TENDER DOCUMENT

TENDER No.: DLI/C&E/WI- 675/021 (R)

FOR

Tender for Civil and Structural Steel works for Construction of “Augmentation of Fuel & Flux crushing facilities of Bhilai Steel Plant (BSP).” (Package - 64), at Chattisgarh.

VOLUME – III

TECHNICAL SPECIFICATION
(TS)

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04.02 CIVIL WORKS

04.02.01 This section of the specification covers entire civil engineering work for buildings, technological structures, new equipment and facilities for all production, auxiliary and ancillary units, foundation for all buildings, structures and main equipment described elsewhere in this specification on a Turnkey basis for Augmentation Of Fuel & FLUX CRUSHING FACILITIES.

Augmentation Of Fuel & FLUX CRUSHING FACILITIES will come up in the area as indicated in the general layout drawing. Paved areas, approach roads, drainage and sewerage as required, trenches, pits and all other miscellaneous civil engineering works, including demolition, relocation and diversion [if necessary] of the existing foundations, pits, trenches, drains, underground and overhead services, roads, tracks, buried cables, etc., for the proposed Plants

04.02.02 The proposal is to install Coal Handling and Coke Sorting Plant for COBP#11 and augmentation of fuel and flux for the new sinter machine of SP-III in an area indicated in the general layout drg and situated within the Bhilai Steel Plant boundary. The contractor has been advised to visit the site and acquaint himself of the site condition and collect all such data as may be necessary. The scope shall cover complete civil engineering work for the proposed plant within its battery limit, on turnkey basis including design supply of all materials and execution. Please refer clause 02.00 for scope of work and battery limits.

04.02.03 Soil Characteristics

Detail soil investigation report along-with Bore log data available with the Employer shall be considered by contractor for estimation and design. Foundation recommendation given in the report shall be final and binding on the contractor.

04.02.04 The major civil works involved
A. For installation of the Coal Handling shall pertain to the following areas:

- Addition of 5 nos. of RCC mixing bins (Silos), each of 500t storage in 3rd row of silos.
- Provision 2 nos. of additional reversible hammer mills (designated as hammer mill 7&8), each of capacity 350t/h in existing row of hammer mills after extending the existing final crushing station suitably.
- Up rating & modification of existing collecting conveyors Y7-12 & Y7-13 to 1000 t/hr. capacity in the existing location with minimum shutdown.
- Connecting conveyor stream, connecting new coal tower no.7 with existing coal handling plant.
- Connecting conveyors for new silos & new crushers to the existing Coal Handling Plant.

B. For installation of the Coke Sorting Plant shall pertain to the following areas:

The major scope of work of Coke Sorting Plant comprising of Coke crushing station, coke screening station, coke breeze bunkers, emergency coke storage yard, coke dedusting units, junction houses, traveling tripper gallery, galleries and associated mechanical, civil, structural, electrical works of COBP # 11

C. For Augmentation in Flux - Fuel Preparation and Plant return fines handling for SP III facilities comprises of the following:

- Connecting existing Blast furnace return fines C-Line conveyor with new BF#8 return fines conveyor.
- Up gradation / Addition of coke crushing and screening and grinding facilities.
- Up gradation/ addition of Flux crushing & screening facilities.
- Dismantling of C-line conveyors & Junction houses (including foundation of Junction houses & trestle of conveyors with an undulation of about +500mm) & Re-routing of existing sinter fines conveyors (C-lines).
The materials and services shall include but not be limited to the following:

i. Earthwork for foundations, pits, trenches, basements, tunnels, drains, sumps, sewers, etc including final grading up to +/- 500mm at the locations of proposed units with disposal of surplus earth up to a distance of 10 KM.

ii. Reinforced concrete for foundations, channels, tunnels, basements, pits, trenches, sumps, etc.

iii. Soling and sub-grade work for all foundations, flooring, trenches, pits and other underground structures

iv. All doors, windows, gates, etc.

v. Reinforced concrete work in columns, beams, floors, slabs, frames and other superstructures

vi. Reinforced concrete work in supporting structures of equipments

vii. All masonry work in superstructure and partition. Fly ash cement bricks shall be used in masonry constructions.

