
6.	Contactors:	ABB, GE, BCH, L&T, SCHNEIDER, SIEMENS, C&S
7.	Control switches	ABB, BCH, EPCC, KAYCEE, L&T, SIEMENS, GE POWER
8.	Overload relays	ABB, ANDREW YULE, BCH, L&T, SIEMENS, SCHNEIDER, GE, ROCKWELL, C&S
9.	IT bus duct	ECC, STAR DRIVE, LOTUS POWER, L&T
V	Illumination	
1.	Lighting fixtures	BAJAJ, CROMPTON GREAVES, GE LIGHTING, HAVELLS, PHILIP S, SURYA, WIPRO
2.	Socket outlet	BCH, BEST & CROMPTON, CGL, SCHNEIDER, HAVELLS
3.	Miniature circuit breaker (MCB)	HAVELLS, INDO KUPP, LEGRAND(MDS), S&S, SCHNEIDER, STANDARD, C&S
VI (A)	TRANSFORMER	
1.	Upto 33 kV	ABB, SCHNEIDER, BHARAT BIJLEE, BHEL, CGL, EMCO, KIRLOSKAR ELEC.COMPANY, SUDHIR TRANSFORMERS(INTRA, VIDYUT), VOLTAMP, SIEMENS
2.	Above 33 kV	SCHNEIDER(ALSTOM), BHARAT BIJLEE, BHEL, CGL, TELK, SIEMENS
3.	Dry type	CGL, KIRLOSKAR ELECTRIC COMPANY, SUDHIR TRANSFORMERS(INTRAVIDYUT), VOLTAMP, ABB, BHEL
VI (B)	REACTOR	PS ELECTRICALS, QUALITY POWER, ALSTOM

SL.NO.	ITEMS	MAKE
VII	AUTOMATION	
1.	Programmable logic controller (PLC)	ABB, GE, ROCKWELL AUTOMATION, SCHNEIDER SIEMENS
2.	Variable frequency drive (VFD)	ABB, DANFOSS, HITACHI-HIREL, ROCKWELL, AUTOMATION, SCHNEIDER, SIEMENS, L&T, (YASKAWA), VACON
3.	Thyristor Converter:	ABB, L&T, SIEMENS, ROCKWELL AUTOMATION
4.	Soft starter	ABB, ROCKWELL AUTOMATION, SCHNEIDER, SIEMENS
5.	FCMA /series reactor type softstarter	INNOVATIVE TECHNOMICS, JAYSHREE
6.	Un-interruptible power supply (UPS):	EMERSION (DB POWER ELECTRONICS), HITACHI-HIREL, SIEMENS,GE, SCHNEIDER(APC)
VIII	MOTORS	
1.	HT – AC	ABB, MARATHON, BHEL, CGL, GE, KIRLOSKAR, ELEC.COMPANY, SIEMENS, WEG
2.	LT – AC	ABB, AREVA, BHARAT BIJLEE, CROMPTON, KIRLOSKAR, SIEMENS, MARATHON
3.	DC	BHEL, IEC, KIRLOSKAR ELEC. COMPANY
IX	CABLES	
1.	HT(up to 11kv)	CCI, GLOSTER, NICCO, RPG CABLES (ASIAN), UNIVERSAL, KEI, HAVELLS
2.	LT power & control:	CCI, GLOSTER, NICCO, POLYCAB, RPG CABLES (ASIAN), UNIVERSAL, KEI, HAVELLS
X	MISCELLANEOUS	
1.	Battery charger	AEL, AMAR RAJA, APLAB, CALDYNE, CHABI, ELECTRICALS, NELCO, SABNIFE(HBNIFE POWER SYSTEM), STANDARD
2.	Battery bank	AMAR RAJA, AMCO, CHLORIDE (EXIDE), SABNIFE STANDARD
3.	Master controller	AG MECH, EPCC, KAYCEE, L&T, SIEMENS, STROMKRAFT
XI	GENERATOR	BHEL, TOYO DENKI, ABB, SIEMENS
XII	AVR	BHEL, TOYO DENKI, ABB, SIEMENS

SL.NO.	ITEMS	MAKE
B. INSTRUMENTATION & AUTOMATION		
I. FIELD INSTRUMENTATION		
1.	Capacitance type Smart Transmitter	EMERSON, IL, FUJI, E&H, HONEYWELL, SIEMENS, YOKOGAWA
2.	Solid State/ Silicon Resonant type Smart Transmitter	ENDRESS & HOUSER, YOKOGAWA, FUZI, HONEYWELL, IL, SIEMENS, ABB, EMERSON
3.	RTD / Thermocouple	TEMPSEN, PYROELECTRIC, NAGMAN, DETRIV, TOSHNIWAL
4.	Temperature Transmitter	EMERSON, HONEYWELL, ABB, FUJI, YOKOGAWA, SIEMENS, E&H
5.	Pressure / DP switch	SWITZER, DANFOSS, ASHCROFT, INDFOSS, WIKA
6.	Tuning Fork type Level Switch	ENDRESS & HOUSER, VEGA
7.	RF Capacitance type Level Switch	ENDRESS & HOUSER, VEGA, NIVO CONTROL
8.	Float type Level Switch	LEVCON, TRAC, ENDRESS & HOUSER, NIVO CONTROL, WAREE
9.	Ultrasonic / Radar Type Level Instrument	ENDRESS & HOUSER, VEGA, SIEMENS, EMERSON, KROHNE MARSHALL
10.	Electro Magnetic Flow meter	EMERSON, YOKOGAWA, ENDRESS & HOUSER, SIEMENS, KROHNE MARSHALL
11.	Rotameter	ROTA INSTRUMENTS, PLACKA, FORBES MARSHALL, KROHNE MARSHALL
12.	Flow Elements	IL, ENGG SPECIALTIES, EMERSON, UNICONTROL
13.	Annubar	ENGG SPECIALTIES, EMERSON, SWITZER
14.	Radiation Pyrometer (Spot & Scanning)	LAND, IRCON, CHINO, RAYTEK, NAGMAN
15.	Orifice Plate, Venturi, Flow Nozzle	IL, EMERSON, ENGINEERING SPECIALITIES, MICRO PRECISION, UNI CONTROL
16.	Pressure Gauge	BUDENBERG, ANI, WIKA, FIEBIG, WAREE, SWITZER, ASHEROFT, FORBES MARSHALL
17.	Temperature Gauge	ANI, WAREE, WIKA, FIEBIG, SWITZER, GE, FORBES MARSHALL
II. CONTROL VALVES		
1.	Globe Valve	IL, FISHER, KOSO, SAMSON, FORBES MARSHALL
2.	Butterfly Valve	IL, FISHER, KOSO, DELVAL
3.	Pneumatic Actuator	IL, KOSO, SAMSON, OM CONTROL, ROTEX, FORBES MARSHALL, DELVAL
4.	Electro-hydraulic Actuator	REINEKE, VOITH, REXA
5.	Electrical Motor Actuator	BHEL, BERNARD, ROTORK, AUMA
6.	I/P Converters	FORBES MARSHALL, ABB, FISHER, EMERSON, HONEYWELL, MARSH BELLOFRAM, YOKOGAWA,

SL.NO.	ITEMS	MAKE
		SIEMENS
7.	Solenoid Valve	ROTEX, SCHRADER SCHOVILL, ASCO, HERION, BURKERT
8.	Fittings	SWAGLOK, PARKER
9.	Air Filter Regulator	SHAVO NORGREN, PLACKA, DELAIR, SCHRADER SCHOVILL
III. CONTROL SYSTEM EQUIPMENT		
1.	Signal Isolator	P&F, MTL, STAHL, YOKOGAWA, PHOENIX, MASIBUS
2.	Zenner Barrier	P&F, MTL, STAHL
3.	Distributed Control System	YOKOGAWA, EMERSON, TOSHIBA
4.	PLC with DCS Feature	SIEMENS (PCS7 SERIES), ABB (800 XA), HONEYWELL (C300 Experion), ROCKWELL (PLANT PAX)
5.	PLC for Process Control	SIEMENS, ROCKWELL, ABB, GE, SCHNEIDER
6.	Technological Control System/ Multi Tasking Control System/ Embeded Control System	SIEMENS, SMS, DANIELI, GE, ABB, TMEIC
7.	DAS	YOKOGAWA, EURO THERM, EMERSON, HONEYWELL
8.	SCADA	RS View, WONDERWIRE, WIN CC, INTELLUTION, EXPERION, CITECT, I FIX
9.	PDA	IBA, DANIELI, LMS, SOMAT
10.	Panel / Encloser / Rack	RITTAL, HOFFMANN, SIEMENS, APW PRESIDENT, VALRACK, PYROTECH
IV. PANEL BASED INSTRUMENTATION		
1.	Digital Indicator/ Scanner	YOKOGAWA, HONEYWELL, ABB, MASIBUS, PYROTECH, CHINO
2.	Bargraph Indicator	YOKOGAWA, HONEYWELL, MASIBUS, TOSHIBA, PYROTECH, CHINO
3.	Single Loop Stand Alone Controller	YOKOGAWA, HONEYWELL, FUJI, TOSHIBA, ABB, SIEMENS
4.	Paperless Recorder	YOKOGAWA, HONEYWELL, CHINO, LAXONS, FUJI
5.	Alarm Annunciator	IIC, IL, MINILEC, PROCON, SEMUDA
6.	Flow Totaliser	YOKOGAWA, HONEYWELL, MASIBUS, PYROTECH
7.	Regulated DC Power Supply Unit / SMPS	APLAB, COSSEL, PHOENIX, SIEMENS
8.	UPS	EMERSON, GE, NUMERIC, APC
9.	UPS (Non Industrial less than 2.5KVA)	EMERSON, APC, HITACHI
10.	SMF Battery	EXIDE, OMRON, PANASONIC, FURUKAWA, AMAR RAJA, HBL NIFE

SL.NO.	ITEMS	MAKE
V. ANALYSERS		
1.	Gas Analyser	ABB(H&B), EMERSON, YOKOGAWA, AMETEK, PANAMETRICS, SIEMENS, FUJI, CHEMTROL, HONEYWELL, FORBES MARSHALL
2.	Gas Detector	BEILER & LANG, DRAGGER, MSA, OLDHAM, DETRONICS, INDUSTRIAL SC. CORPN
3.	Flame Detector	HONEYWELL, DURAG, YAMATAKE, ENDEE
4.	Moisture Analyzer (Nucleonic)	CONCORD, EMERSON, THERMO FISHER, CHINO
5.	Moisture Analyzer (IR Type)	MOISTECH, NDC (EMC), CHEMTROL
6.	Opacity Analyser	CODEL, SICK MAIHEK, DURAG, FUJI, CHEMTROL
7.	Calorific Value Analyser	UNION CALORIMETER, REINEKE, YOKOGAWA
8.	pH / Conductivity / ORP Analyser	EMERSON, YOKOGAWA, E&H, FORBES MARSHAL
9.	SOX / NOX Analyser	EMERSON, YOKOGAWA, SIEMENS, ABB, HONEYWELL, SICK MAIHEK, FORBES MARSHAL
VI. WEIGHING		
1.	Electronic Weighing System (Hopper Weighing/ Platform/ Scales/ In-motion W.B.)	TRANSWEIGH, ABB, SCHENK, SARTORIUS, KELK, PRECIA MOLEN, RICELEK
2.	Belt Weigher/ Weigh feeder System	SCHENCK, SIEMENS (MILTRONICS), FLSMIDH PFISTER, PRECIA MOLEN
VII. MILL INSTRUMENTATION		
1.	Thickness Gauge	TOSHIBA, THERMO ELECTRON, IRM, IMS, MESACON
2.	Hot Metal Detector	TOSHIBA, DELTA, DANIELI, SICK
3.	Width Gauge	TOSHIBA, THERMO ELECTRON, PSYSTEME, ABB, DELTA, DANIELI
4.	Roll Force/ Tension Measurement System	ABB, KELK
5.	Strip Profile Gauge	TOSHIBA, THERMO FISHER, IRM, IMS, MESACON
6.	Flatness/ Shape Gauge	ABB, P-SYSTEME, THERMO ELECTRON, DELTA, SIEMENS, IMS
7.	Laser Doppler Velocity Meter	KELK, DELTA, LASER SPEED, ACCUSPEED
8.	Coating Thickness Gauge	THERMO FISHER, SCIENTIFIC, ACT
9.	Light Barrier	PAULI, SICK, ABB, DELTA
10.	Position Transducer	SONY MAGNESCALE, TEMPOSONIC, LEONARD BAUR
11.	Optical Encoder	HUBNER, STEGMANN, LINE & LINDEY
12.	Surface Inspection System	COGNEX, PARSYTEC, ABB
VIII. IT EQUIPMENT		
1.	Desktop PC	DELL, HP, LENOVO
2.	Industrial PC	RUGGEDCOM, ADVANTEC, SIEMENS
3.	Laptop	DELL, HP, LENOVO, SONY, TOSHIBA

SL.NO.	ITEMS	MAKE
4.	Server	DELL, IBM, HP, SUN
5.	Network Switch (IT, office)	CISCO, HP, ENTERASYS, EXTREME, AVAYA
6.	Security Appliances like Firewall, UTM etc.	CISCO, JUNIPER, CHECK POINT, CYBEROAM
7.	Router	CISCO, JUNIPER
8.	Passive Network Component / accessories	MOLEX, TYCO(AMP), SYSTIMAX, PHINOLEX, DIGILINK
9.	Industrial FLTP Converter	PHOENIX, MOXA, HIRSCHMANN, SIEMENS - SCALANCE
10.	Network Switch (Industrial grade)	SIEMENS, CISCO, SCHNEIDER, ROCKWEL, HIRSCHMANN
11.	Wireless Network Controller (to control wifi access points)	CISCO, JUNIPER, MOXA
12.	Data Storage System	HP, IBM, EMC, HITACHI
13.	Laserjet Printer	HP, CANNON, SAMSUNG, XEROX
14.	Dot Matrix Printer	EPSON, TVSE, SAMSUNG
15.	Plotter	HP, GRAPHTEC, CALCOMP
16.	Scanner	HP, CANNON, EPSON
IX. COMMUNICATION EQUIPMENT		
1.	GPS	MOTOROLA, ERICSSON
2.	Wireless Network Equipment	CISCO, EXTREME, JUNIPER, MOXA
3.	Radio Communication Equipment	MOTOROLA, STAHL, RADIUS, SATELLINE, GE, LOTUS WIRELESS
4.	VHF Communication	MOTOROLA
5.	EPABX	ITI, SIEMENS, AVAYA
6.	Telephone Instruments (Procurement with EPABX either from its OEM or as per these preferred makes)	BPL, BEETEL, SIEMENS, PANASONIC
7.	Yard – Communication System	PHI AUDIO COM, BOSCH
8.	Shop Announcement system (PAS)	AHUJA, PHI AUDIO COM, BOSCH
9.	Despatcher System (EPABX) / Inter Com / Hot – Lines	SIEMENS, ERICSSON, AVAYA
10.	Programmable Loud speaking – Inter Com System (PROGRAM System)	PHI – AUDICOM, BYTE
11.	Press to Talk	PHI – AUDICOM, BYTE
12.	Conferencing System a) PA system / Chairman Unit & Delegate Unit	BOSCH, AHUJA
X. DISPLAY, CCTV & FDA EQUIPMENT		
1.	LED/ TFT Monitor	SAMSUNG, SONY, PANASONIC, HITACHI