viii. All finishing work in flooring, wall-cladding and ceiling

ix. All necessary waterproofing, heat resisting, fireproofing and anti-corrosive treatment to building structures and foundations

x. All plumbing, rainwater drainage, sanitary sewerage works for all buildings, roadway, parking, paved areas and open spaces within the battery limits of this specification

xi. All temporary buildings, offices, roads, tracks and services for construction of the above package.

xii. Removal of all materials, cleaning, and handing over of site in a presentable manner.

xiii. Walkways of ground portals shall be of RCC over 75mm thick PCC.

xiv. All conveyor galleries shall be of cast in situ RCC in full width However for all return fines for SP-III route conveyors, covered gallery with structural floor shall be provided.

It shall include all works required for completeness of the project. All the materials and workmanship shall conform to relevant Bureau of Indian Standard norms and specifications.
04.02.06 Design parameters

i. Loading, design of structures, permissible stresses and other design criteria shall generally be in accordance with the latest edition of relevant I.S. Codes and practices, viz., IS – 456; IS – 875; IS – 1893; IS – 2974; IS –3370; IS – 1786; IS – 432; etc.

ii. All buildings and supporting structures including connections and foundations shall be designed to withstand the most adverse combination of loads

iii. Rigidity of the building structures in both directions and stability of structures for worst combination of loadings shall be ensured. Other precautions like waterproofing, dust proofing, protection from heat, sound and corrosion etc. shall also be considered.

iv. SBC shall be as per approved Geo Technical report for designing of foundations water table to be considered at ground level

v. Earth pressure for all under ground structures shall be calculated using co-efficient of earth pressure at rest, co-efficient of active or passive earth pressure as applicable.

vi. Contractor shall submit drawings with design calculations in soft (readable/editable) and hard copies.

vii. Contractor shall establish quality control lab at site and concrete mix produced from batching plant shall be used in works.

viii. All civil engineering works shall be designed and executed as per relevant IS codes.

04.02.07 Concrete and reinforced concrete structures
i. Concrete and reinforced concrete structures including superstructures and underground construction shall be designed and constructed in accordance with I.S. Codes. However, concrete of following minimum grades shall be used:

- Leveling courses/Mudmat M7.5/M 10
- R.C.C. M25
- For flooring / paving etc. M 20 grade concrete may be used.

ii. The mix-design shall be adopted for proper strength, workability and service requirement.

iii. Additives and retarding agents for concreting, floor hardening additives, acid resisting and integral waterproofing compounds shall be added to the concrete depending upon requirements.

04.02.08 Finishes

i. All floor finishes shall be as per B.I.S./ specification and shall meet the functional requirements.

ii. The wall finishes shall be as per B.I.S./ specification and shall meet the functional requirements.

iii. The roof finishes shall be as per B.I.S./ specification and shall meet the functional requirements.

04.02.09 Necessary false ceiling shall have to be provided as per technological requirements and specified elsewhere in this specification.

04.02.10 All concrete roofs exposed to weather shall be provided with water proofing treatment of polymer based cementations material of SIKO,CIKA,FOSROC. Drainage of rainwater from roof shall be ensured by rainwater down comers and proper slope.

04.02.11 All doors and windows shall be provided as per technological requirements.
04.02.12 Adequate natural lighting and ventilation shall be planned and provided for general buildings.

04.02.13 The connections of the roads, drains and sewer lines, being provided for the project shall be properly co-ordinated with the existing lines.
   i. The roadways shall be so laid as to facilitate movement of materials, equipment, products, etc. as well as operators and executives.
   ii. Necessary paved areas shall be provided around plant and auxiliary units for car-parking.
   iii. Roads with 2m berm on both sides shall be provided for all the facilities under the scope of contractor. Roads shall be of bituminous (WBM type)

04.02.14 Drainage and sewerage
   i. All rain water drainage, sanitary, faecal sewerage and plumbing system for all buildings and open areas shall be provided, as required.
   ii. All service pipelines, water supply, plumbing and other utility pipelines and electrical wiring within the ancillary and auxiliary buildings of RC/Masonry construction, will be concealed within the masonry, concrete work etc.
   iii. All auxiliary and ancillary buildings housing toilets/drinking water facilities shall be provided with water storage tanks at roof of the building separately for drinking and sanitary purposes.
   iv. All surface drains shall be covered with pre cast slabs/gratings, as per requirements where ever necessary.
   v. Road side drains shall be of RCC and garland drains around buildings shall be of masonry.