SL.NO.	ITEMS	MAKE
2.	Alpha Numeric Display/ Jumbo Display	AGLA, ESSEN, VINAY, BLE BELL, MICROTECH, BCH, GE, KHERAJ, EPCC, BEMCO, LECTROTEK
3.	Solid State Hooter/ Buzzer	KHERAJ, EPCC, BEMCO
4.	Large Screen Display (42" or more)	SAMSUNG, SONY, PANASONIC, HITACHI
5.	Video Walls (LED)	SAMSUNG, SONY, PANASONIC, HITACHI, DELTA
6.	Fire Detection System & Detectors	SIEMENS, TYCO, HONEYWELL (NOTIFIER)
7.	CCTV Camera, Lens, PTZ unit, Housing and Receiver Driver	HONEYWELL, PELCO, BOSCH, SONY, SIEMENS, PANASONIC
8.	CCTV Monitor	HITACHI, PHILIPS, LG, SAMSUNG, SONY, PANASONIC
9.	Attendance System	LENEL, BOSCH, GE CASIRUSCO
10.	Card Reader	HID, BOSCH, LENEL, SUPREMA
11.	LCD Projector	HITACHI, CANON, PANASONIC, SONY, SHARP, HP
XI. INSTRUMENTATION CABLES		
1.	UTP Cable	MOLEX, TYCO(AMP), SYSTIMAX, DIGILINK, ELKAY TELELINK, UNIVERSAL
2.	FO Cable	MOLEX, TYCO(AMP), SYSTIMAX, DIGILINK, BELDEN, FINOLEX, LUCENT, STARLITE
3.	Instrumentation/ Compensating/ Screened/ Co-axial/ Special Cables	INCAB, FINOLEX, CCI, UNIVERSAL, NICCO, MEM, LAPP, DELTRON, THERMOCABLES, HAVELLS, TOSHNIWAL
4.	Telephone Cable	FINOLEX, DELTON, BELDON, NICCO, UNIVERSAL, TELE LINK
5.	Load Cell Cable	HBM, SIEMENS, FLINTEC, SCHENK, SARTORIOUS,
XII. SPECIAL INSTRUMENTATION ITEM		
1.	Vibration Monitoring System (API-670 Compliance)	BENTLEY NEVADA, SHINKAWA, ENTEK
2.	Portable Vibration Monitor with analysis software	BENTLEY NEVADA, FORBES MARSHAL, IRO
3.	Test & Measuring Equipment	APLAB, KANE, SCIENTIFIC, TECHNOFIX, FLUKE
4.	Laboratory Equipment	FLUKE, BEAMEX, SCANDURA, WIKA
5.	Digital Multi-Function Meter	L&T, SECURE, RISHAV, CONSERVE, ACORD
6.	Computer Furniture	GODREJ, USHA LEXUS, ZUARI, WIPRO, METHODEX
C MECHANICAL		
I	GENERAL	
1.	Gearbox (other than crane)	ELECON, NAW, FMG, SHANTHI, PREMIUM ENERGY TRANSMISSION, SUMI-CYCLO DRIVE INDIA PVT.LTD., AR ENGG, KIRLOSKER, HEC, SAN ENGG. LOCOMOTIVE COMPANY LTD.
2.	Geared Motor	IC BAUER, POWER BUILD, BONFIGLIOLI, SHANTHI,

SL.NO.	ITEMS	MAKE
		NORD, SEW-EURO DRIVE, CYCLO TRANSMISSION, SUMI-CYCLO DRIVE INDIA PVT.LTD.
3.	Coupling (other than fluid)	NAW, FLEX-TRAN INDUSTRIES, CONCORD STEEL WORKS PVT. LTD., ELECON, WELLMAN WACOMA, GBM, RATHI, ROMA, ALLIANCE ENGG. CO., LOVEJOY
4.	Fluid Coupling	VOITH, FLUIDOMAT, PREMIUM ENERGY TRANSMISSION, ELECON, GHATKE-PATIL INDUSTRIES
5.	Resilient Coupling	WELLMAN WACOMA, NAW, ELECON, LOVEJOY, FENNER
6.	Transmission Chain & Sprocket	ROLCON, ROLON, REYNOLD, DIAMOND, ROLKOBO
7.	DCEM Brake	BCH ELECTRIC LTD., ELECTRONIC & POWER CONTROL, ELECTROMAG, EMCO PRECIMA, KATEEL, SIBRE
8.	Hydraulic thruster brake	EMCO PRECIMA, SIBRE, KATEEL
9.	Paint	ASIAN , J&N, GARWARE , BERGER , SHALIMAR, ICI, NEROLAC , BRITISH PAINTS
10.	Non metallic Liner	TEGA, KAVERI, THEJO
11.	Portable Electric Drilling Machine	RALLIWOLF, KULKARNI POWER TOOLS LTD.,
12.	Portable Electric Grinder	RALLIWOLF, KULKARNI POWER TOOLS LTD ,
13.	Lathe	HMT , MYSORE KIRLOSKAR , VOLTAS, HEC,
14.	Radial Drilling Machine	HMT , VOLTAS
15.	Shaper	MYSORE KIRLOSKAR, VOLTAS
16.	Bench Type Drilling Machine	EIFCO, BATLIBOI, EIFCO
17.	Pedestal Grinder	GRIND TOOLS, GECO, EIFCO
18.	Power Hacksaw	INDEF, MYSORE, KIRLOSKAR , PMT
19.	Bearing	SKG , FAG , NTN, TATA TIMKEN, NEI (NBC), GPZ, ZKL. COOPER
20.	Passenger cum Goods Elevator	OTIS, KONE ELEVATOR , ECE, OMEGA, MITSUBISHI
21.	Hook (up to 10 t)	HERMAN MOHTA, FREE TRADING CORPORATION, MACHINE TOOLS, OM ENGG., ESKAY MACHINERY
22.	Hook (above 10 t)	HERMAN MOHTA , FREE TRADING CORPORATION, STEEL FORGINGS & ENGINEERING
23.	Wire Rope	MUMBAI WIRE ROPE, USHA MARTIN, FORT, WILLIAMS, ORION ROPES, BHARAT WIRE ROPES
24.	Expansion Joint	LONE STAR, MB METALLIC BELLOWS,

SL.NO.	ITEMS	MAKE
	(metallic)	FLEXATHERM, FLEXICAN
II	MATERIAL HANDLING EQUIPMENT	
1.	Conveyor Belt	PHOENIX YULE, DUNLOP, SIMPERLRANS NIRLON, HILTON, NORTH LAND RUBBER , ORIENTAL RUBBER , HINDUSTAN RUBBER, JONSON RUBBER INDUSTRIES LTD.
2.	Idler & pulley	L & T, ELECON, TRF, BENGAL TOOLS, MSEL, HITECH EQUIPMENTS PVT. LTD., SUNRAJ INDUSTRIES, MACMET, TECHNO IMPEX, BEVCON, NEWALL INDUSTRIES, ARUDRA ENGINEERS PVT. LTD., SOLCON, VISHWA INDUSTRIAL CO. LTD., GOLDEN ENGINEERING INDUSTRIES
3.	Belt Scrapper	HOSCH , KAVERI
4.	Vibrating Screen	IC , SCHENK PROCESS, TRF, McNALLY SAYAJI ENGINEERING LIMITED, ELEKTROMAG-JOEST VIBRATION PVT. LTD.
5.	Vibrating Feeder	IC , SCHENK PROCESS, TRF, McNALLY SAYAJI ENGINEERING LIMITED, ELEKTROMAG-JOEST VIBRATION PVT. LTD
6.	Apron Feeder	TRF, ELECON , McNALLY SAYAJI . THYSSEN KRUPP, TENGL, L & T, HAZEMAG
7.	Electro mechanical Actuator	PREPEC. AUMA, ROTORK, LIMITORQUE
8.	EOT Crane & it's gear box (above 50t)	HEC ,MUKAND, WMI-KONE , UNIQUE INDUSTRIAL HANDLERS, FURNACE & FOUNDRY , SMACO, ANUPAM, DEMAG CRANES
9.	EOT Crane & it's gear box (up to 10 t)	ARMSEL,FAFECO, MUKAND, WMI-KONE, ANUPAM INDUSTRIES, SHIVPRA, TUBROFURGUSON
10.	EOT Crane & it's gear box (above 10t and up to 50 t)	HEC , MUKAND, WMI-KONE, UNIQUE INDUSTRIAL HANDLERS , FURNACE & FOUNDRY EQUIPMENT CO., VOLTAS, BOMBAY CRANES, AARCO, ARMSEL, EDDY CRANE, TOUBRO FURGUSON , DEMAG CRANES , CENTURY CRANE , RANSPADE, ELECTRO THERAPY , ANUPAM INDUSTRIES , SMACO, ELECTROMECH MHS PVT. LTD.
11.	Electric Hoist	VOLTAS, BOMBAY CRANES, ARDEC, REVA ENGG, HERCULES HOIST LTD., ELECTROTHERAPY, AARCO, ARMSEL, EDDY CRANE, ROBIN ENGG., AVON , SHIVPRA, BRADY& MORRIS, GRIP ENGRS., HI-TECH INDUSTRIES, CENTURY CRANE
12.	Electric Winch	BOMBAY CRANES, PULLMAN, ELECTROMECH MHS PVT. LTD. ENGG, AARCO, EDDY CRANE,