04.02.15 The contractor shall divert, at his own cost, any unforeseen underground facilities, pipelines that need to be diverted during civil construction in consultation with the Employer.

04.02.16 The Contractor shall indicate the quantities of major civil engineering works like excavation, PCC, RCC, reinforcing steel, inserts, shuttering, brickwork, roadwork, pipelines, etc. under his scope of work as indicated
under ANNEXURE -I. The Contractor shall not make any additional claim if the total concrete quantity or quantity of any of the civil engineering items required for completion of the entire package as per terms of contract exceed the quantity indicated by the Contractor in Annexure-I of this section. The Contractor shall also indicate soil investigation and site/ topographical survey, if any, to be undertaken by him.

04.02.17 The Contractor shall indicate the estimated number of civil engineering drawings. [in equivalent A1 size]

04.02.18 The Contractor shall submit all basic engineering, schematic and subsequently detailed civil engineering drawings along with relevant load data and design calculations for Employer’s approval as indicated under ANNEXURE -II as per schedule/ documentation requirements.

04.02.19 General instructions

1) Local conditions

The Contractor, 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 Contractor.

2) Setting out and leveling

The Contractor 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 Contractor in any way, of his responsibility for correct setting out.
3) Safety

The Contractor 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 stated below:

- IS 4014:1967 : Safety Regulations for scaffolding work
- IS 4081:1986 : Safety Code for drilling and blasting operations
- IS 7923:1985 : Safety Code for working with Construction machinery

4) Keeping work free from water

The Contractor shall provide and maintain 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

Rubbish

The Contractor 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.

5) Bench Marks, Reference Pillars etc.

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

7) Drawings

Work shall be carried out as per drawings prepared by the Contractor and approved by the Employer. The drawings shall include General Arrangement, shuttering, excavation, anchorage plans, bolt plans, insert plan and details, conduit plans, etc required for execution of the job. Also, the design calculations shall be submitted in requisite number of copies (as mentioned elsewhere) for the approval by the Employer.

8) This specification shall be read in conjunction with the general conditions of contract and other project requirement provided in the other volumes containing special conditions of contract, instruction to contractors, special instructions to contractors etc.

Specification for civil works comprises, besides this section, one volume of General Technical Specification(11-CIVIL–GS-07) for civil engineering works. This volume shall also form part of this section and therefore shall be read in conjunction with this section.
Estimated Quantities for Civil Works

1) Excavation
2) RCC
3) PCC
4) Shuttering
5) Reinforcement Steel
6) PCC Flooring
7) Finishing
8) Inserts/ Bolts
9) Any miscellaneous items deemed necessary for successful completion of civil works of the proposed plant.
ANNEXURE –II

List of Civil Engineering Drawings and Documents for Approval/Information

Group – 1 : For Approval

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<td>Drawing numbering system</td>
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<td>2.</td>
<td>List of drawings, with drawing Nos. and title</td>
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<tr>
<td>3.</td>
<td>Basic design criteria and loading for all buildings, structures and foundations.</td>
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<td>4.</td>
<td>Site plan/layout drawing with battery limit in 1:500 scale</td>
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<tr>
<td>5.</td>
<td>Design calculations along with load data for buildings, foundation for equipment and structures, auxiliary etc., (design calculations shall be submitted along with or before submission of G.A. and design drawings).</td>
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<tr>
<td>6.</td>
<td>General arrangement plan and sectional drawings with all dimensions and details for foundation of equipment and structures, auxiliary facilities etc.</td>
</tr>
<tr>
<td>7.</td>
<td>Layout and sectional details of drainage, sewerage network with all invert levels slopes, sizes, dimensions, manholes top level etc.</td>
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Group – 2 : For information and comments, if any

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<td>1.</td>
<td>Detail reinforcement drawings.</td>
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<td>2.</td>
<td>Detail of bolts, inserts/ embedment, coverings, etc.</td>
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04.03 STRUCTURAL WORKS

SECTION-1 GENERAL

1.1 This specification for structural works furnished herein are intended as guidelines for execution of the works satisfying the Employer's requirements as also complying with all technical norms in totality.