SL.NO.	ITEMS	MAKE
		HTMC ENGG. CO.
13.	Chain Pulley Block & Hand Operated Travelling Crane	HERCULES HOIST LTD., BRADY & MORRIS, TRACTEL TRIFOR, AARCO, REVA ENGG, CENTURY CRANES, LIGHT LIFT IND., HI-TECH,
14.	Underslung Cranes	ARMSEL, FAFECO, MUKAND, WMI-KONE, ANUPAM INDUSTRIES, SHIVPRA, TUBROFURGUSON, BRADY & MORRIS
15.	Stacker & Reclaimer	ELECON, L & T, McNALLY BHARAT, METSO, FL SMIDTH, TRF, THYSSENKRUPP, HEC
16.	Stacker-cum-Reclaimer	L & T, McNALLY BHARAT, METSO, FL SMIDTH, TRF, THYSSENKRUPP, HEC
17.	Bucket-Wheel Reclaimer	L & T, McNALLY BHARAT, METSO, FL SMIDTH, TRF, THYSSENKRUPP, HEC
18.	Wagon Tippler	ELECON, L & T, McNALLY BHARAT, METSO, FL SMIDTH, TRF, THYSSENKRUPP, HEC
19.	Belt Feeder	ACME, SHENCK, HEC, ELECON, TRF
20.	Hanging Magnet/ Cross belt /Inline Magnetic Separator	METSO, HUMBOLDT WEDAG, ELECTRO ZAVOD, ELEKTROMAG, MSEL
III	HYDRAULICS SYSTEM	
1.	1. Hydraulic Cylinder	REXROTH, EATON, WIPRO, USHA TELEHOIST, OSCAR, PARKER, YUKEN, VELJAN, VECTRA ENGG., HYDAIR
2.	Hydraulic System with Accessories	REXROTH, EATON, YUKEN, PARKER, MOOG, HYDAC
3.	Accumulator	BOSCH REXROTH, EATON, YUKEN, PARKER, EPE, HYDAC
4.	Hydraulic Fitting & Clamp	HYDAC, HYTECH, PTS, HYDAIR, EPE, HYDROMATIK
5.	Hydraulic Filter	INTERNORMEN, PARKER, HYDAC
6.	Hydraulic Motor	EATON, REXROTH, YUKEN, PARKER, SAUER DANFOSS
7.	Hose	HYDROKRIMP, HYDROLINE, INDO INDUSTRIAL SERVICES, AEROLEX, SUPERSEAL, PSI HYDRAULICS
IV	PNEUMATIC SYSTEM	
1.	Pneumatic Cylinder	WIPRO, , NUCON, VELJAN, HYDAIR, GABRIEL PNEUMATICS, SHRADER, SMC, ROTEX, I.L. PALAKKAD, EL-O-MATIC (INDIA) PVT. LTD.
2.	Hose	HYDROKRIMP, HYDROLINE, INDO INDUSTRIAL SERVICES, AEROLEX, SUPERSEAL, PSI

SL.NO.	ITEMS	MAKE
		HYDRAULICS
V	LUBRICATION SYSTEM	
1.	Oil Lubrication System	CEN. LUB , LINCOLN HELIOS, SHAAN LUBE, LUBRICATION SYSTEM LTD., PRAKASH LUBRIQUIPMENT, HYDAC
2.	Screw Pump	TUSHACO, ROTO, UT PUMPS & SYSTEM,
3.	Gear Pump	ROTO,TUSHACO,ROTODEL,REXROTH, PARKER, ALFA
4.	Filter Strainer	OTOKLIN, SUPERFLOW FILTERS, SPAN ASSOCIATES PUNE, MULTITEX FILTRATION
5.	Oil Mist / Mist cool & Spray Lube System	LINCOLN HELIOS, BIJUR DELIMON AFMC, OILAIR LUBRICATION
6.	Grease Lubrication System	LINCOLN HELIOS, AFMC, BIJUR DELIMON, PRAKASH LUBRIQUIPMENT. CEN-LUB
7.	Hose	HYDROKRIMP, HYDROLINE, INDO INDUSTRIAL SERVICES, AEROLEX, SUPERSEAL, PSI HYDRAULICS
D	MINING & MINERAL PROCESSING AREA:	
1.	Dumper (50 t & above)	BEML, KOMATSU, CATERPILLAR , LIBHERR, BELAZ, TEREX
2.	Excavator (0.9 m3 bucket capacity & above)	BEML, KOMATSU, VOLVO, HIND-DEMAG, CATERPILLAR, LIBHERR
3.	Drill (≥ 6 " dia. - DTH)	ATLAS COPCO, SANDVIK
4.	Dozer	BEML, KOMATSU, HYUNDAI, CATERPILLAR, LIBHERR,
5.	Grader	BEML, KOMATSU, VOLVO , KAWASAKI , CATERPILLAR
6.	Wheel Loader	BEML, KOMATSU, VOLVO, CATERPILLAR, HINDUSTAN, TEREX
7.	Crusher (Cone / Gyratory / Jaw)	METSO, SANDVIK, L&T,TRF, MSEL,HEC, FLSMIDTH, URALMASH,THYSSENKRUPP, EARTHTECHNICA
8.	Impact / Hammer Crusher	TRF, MSEL, L&T, SANDVIK, HEC, METSO, THYSSENKRUPP, EARTHTECHNICA
9.	Roll Crusher	FLSMIDTH, ELECON, TRF, MSEL, HEC, SANDVIK, URALMASH, L&T, THYSSENKRUPP, EARTHTECHNICA
10.	Sizer	FLSMIDTH, MMD, THYSSENKRUPP, SANDVIK, TERRASOURCE

SL.NO.	ITEMS	MAKE
11.	Ball / Rod / Ag Mill	TRF, MSEL, L&T, SANDVIK , HEC, METSO, TENOVA-DELKOR, URALMASH, CEMTEC, AUTOTEC, THYSSENKRUPP
12.	Classifier	HUMBOLDT WEDAG, HINDUSTAN DORR OLIVER, METSO, FLSMIDTH, DURGA METALS, EIMCO-KCP
13.	Thickener	FLSMIDTH, HINDUSTAN DORR OLIVER, OUTOTEC, TENOVA-DELKOR, WESTECH, METSO, MSEL
14.	Jig	TENOVA-DELKOR, ALLMINERAL, MSEL-HUMBOLDT WEDAG
15.	Filter(Vaccum/Pressure)	METSO, FLSMIDTH, TENOVA-DELKOR, OUTOTEC, ANDRITZ, DIEMME, WESTECH
16.	Wet High Intensity Magnetic Separator /High Gradient Magnetic Separator	METSO, ALLMINERAL, MSEL-HUMBOLDT WEDAG, ERIEZ, OUTOTEC, LONGI MAGNET, MINERAL TECHNOLOGIES
17.	Dewatering Screen	IC / SCHENCK PROCESS, TRF- HEWITT ROBINS , METSO, McNALLY SAYAJI ENGINEERING LIMITED, ELEKTROMAG-JOEST VIBRATION PVT. LTD., WEIR MINERALS , FLSMIDTH -LUDOWICI
18.	Spiral – Gravity Concentrator	MULTOTEC, MINERAL TECHNOLOGIES, AKW A+V GMBH, OUTOTEC
19.	Low Intensity Magnetic Separator	ERIEZ , METSO , MINERAL TECHNOLOGIES , MULTOTEC, MSEL-HUMBOLDT WEDAG, LONGI MAGNET
20.	Hydrocyclones	MOZLEY, FLSMIDTH KERBS, MSEL , METSO, CDE, WEIR MINERALS
21.	Metal Detector	METSO, ERIEZ, HUMBOLDT WEDAG, ELECTRO ZAVOD, ELEKTROMAG
E.	UTILITIES & SERVICES AREA:	
	GENERAL	
1	PUMPS	
1.1	Centrifugal Pumps (Horizontal Split Casing Type)	MATHER & PLATT, BEACON WEIR, WPIL, BHEL, CHEMFLO, JYOTI, SAM, METSO, JOHNSON, SULZER, FLOWMORE, FLOW SERVE
1.2	Centrifugal Pumps (Horizontal Back Pullout Type)	KSB, WPIL, MATHER & PLATT, BEACON, WEIR, BHEL, CHEMFLO, JYOTI, SAM, METSO, JOHNSON, CALAMA, FLOWMORE, FLOW SERVE, SULZER