This specification is to be read in conjunction with GTS (Turnkey) for structural works of the project.

1.2 Units:

Structural steel work under the scope of this contract cover the following main facilities envisaged for Coal Handling Plant & Coke Sorting plant of COBP # 11 and BF return, Coke Breeze & Fuel and Flux Crushing-Screening Facilities at SP-III (Package no – 064 ) of Bhilai Steel Plant. Technological layout drawing & Flow diagrams which are issued along with Contract Specification shall be referred to in this context.


Junction Houses and other Buildings: JH-1, JH-2, JH-3, JH-4, JH-5, JH-6, JH-7, JH-8, JH-9, JH-10, JH-11, JH-12, JH-13, JHZ-17, Surge Bunker Building, Coke De-dusting Unit, Coke Crushing Station, Coke
Screening Station, Coke Breeze Bunker, Take-up Unit, Coke Car Repair Shop, Return Car Bunker, etc.

New units (BF return, Coke Breeze & Fuel and Flux Crushing-Screening facilities at SP-III):

Conveyor Galleries: C3A-G1, C3-G1, C4-G1, C4-G2, C5-G1, C6-G1, C6-G2, C7-G1, J127-G1, C102-G1, CK1-G1, CK2-G1, CK3-G1, CK4-G1 (to Screen Bldg.), C111A-G1, C113A-G1, L114A-G1.


Further to the above-mentioned units, any other units not mentioned here but required for technological requirement shall also be included in the scope of work.

**Modification, Addition & Strengthening of Existing Units**

- Suitable modification and strengthening in existing galleries/junction house and other units are required to receive up taking materials for which Flow Diagram of the System shall be referred.

**1.3 List of Steel Structures**

Columns (rolled section or built-up), column bracings, Crane Girder, Surge Girder, Gable Platforms, Rails & Fixtures, Monorail beams and supports, Roof Trusses, Roof Girders, Bunker Girder, Bunker, Liner
Plate, Purlins, Roof hand rails, Floor Beams, Sheeting Posts, Side runners, Louvers, Bracings, Sag angles, Sag rods, wind-ties on roof, Wind girders, Platforms, Walk-ways, Stairs, Ladders, Hand rails, Gutters and Down comers, Gallery truss, Gallery Trestles, Bracings, rafter & rafter bracings for gallery truss, End portal, Top & Bottom chord Bracings for Gallery Trusses, Roof & side Cladding with Troughed colour coated galvalume metal sheets and FRP sheets.

1.4 The work to be performed under this specification consists of design, engineering, dismantling, modification, strengthening, addition of new floors, supply, fabrication, erection and cladding, as well as providing all labour, materials, consumables, equipment, temporary works, temporary labour and staff colony, constructional plant, fuel supply, transportation and all incidental items not shown or specified but reasonably implied or necessary for the completion and proper functioning of all the above units and auxiliaries, all in strict accordance with the specifications, including revisions and amendments thereto as may be required during the execution of the work.

1.5 Supply of all materials including structural steel, roof cladding & side-cladding sheets, fasteners, paints, consumables like gas, electrodes etc. and all other materials as deemed necessary for proper completion of the work, are included in the scope of the Contractor.

1.6 The work shall be carried out according to the design/drawings to be developed by the Contractor and approved by the Owner/Consultant. For all buildings and structures, necessary layout and details are to be developed by the Contractor keeping in view the statutory & functional requirements of the plant and facilities and providing enough space and access for operation, use and maintenance. Certain minimum requirements are indicated in this specification for guidance purpose only. However, the Contractor’s offer shall cover the complete
requirements as per the best prevailing practices and to the complete satisfaction of the Owner.

1.7 Fabrication of structures shall be carried out out-side BSP Plant Premises.

1.8 Junction house flooring shall be RCC construction. Conveyor gallery flooring shall be of cast in situ RCC construction in full width. Coke dedusting unit, coke crushing station shall be of RCC up to top floor, above which these shall be steel structure. All bunkers including breeze bunkers and surge bunkers of RCC with structural steel roofing.