SL.NO.	ITEMS	MAKE
1.3	Centrifugal Pumps (Vertical Turbine)	WPIL, JYOTI, FLOWMORE, FLOW SERVE, MATHER & PLATT, SAM, SULZER
1.4	Centrifugal Pumps (Vertical)	KSB, JYOTI, WPIL, BEACON WEIR, CHEMFLO, JOHNSON, FLOW SERVE, SULZER
1.5	Submersible pump	KSB, SU MOTORS, WPIL, KISHORE PUMPS, DARLING, CALAMA, SAM, JYOTI, FLOWMORE, SULZER, BHARAT BIJLEEE
1.6	Multi-stage Pumps	FLOWMORE, MATHER & PLATT, BEACON WEIR, CHEMFLO, SAM, SULZER, BAREJA
1.7	Centrifugal Pumps For Slurry Handling	SAM, WEIR MINERAL, METSO, FLOW SERVE, DORR OLIVER, FLOW MORE
1.8	Reciprocating Slurry Pump	DORR OLIVER
1.9	Screw pump	TUSHACO, ROTO, AIRAUTO, UT PUMPS, BORNEAMAN, ALLWEILER, FLOW SERVE
1.10	Gear Pump	UT PUMPS, AIRAUTO, BAREJA, TOWN INDUSTRIAL ENGINEERS, JOHNSON, ROTODEL, FLOW SERVE
1.11	Dosing pump	ING-TECH ENGG CO., ANTICO (TRANSFER PUMPS), THERMAX, MATZ ENGINEERS, VK PUMP, MILTON –ROY, SHAPOTOOL, ION EXCHANGE
1.12	Reciprocating Pumps	ACME, AIRAUTO, BHARAT PUMPS & COMPRESSOR, CHEMTROL, SWELORE ENGG., TOWN INDUSTRIAL ENGINEERS, FLOW SERVE
1.13	Diaphragm Pumps	WILDEN, YAMADA, BLAGDON, WATERMAN, SWELORE ENGG, KRUPAM, SOLTECH PUMPS, VK PUMP
1.14	Liquid Ring Pump	FLOWMORE, KIRLOSKAR, ACMEVAC, KAKATI, USHA, VINDI
1.15	Fire Fighting Pumps	MATHER & PLATT, FLOWMORE, KIRLOSKAR, WPIL, BEST & CROMPTON
2	VALVES	
2.1	Gate, Globe, Non-Return Valves (Cast Steel Or Forged Steel)	BHEL, L & T, KSB, WEIR-BDK, KIRLOSKAR, LEVCON, IVC, TYCO VALVES, NSSL, FOURESS, HAWA VALVES, ADVANCE, JOSHI JAMPALA, GM ENGG., INTERVALVE

SL.NO.	ITEMS	MAKE
2.2	Gate, Globe, Non-Return Valves (Alloy Steel)	BHEL, KSB, L & T, FOURESS
2.3	Gate, Globe, Non-Return Valves (CAST IRON, & SG IRON)	LEADER, IVC, CALSEN, KIRLOSKAR, BDK, UPADHYAY, SHIVA DURGA, BLUESONS, SIGMA FLOW, ADVANCE, AKSONS, MEHTA NANAVATI, GM DALUI
2.4	Double & Triple Eccentric Butterfly Valves	ADAMS, FOURESS, VIRGO, DEL –VA, INTERVALVE
2.5	Butterfly Valve	AUDCO, FOURESS, KIRLOSKAR, METSO, KSB, UNIVERSAL, WEIR-BDK, SIGMA FLOW, INTERVALVE, IVC, TYCO VALVES, VIRGO, HABONIM, VASS, DEL VAL
2.6	Fabricated Valves (Gate, Goggle & Butterfly Valves)	CHEMTECH, JOSHI & JAMPALA, FOURESS, LEVCON
2.7	Plug Valve (CS / FS / CI / SS)	FLOW SERVE, KSB, MICRO FINISH, XOMOS, DEZURIK, NSSL, WEIR-BDK, UNIVERSAL ENGG.
2.8	3 Or 4 Way Cock (CS/ FS / CI)	AUDCO, AL SAUNDERS, UNIVERSAL ENGG.
2.9	Ball Valve (SS/CS / FS / CI)	AUDCO, KSB, WEIR-BDK, DEL VAL, AL SAUNDERS, XOMOX, NSSL, MICROFINISH, VIRGO, TYCO VALVES, VASS IND, INTERVALVE
2.10	Float Valve	LEVCON, LEADER, IVC, UPADHAYA, BLUESON, CALSEN, SHIVA DURGA,
2.11	Foot Valve	LEVCON, LEADER, IVC, CALSEN, UPADHAYA, SHIVA DURGA, WEIR-BDK
2.12	Piston Valve	UNI KLINGER
2.13	Diaphragm Valve	FLUID SYSTEM, AL SAUNDERS, WEIR-BDK,
2.14	Air Release Valve	LEVCON, SHIVA DURGA, IVC, UPADHYAY, CALSEN, SIGMA FLOW, LEADER
2.15	Safety Valve	IL, KEYSTONE / TYCO, MEKASTAR, J.N. MARSHALL, WEIR-BDK, DARLING MINESCO, VELJAN, VICKERS SPERRY, PRIME, BHEL
2.16	Needle Valve	FOURESS, SEIMAG, AIR CHEM, SCHRODER

SL.NO.	ITEMS	MAKE
2.17	Knife Edge Gate Valve	WEIR MINERALS, HABONIM VASS, TYCO DEZURIK, VELJAN,
2.18	Plunger Valve	VAG-RIKO, UNI-KLINGER
2.19	Valves (Non-Metallic)	GEORGE FISCHER, POLY VALVE
2.20	Pressure Reducing Valve	J.N.MARSHALL, IL, MEKASTER, AKSONS, CRESCENT, FLOWTEK VALVES, VK
2.21	Non-Ferrous Valves (General Purpose)	AKSONS, CRESCENT, BOMBAY METAL, LEADER, FLUIDLINE, ASCO, GM DALUI, SANT VALVES
2.24	Solenoid Valves	BURKERT, SIEMAG, SCHARDAR, ROTEX
2.24	Blow Down Valves	BHEL, LEVCON, BOILER MANUFACTURER'S OWN MAKE
2.25	Sluice Gate	JASH, IVPL, LEVCON, IM ENGG
3	VALVE ACTUATORS	
3.1	Valve Actuator (Electrical)	AUMA, ROTORK, LIMITORQUE, SIEMENS,
3.2	Valve Actuator (Pneumatic)	ROTEX, ELOMATIC, L&T, KEYSTONE, VIRGO, AL SAUNDERS, DEL VAL,
4	HEAT EXCHANGERS	
4.1	Heat Exchanger (Plate Type)	IDMC, ALFA LAVAL, GEA, SWEP, TRANTER, APV
4.2	Heat exchanger (Shell & Tube Types)	TEMA INDIA, BHEL, L&T, TEXMACO, THERMAX, ING-TECH ENGG. CO, RELIANCE, GODREJ, AIR CARE EQUIPMENTS, PRECISION COOLING, THERMAL SYSTEMS, ALFA LAVAL, APV
5	COOLING TOWERS	PAHARPUR, WET BULB, GAMMON, PALTECH, SOUTHERN COOLING TOWERS, SHRIRAM TOWER THERMOPACK, , GEA COOLING TOWERS
6	FILTERS / STRAINERS	
6.1	Filters /Strainers	OTOKLIN, SUPERFLOW, AMIAD, FILTRATION ENGINEERS, PUROLATOR, CADILLAC, SUREFLOW, POONAM
6.2	Pressure Filters	THERMAX, ION EXCHANGE, RESIN INDIA, DRIPLEX, ING-TECH ENGG. CO., VA TECH, PENTAIR WATER, EUREKA

SL.NO.	ITEMS	MAKE
6.3	Activated Carbon Filter	THERMAX, RESIN INDIA, ION, EXCHANGE, OTTOKILN, ING-TECH ENGG. CO, ARUDRA, VASMYL, PENTAIR WATER
6.4	Y-Strainer	DRAYTON-GREAVES, J.N. MARSHALL, UNIKLINGER, CADILLAC
6.5	Filters For Oxygen Service	BHPV, LINDE-BOC, CADILLAC, BLUE STAR
7	EXPANSION JOINTS/COMPENSATORS	
7.1	Expansion Joints / Compensators (Metallic)	SUR INDUSTRIES, DIENS FLEXO, FLEXICAN, METALLIC BELLOWS, ATHULYA, BD ENGINEERS, PRECISION ENGINEERS, LONE STAR
7.2	Expansion Joints/Compensators (Rubber)	DIENS FLEXO , CORI ENGG., SUR INDUSTRIES, PRECISION ENGRS., STANDARD PRECISION BELLOWS, KELD ELLENTOFT INDIA, GBM,
7.3	Expansion Joints/Compensators (Non-Metallic)	DIENS FLEXO , HINDUSTAN FERODO, KELD ELLENTOFT INDIA, GBM, SUR INDUSTRIES
8	CENTRIFUGAL GAS BOOSTER	TLT, ANDREW YULE, DONKIN, AIRTO BOLDROCCHI, BHEL
9	INSULATION MATERIAL AND WORK	FINLAY, LLYODS INSULATION, RAYCHEM, FRG, BAKELITE HYLAM, TWIGA
10	PRESSURE VESSELS / BUFFER VESSELS/TANKS (Unfired)	BHPVL, TEXMACO, L&T, ACC – BABCOCK, NTPC-ALSTOM, PRESSURE VESSEL INDIA (P) LTD., TITAN ENGINEERING, EUREKA
11	GAS HOLDER	CLAYTON WALKER (GILLANDERS ARBUTHNOT , UNIT:MICCO), LAZARUS & ASSOCIATES (MUKUND)
12	PIPES AND HOSES	
12.1	Steel Pipes	SAIL (RSP), TATA TUBES, SURYA TUBES, MAHARASHTRA SEAMLESS, INDIAN SEAMLESS, KHANDELWAL, JSW, UTKARSH