1.9 Sheeting of Conveyor Gallery, Junction Houses and others shall be colour coated (non-insulated) troughed galv-alume metal sheets (Zinc aluminium alloy coated, not less than 150 gms / sq.m, having high tensile steel sheet (Fy 550 MPa) of 0.5 mm minimum thickness (BMT). The outside face (exposed face) shall be permanently colour coated with PVF2 paint of minimum DFT 20 microns over primer and inner side (internal face) shall be coated with same paint of minimum DFT 12 microns.

1.10 3 mm thick fibre glass reinforced polyester (FRP) sheets of profile matching with permanently colour coated sheets shall be used for Translucent sheets for natural lighting. The sheet shall have light diffusion classification = III as per table 3 of IS – 12866-1989.

1.11 Conveyor Gallery shall be covered on Roof & Sides.

SECTION - 2 SCOPE OF WORK

2.0. The scope of work shall cover, but shall not be exclusively limited to, the following:
• collection of all site related data & conducting site investigations,

• design, preparation of all design drawings, fabrication drawings,

• Dismantling, Modification, Addition of Floors, Strengthening of Existing Units.

• obtaining Owner's/Consultant's approval on general arrangements and design of structures

• Dismantling, retrieval, sorting and storing of any existing structures as directed by the owner.

• supply of all materials viz, raw steel, sheeting for roof and side cladding, and paints

• supply of fasteners like bolts, nuts, washers etc

• supply of consumables like electrodes for welding, gases for gas cutting etc

• supply of plant & machinery, tools tackles, instruments for fabrication and erection

• providing facilities for testing of materials and conducting NDT

• providing facilities for transport and handling

• deploying requisite skilled and unskilled manpower

• making arrangements for all services like approach to site, electricity, water etc
- fabrication of structures, their transport and proper storing at site
- erection of structures, claddings, gutters, down pipes etc
- application of paints at shop after fabrication and at site after erection
- providing all reasonable facilities for inspection by Owner/Consultant
- conducting NDT as stipulated by the Owner and making test results available to Owner / Consultant for evaluation
- compliance with primary acceptance tests / inspection, liquidation of defects; compliance with final acceptance tests / inspection, liquidation of defects;
- carrying out field-engineering decisions as desired by the Owner
- Preparation of “As Built” drawings for all the structures and hand over to the Owner the completed structural work to the Owner’s full satisfaction.
- Any other work deemed incidental for the completion of the overall work but not included in the above detailed scope.

SECTION – 3 DESIGN OF BUILDING STRUCTURES

3.1 Design considerations

3.1.0 General

3.1.01 Structures shall be designed such that they are economical and safe and meet the functional and service requirement of the technological process
for which they are designed. The architectural planning of the building shall be based on technological requirements.

3.1.02 The structures shall be designed conforming to the relevant safety regulations, Factory Acts, Electricity Rules and stipulations of Statutory bodies as applicable to the project and as per relevant Indian Codes of Practice or, any International Code approved by the Owner.

3.1.03 Natural ventilation shall be provided ensuring that it does not permit rain water entry into the building. Scope of natural lighting shall be used to the maximum possible extent.

3.2 Design

3.2.01 Design of structures

a) Design of steel structures shall be done in accordance with IS: 800-1984 or any equivalent international code of practice that may be acceptable to the Owner.

b) Structures subjected to fluctuating/reversal of stress (e.g. Rail Supp. Beams) shall be designed in accordance with IS: 1024-1979.

c) Resonance in structures: Structures supporting vibratory/reciprocating equipments shall be designed so as to obviate occurrence of resonance. The ratio of applied frequency to natural frequency shall not lie within the range 0.7 to 1.2.

3.2.02 Loading codes

a) All live loads shall be considered in accordance with IS: 875(Part-2) -1987.
b) Wind loads shall be in accordance with IS: 875(Part-3) -1987 and any other consideration specific to the site.

c) Seismic loads shall be in accordance with IS: 1893- Part 1, 2002 & IV, 2005 and important factor mentioned in the latest code shall be considered.