SL.NO.	ITEMS	MAKE
12.2	Stainless Steel Pipes	CHOKSY, ZENITH, STANDARD (INDIA), JINDAL STERLING, DIVINE TUBES, NOBLE TUBES, MAHARASHTRA SEAMLESS, MEC TUBES
12.3	Cast Iron Pipes & Specials	KESORAM, KALINGA
12.4	RCC Pipes	SUR INDUSTRIAL CORP., INDIAN HUME PIPES, HIND CERAMICS
12.5	DI Pipes	SAW, ELCTRO STEEL CASTING, TATA METALLIC
12.6	HDPE Pipes, PVC Pipes & Fittings	GEORGE FISHER, ASTRAL, ORIPLAST, EMCO, POLYFIX, CHEMPLAST, EMOCOTHENE, PIL, POLYOLEFINS, FINOLEX
12.7	FRP Pipes & Fittings	GEORGE FISHER, GLASS ROLL INDUSTRIES, FIBRE GLASS, FIDRO PLASTICHEM, COROMANDAL, NOCIL, PIL, ORIPLAST
12.8	Hoses (Rubber & Stainless Steel)	D.WREN, HYDRA, OTOKILN, FLEXICAN, INALSA, AEROFLEX, TEKSONS, MARKWEL
13	PIPES FITTINGS	
13.1	Steel Pipe Fittings	TUBE BEND, ITC (S&L), NL HAZRA, AJANTA, ENGINEERING SERVICE ENTERPRISE, MS FITTINGS, WELSPUN, M.S. FITTINGS, S. NOMI, SWASTIK LLOYDS, NOBLE TUBES, KHANDELWAL BROS., SHYAM ENGG
13.2	SS Pipe Fittings	TUBE BEND, ITC (S&L), N.L. HAZRA, M.S. FITTINGS, NOBLE TUBES, HEAVY METAL TUBES POONAM ENTERPRISES, SHYAM ENGG
13.3	Sewage Pipes And Fittings	MYSORE STONEWARE PIPES, HIND CERAMICS
14	WATER TREATMENT AND DM WATER PLANT	
14.1	DM & Soft Water Plant	THERMAX, ION EXCHANGE, DOSHI ION, RESIN INDIA, DRIPLEX, AQUA TECH, PENTAIR WATER, TRIVENI, GEA ENERGY SYSTEMS, IJT
14.2	Waste Water Treatment Plant	HINDUSTAN DORR OLIVER, TRIVENI, ING- TECH ENGG. CO., THERMAX, KIRLOSKAR, KAAF, DOSHI ION,EDI
14.3	Water Pre-Treatment	TRIVENI, THERMAX, ION EXCHANGE, DORR OLIVER, KIRLOSKAR, KAAF, DOSHIION

SL.NO.	ITEMS	MAKE
14.4	Clarifier	HINDUSTAN DORR OLIVER, EIMCO-KCP, JORD ENGINEERS,
14.5	Effluent Treatment Plant	VA TECH, GEA ENERGY SYSTEM, TRIVENI, UEM INDIA, DOSHIION
14.6	Drinking Water Treatment Plant	DRIPLEX, VA TECH, GEA ENERGY SYSTEM, TRIVENI, UEM INDIA, THERMAX
14.7	Chemical Dosing System	HINDUSTAN DORR OLIVER, TELLABS CHEMICALS, NALCO
15.	EQUIPMENT & SYSTEM FOR AIR AND GAS	
15.1	Turbo-Blower	MAN TURBO, SIEMENS, BHEL
15.2	Compressor (Centrifugal)	ATLAS COPCO, KIRLOSKAR, ELGI, INGERSOLL RAND, SEIMENS
15.3	Compressors (Screw)	KIRLOSKAR PNEUMATIC, ELGI, ATLAS COPCO, INGERSOLL RAND
15.4	Compressors (Reciprocating)	KIRLOSKAR PNEUMATIC, INGERSOL RAND, ELGI, BURCKHARDT COMPRESSION
15.5	Portable Air Compressors	HOLMAN CLIMAX, ELGI, ATLAS COPCO, KIRLOSKAR, INGERSOLL RAND
15.6	Blowers & Fans (General Purpose)	
	Capacity \leq 50,000 m ³ /h	AEROTO BOLDROCCHI, INGERSOL RAND, MAXFLOW, KAY INT., TLT ENGG., BATLIBOI, ANDREW YULE, RIECO , FLAKTWOOD, REITZ, DUSTVEN, AIRLINK ,
	Capacity $>$ 50,000 m ³ /h	BHEL, ANDREW YULE, AEROTO BOLDROCCHI, FLAKT WOOD, TLT, REITZ
15.7	Regulators	NUCON, VELJAN, HYDAIR, SHAVO NORGEN, IRON & METALS, GABRIELPNEUMATICS, I.L.PALGHAT, SCHRADER, ROSS, SMC
15.8	Air Drier	DELAIR, TRIDENT, SANPAR, ATLAS COPCO, ROOS TEMPKOOL, EXAL, INGERSOL RAND
15.9	Air Trap	DRAYTON GREAVES, UNI KLINGER, FORBES MARSHAL
15.10	Moisture Separator	UNIKLINGER, NUCON, VELJAN, HYDAIR, FESTO

SL.NO.	ITEMS	MAKE
		CONTROL, SCHRADER, ROSS, SMC, DRYTECH ENGINEERS
15.11	Air Receiver	INGERSOLL RAND, KIRLOSKAR, AIR CARE EQUIPMENT, AIR EQUIPMENT & SYSTEM, DELAIR, TRIDENT, EUREKA
15.12	Pneumatic Sample Conveying System	KERRY DRYING & CONVEYING SYSTEMS, JOST ENGINEERING
16	POWER PLANT EQUIPMENT	
16.1	Boilers (Fired)	BHEL, THERMAX, IJT, ALSTHOM, THYSEN KRUPP
	Boilers (Waste heat recovery)	THERMAX, IJT, ALSTHOM, THERMAL SYSTEM
16.2	Steam Turbines	BHEL, TRIVENI ENGG., SKODA POWER, MAN TURBO DIESEL, SIEMENS
16.3	Gas Turbines	GE, SIEMENS, BHEL, ALSTOM
16.4	Condenser (Water)	BHEL, ALSTHOM, GE GODAVARI, UNIVERSAL HEAT EXCHANGER
16.5	Condenser (Air)	PAHARPUR COOLING TOWERS, GEA
16.6	HP / LP Dosing	ASIA LMI / ENPRO / META CHEM / VK PUMPS
16.7	Soot Blowers	BHEL / BERGMAN / SISTON
16.8	DG Set	ENGINE MTU, CATERPILAR, KIRLOSKAR CUMMINS
16.9	De-aerator	IJT, ION EXCHANGE, THERMAX
16.10	PRDU	BHEL, THERMAX, FORBES MARSHAL
16.11	Boiler Feed Pumps	KSB, BHEL, SULZER
17	CRYOGENIC PLANT & EQUIPMENT	
17.1	Cryogenic Pumps	ASIA(ICL), LINDE, PRAXAIR, AIR LIQUIDE, AIR PRODUCT
17.2	Oxygen Compressors	LINDE, PRAXAIR, AIR LIQUIDE, AIR PRODUCT
17.3	Blower	LINDE, PRAXAIR, AIR LIQUIDE, AIR PRODUCT
17.4	Expander	LINDE, PRAXAIR, AIR LIQUIDE, AIR PRODUCT
17.5	Chiller	LINDE, PRAXAIR, AIR LIQUIDE, AIR PRODUCT
17.6	Oxygen Filter	LINDE, PRAXAIR, AIR LIQUIDE, AIR PRODUCT
17.7	Non Ferrous Fitting For Oxygen	LINDE, PRAXAIR, AIR LIQUIDE, AIR PRODUCT