SECTION-4 FABRICATION OF STEEL STRUCTURES

4.1 Drawings

The Contractor shall prepare fabrication drawings, erection drawings, bill of materials, drawing office despatch lists / shipping documents, schedule of bolts and nuts and as built drawings. All drawing work shall be in metric system and all writing work shall be in English.

4.2 Material of Construction

4.2.1 All steel and other materials used for steelwork and in association with steelwork shall conform to appropriate Indian standards. Only tested materials shall be used unless written authority is obtained for the use of untested materials for certain secondary structural members.

Unless otherwise specified in the drawings

a) All rolled sections and plates up to & including 20 mm thickness shall conform to Grade "A" as per IS : 2062.

b) Plates of thickness above 20 mm and Plated structures subjected to dynamic loading shall conform to Grade "B" as per IS: 2062.
c) For High Tensile steel requirements, material conforming to IS: 8500 or SAIL- MA (HYA or HYB) shall be used.

4.2.2 Steel sheets shall conform to IS: 1079.

4.2.3 Steel tubes for structural purpose shall conform to IS: 1161 (of Grade Yst 240)

4.2.4 Translucent sheets shall be fibreglass reinforced polyester sheets of matching profile as per IS: 12866.

4.2.5 Colour coated sheets shall be as per appropriate standard.

4.2.6 Gutters shall be of copper bearing steel conforming to Grade "A" as per IS: 2062.

4.2.7 Rails shall conform to IS: 3443.

4.2.8 All black bolts, nuts and locknuts shall conform to IS: 1363 and IS: 1364 (for precision and semi precision hexagonal bolts) of property class 6.4 unless otherwise specified. Washers shall conform to IS: 6610.

4.2.9 All tapered washer shall be as per IS: 5372 for channels, and IS: 5374 for Joists. Spring washers shall conform to IS: 3063.

4.2.10 All HSFG bolts shall conform to IS: 3757. Assembly of joints using HSFG bolts shall conform to IS: 4000. Nuts and washers for HSFG bolts shall be as per IS: 6623 & IS: 6649 respectively.

4.2.11 Covered electrodes for arc welding shall conform to IS: 814.

4.2.12 Certified mill test reports of materials used in the work shall be made available for inspection by the Owner / Consultant upon request.
4.3 Fabrication

4.3.1 Fabrication of all structural steelwork shall be in accordance with IS: 800 or their equivalent foreign national standard of the country of origin of supply unless otherwise specified, and in conformity with various clauses of the Technical Specification.

4.3.2 Wherever practicable and wherever perfect matching of parts is required at site, members shall be shop assembled before despatch to minimise site work. Parts not completely assembled in the shop shall be secured, to the extent possible, to prevent damage during despatch.
SECTION-5  ERECTION OF STEEL STRUCTURES

5.1 Scope

The scope of work under erection includes in addition to provision of erection and transport equipments, tools and tackles, consumables, materials, labour and supervision, the following:

a) Storing and stacking at site of erection of all fabricated structural components/ units/ assemblies till the time of erection.

b) Transportation of structures at site.

c) Receiving at site of structures including site handling/movement, unloading, storing and stacking at site of erection of technological structures such as bunkers and the related structures.

d) All minor rectification/ modification such as:

i) Removal of bends, kinks, twists, etc. for parts damaged during transportation and handling;

ii) Cutting chipping, filing, grinding, etc., if required, for preparation and finishing of site connections;

iii) Reaming for use of next higher size bolt for holes which do not register or which are damaged.

iv) Welding of connections in place of bolting for which holes are either not drilled at all or wrongly drilled during fabrication.

e) Other rectification work such as

i) Re-fabrication of parts damaged beyond repair during transportation and handling or incorrectly fabricated.
ii) Fabrication of parts omitted during fabrication by oversight or subsequently found necessary.

iii) Plug-welding and re-drilling of holes which do not register and which cannot be reamed for use of next higher size bolt.

f) Fabrication of minor items/missing items or such important items as directed by the Owner / Consultant.

g) Assembly at site of steel structural components wherever required including temporary supports and staging.

h) Making arrangements for and providing all facilities for conducting ultrasonic X-ray or gamma ray tests on welds; getting the tests conducted by reputed testing laboratories, making available test films/ graphs, reports and interpretation.