SL.NO.	ITEMS	MAKE
	Service	
17.8	Air Separation Unit	LINDE, PRAXAIR, AIR LIQUIDE, AIR PRODUCT
17.9	Regeneration Heater	LINDE, PRAXAIR, AIR LIQUIDE, AIR PRODUCT
17.10	Silencers	LINDE, PRAXAIR, AIR LIQUIDE, AIR PRODUCT
17.11	Vaporizers	LINDE, PRAXAIR, AIR LIQUIDE, AIR PRODUCT, ICL, SHELL & TUBE
17.12	Tower Packing (Polypropylene)	LINDE, PRAXAIR, AIR LIQUIDE, AIR PRODUCT
17.13	Activated Alumina	LINDE, PRAXAIR, AIR LIQUIDE, AIR PRODUCT
17.14	Molecular Sieve	LINDE, PRAXAIR, AIR LIQUIDE, AIR PRODUCT
17.15	Changeover Valve	LINDE, PRAXAIR, AIR LIQUIDE, AIR PRODUCT
17.16	Structured Packings	LINDE, PRAXAIR, AIR LIQUIDE, AIR PRODUCT
17.17	Main Heat Exchanger	LINDE, PRAXAIR, AIR LIQUIDE, AIR PRODUCT
17.18	Cryogenic Valves (other than oxygen)	IL, BLUE STAR, LINDE, AIR LIQUI, L&T, ICL
17.19	Non Ferrous Self Regulating Valve (For Oxygen Service)	LINDE, PRAXAIR, AIR LIQUIDE, AIR PRODUCT
17.20	Non Ferrous Control Valves (For Oxygen Service)	LINDE, PRAXAIR, AIR LIQUIDE, AIR PRODUCT
18	POLLUTION CONTROL EQUIPMENT	
18.1	ESP	
	Capacity \leq 5,00,000 m ³ /h	THERMAX, RIECO, BATLIBOI, SOIL & ENVIRO
	Capacity $>$ 5,00,000 m ³ /h	ALSTHOM, BHEL, LODGE COTTERELL, ANDREW YULE, ELEX, FL SMITH, GEA PROCESSING
18.2	BAG FILTERS	
	Capacity \leq 2,50,000 m ³ /h	SOIL & ENVIRO, BATLIBOI, THERMAX, DUSTVEN, KLEEN AIR
	Capacity $>$ 2,50,000 m ³ /h	ALSTHOM, ANDREW YULE, RIECO, FL SMIDTH,
18.3	DRY FOG DUST SUPPRESSION SYSTEM	F.HARLEY , TPS INFRASTRUCTURE, KAVERI ULTRA POLYMERS, SPRAYING SYSTEMS, CHEMTROL SAMIL

SL.NO.	ITEMS	MAKE
18.4	ID & FD FAN	
	Capacity \leq 5,00,000 m ³ /h	MAXFLOW, C. DOCTOR, DUSTVEN, BATLIBOI, RIETZ, TLT, ANDREW YULE, BHEL
	Capacity $>$ 5,00,000 m ³ /h	BHEL, ANDREW YULE, SOLYVENT FLAKT, HOWDEN, VENTI OELDE, AEROTO BOLDROCHI, TLT
18.5	CYCLONES AND MULTI CYCLONES	THERMAX, ALSTOM, BATLIBOI, F.HARLEY, AIR TECHNICO, RIECO INDUSTRIES, DUSTVEN, RAJDEEP ENGG.
19	AIR CONDITIONING, RFRIGERATION & VENTILATION	
19.1	Window/Tower/Split AC/ Ductable Split AC	HITACHI, DAIKIN, FEDDERS LLYOD, VOLTAS, BLUE STAR, CARRIER, SAMSUNG
19.2	Packaged Chillers	VOLTAS, BLUE STAR, CARRIER, TRANE, YORK, HITACHI
19.3	Package AC	VOLTAS, BLUE STAR, SAMSUNG, ETA, ROOTS COOLING
19.4	Precision Air Conditioning System	EMERSON, STULLZ-CHSPL (INDIA)
19.5	Air Conditioning System	VOLTAS, BLUE STAR, CARRIER, TRANE, ETA, ETHOS HVAC, STERLING & WILSON, ABB LTD, AIRCON, m+W ZANDER
19.6	Cabin Air Conditioning System	KABU PROJECTS PVT. LTD., SUNBEAM, DOCON AIR CONDITIONING PVT. LTD.
19.7	Cooling Tower	VOLTAS, DBR, FRICK INDIA, ADVANCE COOLING TOWERS, MIHIR ENGINEERS, ARMEC, HIMGIRI, PAHARPUR, WET BULB, GAMMON INDIA, SOUTHERN COOLING TOWERS
19.8	Air Handling Unit	VOLTAS, BLUE STAR, ALSTOM, ROOTS COOLING, ETA, FEDDERS LLYOD

SL.NO.	ITEMS	MAKE
19.9	Tube Axial Fan	KHAITAN, EFE, HUMIDIN, MESINA, FLOWLINK, KRUGER, CARYAIRE, AEROVENT, DUSTVEN, TUBOFLOW, MAXFLOW
19.10	Panel Filter For Air	FMI, EFE, FLOW LINK, CADILLAC, C.DOCTOR, GEC, ACCO, ABB, WFI, BHARAT, PUROLATOR
19.11	Air Washer	EFE, ROOTS COOLING, AIRLINK, MARCO, HUMIDIN, MESINA
19.12	Propeller Fan	ABB, VENTURA, DUVENT, ANDREW YULE, ACCO, MESINA, AEROVENT, DUSTVEN, TUBOFLOW
19.13	Man Coolers	KHAITAN, C. DOCTOR, ORIENT, ALMONARD, FLOWLINK, VENTURA
19.14	Roof Extractors	ALMONARD, KRUGER, CARYAIRE, FLOWLINK, VENTURA, EFE, AIRLINK, HUMIDIN, C. DOCTOR
19.15	Vapor Absorption Machine	VOLTAS, BLUE STAR, CARRIER, KIRLOSKAR
19.16	Water Cooler	VOLTAS, BLUE STAR, USHA, SAMSUNG
20	FIRE FIGHTING EQUIPMENT	
20.1	Portable Fire Extinguishers	FIREX, MINIMAX, NITIN, FIRE SHIELD, SAFEX, STEELAGE, ZENITH
20.2	Fire hydrant	NEWAGE, STEELAGE, ASCO, ZENITH, STEELCO, MINIMAX, NITIN
21	REHEATING FURNACE (Pusher/Rotary)	WESMAN, VULCAN, ENCON, TECHNO THERM, HYPER THERM
	WALKING BEAM FURNACE	ANDRITZ, FIVES STIEN, LOI, TENOVA, DANIELLI SANTRO
22	MISCELLANEOUS ITEMS	
22.1	Steam Traps	DRAYTON GREAVES, FORBES MARSHALL, UNIKLINGER
22.2	Surge Tanks	ANUP ENGG., ZENITH ERECTORS, PERFECT ENGG., SAKTHI HITECH

SL.NO.	ITEMS	MAKE
22.3	Oil Skimmer	JVM ENG., PREMIER OIL SKIMMER, HI-TECH ENGRS, POTENTIAL ENGG
22.4	Sludge Scraper	TRIVENI, GEOMILLER, MATA INDIA, NEO-PARISTRUTAN
22.5	Ejector	BHEL, WEIGAND, NEWFIELD, MAZDA
22.6	Traveling Water Screen	MACMET, TRIVENI, MAHINDRA ASTECH, SWAMINA INT., Mc.GALE
22.7	Vibration Isolator	DUNLOP, EMERALD
22.8	Electrical Tracer	THERMOFAB, RAYCHEM, THERMON, NICROPAD
22.9	Spring Supports for Pipelines	BHEL, SARATHI
22.10	Flanged Dismantling Joint	DIENS FLEXO, NL HAZRA, ENGINEERING SERVICE ENTERPRISE

F COAL COKE & CHEMICALS		
SL.NO.	ITEMS	MAKE
1	Flushing Liquor pump	BECON-WEIR LTD., KIRLOSKER BROTHERS, MOTHER & PLATT
2	HPLA Pump	SULZER PUMPS, MOTHER & PLATT
3	Reversing Cock & Isolation Cock for CO & mixed gas	AUDCO, UNIVERSAL ENGINEERING

DECLARATION FOR SITE VISIT

(To be filled up by the Bidder)

We, hereby, declare that we have visited the site for the installation of proposed systems regarding “Installation of Filtration System in RCPH Cooling Water Circuit, BPSCL”, to understand the site conditions and acquaint ourselves with the extent of total works involved for present package as per TS No. CET/23/RN/4060/TS/UT/01/R=0.