i) Rectifying at site, damaged portions of shop primer by cleaning and touch-up paint.

j) Erection of structures including making connections by bolts/high strength friction grip bolts / welding.

k) Alignment of all structures true to line, level plumb and dimensions within specified limits of tolerances as per IS :12843 “Tolerance for Erection of Steel Structures”.

l) Application of second coat of primer paint and two coats of finishing paint at site after erection.

m) Grouting of all column bases after proper alignment of columns and only after obtaining clearance from Owner / Consultant.

n) Conducting preliminary acceptance and final acceptance tests.
o) Preparation of as built drawings, preparing of sketches/drawings to suit field engineering decisions, availability of material, convenience of fabrication, transportation and erection and changes during fabrication and erection.
All such works are subject to approval by the Owner / Consultant.

SECTION-6  PAINTING OF BUILDING STEEL STRUCTURES

6.1 All steel structural work shall be painted as follows unless otherwise stated in the drawing / Technical Specification.

6.2 Surface preparation

The steel surface which is to be painted shall be cleaned of dirt and grease, and the heavier layers of rust shall be removed by chipping prior to actual surface preparation to a specified grade.

Following are the type and standards of surface preparation to be followed based on the requirement of a particular painting system or as specified in the design drawings.

Manual/Power tool cleaning: - Manual/Power tool cleaning shall be done as per Grade St-2 or St-3 of Swedish Standard Institution SIS 05 5900 or cl. 6.2.1.1 & 6.2.1.2 of IS: 1477 - 1987 (Part - 1).

Grade St-2:- Thorough scraping and wire brushing, machine brushing, grinding etc. This grade of preparation shall remove loose mill scale, rust and foreign matter. Finally the surface is to be cleaned with a vacuum cleaner or with clean compressed air or clean brush. After preparation, the surface should have a faint metallic sheen. The appearance shall correspond to the prints designated St-2.
If no grade of surface preparation is specified, St-2 grade of preparation as per Swedish Standard shall be followed.

6.3 **Paint System**

(2P1+ 2F1) as per GTS of Paint shall be adopted.

All paints shall be of approved and shade as per Employer / Consultant's requirements.

6.4 **Paint and Painting**

Manufacture of paints, mixing of paints, etc. shall be generally according to the relevant IS codes of practice.

Generally compatibility between primer intermediate and finishing paint shall be certified by the paint manufacturer supplying the paints.

Guarantee period shall commence from the date of completion of finishing coat of paint on entire structures. The guarantee period shall be indicated depending on the type of surface preparation and system of painting. To fulfil this obligations, the Contractor may obtain from the painting manufacturer, guarantee for the performance of paint/painted surfaces.

Application of paint shall be by spraying or brushing as per IS: 486-1983 and IS: 487-1985 and in uniform layers of 50% overlapping strokes by skilled painters. Painting shall not be done when the temperature is less than 5 degree C or more than 45 degree C and relative humidity is more than 85% unless manufacturer's recommendations permit. Also painting shall not be done in foggy weather. During application, paint agitation
must be provided where such agitation is recommended by the manufacturer.

Painting shall be applied at painting manufacturer's recommended rates. The number of coats shall be such that minimum dry film thickness specified is achieved. The dry film thickness (DFT) of painted surfaces shall be checked with ELCOMETER or measuring gauges to ensure specified DFT.

All structures shall receive one coats of primer paint at shop after fabrication before despatch after surface preparation has been done as per requirements.

Unless otherwise specified all structures after erection shall be given one coat of primer and two coats of finishing paint of approved colour and quality. The under coat shall have different tint to distinguish the same from the finishing coat.

The proposed make, quality and shade of paint shall have the approval of Employer / Consultant.

SECTION-7  Quantities of Structural Items.