Seal of company

Signature of the Bidder

Name

Designation

SCHEDULE 2.1.6-1

**LIST OF RECOMMENDED SPARES FOR TWO YEARS OPERATION AND
MAINTENANCE**

(To be filled up by the Bidder)

Sl. No.	Equipment	Description of spares	Quantity installed	No. recommended	Remarks

Seal of company

Signature of the Bidder

Name

Designation

SCHEDULE-2.1.8-1

LISTS OF CONSUMABLES

(To be filled up by the Bidder)

Sl. No.	Description of Consumables	Quantity

Seal of company

Signature of the Bidder

Name

Designation

LISTS OF INITIAL FILL
(To be filled up by the Bidder)

Sl. No.	Description of Initial Fill	Quantity

Seal of company

Signature of the Bidder

Name

Designation

LISTS OF SPECIAL TOOLS AND TACKLES

(To be filled up by the Bidder)

Sl. No.	Description of Consumables	Quantity

Seal of company

Signature of the Bidder

Name

Designation

LIST OF EXCLUSIONS

(To be filled up by the Bidder)

Sl. No.	Reference clause of TS	Details of exclusions	Reasons

Seal of company

Signature of the Bidder

Name

Designation

LIST OF DEVIATIONS
(To be filled up by the Bidder)

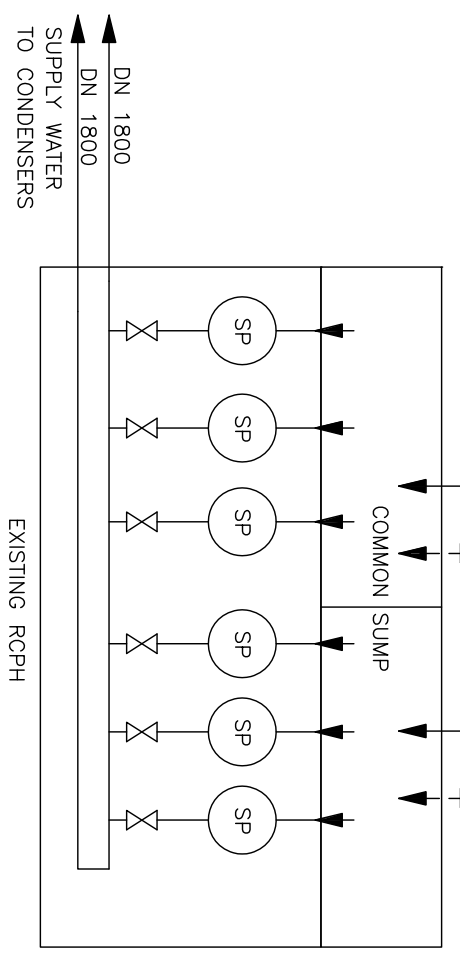
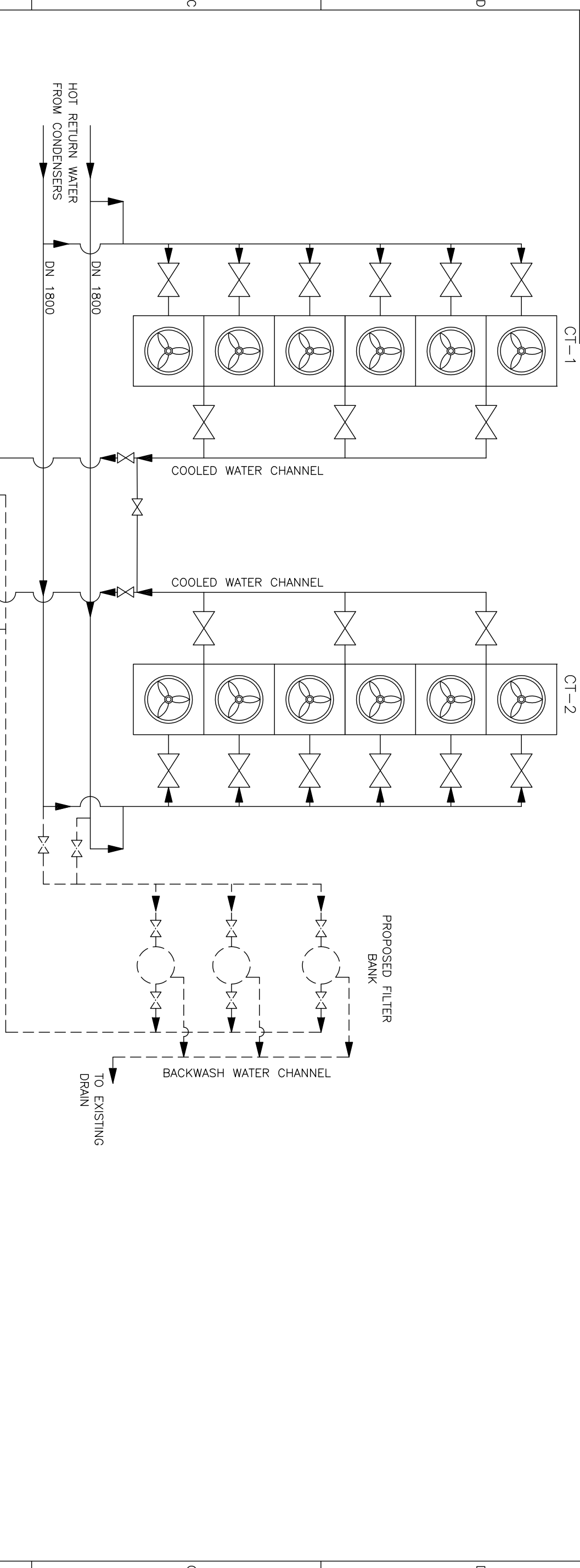
Sl. No.	Reference clause of TS	Details of deviations	Reasons

Seal of company

Signature of the Bidder

Name

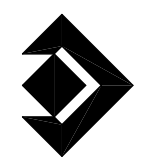
Designation



FOR FR/TS PURPOSE ONLY

LEGEND

- SP - SUPPLY WATER PUMP
- CT - COOLING TOWER
- VALVE
- EXISTING SYSTEMS/FACILITIES
- - - PROPOSED SYSTEMS/FACILITIES



स्टील अथॉरिटी ऑफ इंडिया लिमिटेड
STEEL AUTHORITY OF INDIA LTD.
 सेंट्रल कार्बन इंजीनियरिंग
 CENTRE FOR ENGINEERING & TECHNOLOGY, RANCHI

PLANT (संयंत्र) : BOKARO POWER SUPPLY CO. LTD.

DRAWN	S.CHAKRAVARTY	UNIT (इकाई) : RCPH
DESIGNED	S.CHAKRAVARTY	PROPOSED LAYOUT OF FILTRATION SYSTEM IN RECIRCULATING WATER CIRCUIT
CHECKED	T.K. MISHRA	
APPROVED	A.N. BHAGAT	

DATE:	29.05.2015	SCALE	DRG.NO. CET RN 4060 UT2 00 001	REV	R=0
		SIZE-A3			
			SHEET 01 OF 01		

C L E A R A N C E		SECTION	BY	DATE
REVISIONS		DETAILS		
NO.	DATE	REMARKS	BY	APPD.
6				
5				
4				
3				

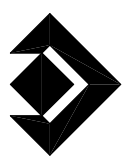


LEGEND

— PROPOSED INLET & OUTLET HEADER FOR SIDE STREAM FILTRATION SYSTEM

FOR TS PURPOSE ONLY

NO.	DATE	REMARKS	BY	APPD.	DRG. NO.	DETAILS	REF. DRAWINGS

		<p>PLANT (संयंत्र) : BOKARO POWER SUPPLY CO. LTD.</p>	
<p>संयंत्र अथॉरिटी ऑफ इंडिया लिमिटेड STEEL AUTHORITY OF INDIA LTD. सेंटर फॉर इंजीनियरिंग & टेक्नोलॉजी, रांची CENTRE FOR ENGINEERING & TECHNOLOGY, RANCHI</p>		<p>UNIT (इकाई) : RCPH</p>	
DRAWN	S.CHAKRAVARTY	PROPOSED LOCATION OF FILTRATION SYSTEM IN RECIRCULATING WATER CIRCUIT	
DESIGNED	S.CHAKRAVARTY	SCALE	DRG.NO. CET RN 4060 UT2 00 002
CHECKED	T.K. MISHRA	NTS	REV R=0
APPROVED	A.N. BHAGAT	SIZE-A3	
DATE:	29.05.2015	SHEET 01 OF 01	