The Contractor shall indicate the estimated quantities of structural items of work i.e. fabrication/ erection tonnage, sheeting in sq.m etc. Contractor shall not make any additional claim if structural quantity of any items required for completion of entire package as per terms of contract exceeds the quantity indicated by the Contractor.
04.05   GENERAL LAYOUT & TRANSPORTATION

04.05.01   General Layout

Introduction

SAIL - Bhilai Steel Plant, located at Bhilai in Durg District of Chhattisgarh, is planning for its expansion of Existing Steel plant to achieve hot metal production of 7.0 Mt with matching Steel making facilities. The Steel Plant is well connected by rail and road network. The nearest railway station is Bhilai on Howrah – Mumbai Line of the SEC Railway. The proposed CHP & CSP of COBP-11 and augmentation of Fuel & Flux Crushing & Screening facilities of SP–3 with rerouting of BF return C-Line Fines Conveyors will be almost located centrally of the plant. It is proposed to dismantle the existing SP-I (dismantling of SP-I by others). The proposed area for area of augmentation is well connected by rail and road network.

General Information about Land

The land for the proposed CHP & CSP of COBP-11 and augmentation of Fuel & Flux Crushing & Screening facilities of SP–3 with rerouting of BF return C-Line Fines Conveyors is generally flat and will require minor earthwork. However the earthwork is not covered under the scope of this package and the Contractor will be given a fairly leveled ground.

Notwithstanding with this micro-levelling upto 500 mm is included in the scope of work of contractor. Apart from this any earthwork required for roads and drainage will also be in the Contractor’s scope. Connection of internal roads, drain & sewerage to main roads, drains, sewerage within the battery limit is included in Contractor’s scope of work.

Proposed CHP & CSP of COBP-11 and augmentation of Fuel & Flux Crushing & Screening facilities of SP–3 with rerouting of BF return C-Line Fines Conveyors is coming within the existing area as such in general area clearance has been covered in separate package, however Contractor has to plan / ensure that existing facilities coming in the area should not be affected due to the proposed expansion.

General Layout of the Plant under Scope of Work of the Contractor

An Area Layout of the proposed CHP & CSP of COBP-11 and augmentation of Fuel & Flux Crushing & Screening facilities of SP–3 with rerouting of BF return C-Line Fines Conveyors is enclosed with this specification. This layout has been developed keeping in the view available space, smooth and uninterrupted flow of materials in
accordance with the technological requirements, safety clearances and statutory provisions.

The disposition of coal feeding conveyor along with new coal silos, extension of existing Hammer mill & coke sorting plant main technological units which are included in the scope of work of the contractor has been kept strictly in consonance with process and logistics vis-à-vis other units like Coke Oven Battery No. 11 whose approximate centre line co-ordinates have been kept as X+4640.00 approximately and CDCP along with total battery lies between Y+7586.86 approximately and Y+7281.38 approximately. In addition to this contractor has to note the following points.

The coal conveyor no. Y11-132 connecting the new coal tower-7 is running over existing cable tunnel, as there is no other space available. As such Civil & structural portion of the trestles for the above conveyor gallery are to be planned/designed in such a way that the existing cable tunnel is not disturbed.

5 nos. of coal silos of each 6m diameter have been proposed for coal blending. Civil foundations of supporting columns of the silos will be also designed in such a way that the existing cable tunnel running by the side of it should not get affected.

The proposed conveyor gallery no. Y11-132 is also running parallel to existing conveyor Y7-49 as such the new gallery will be designed in keeping in mind that both conveyor gallery should not foul in plan as well as elevation.

Dismantling / rerouting of existing facilities in vicinity of existing hammer crusher building extension is included in the scope of work of the Contractor.

The survey of the entire proposed alignment of conveyor and proposed area under scope of work w.r.t plant grid system is included in the scope of work of the contractor. The contractor has to carry out survey prior to submitting engineering drawing for BSP / MECON approval.

**Rerouting of Existing BF Sinter Return Conveyor**

Certain portion of Blast Furnace Sinter return conveyor gallery require rerouting to avoid fouling with the existing facilities, this has been marked on the general layout drawing. The alignment of conveyors planned within the battery limit of this package also coming within the existing areas. As such Contractor has to keep adequate clearances...
with these existing facilities during detailing of the conveyor gallery & finalization of locations of their trestles with prior approval of BSP.

**Coke Sorting plant**

The proposed Coke Sorting plant is located in the dismantled portion of the SP-I.

The centre line of proposed new coal conveyor has been shown on the drawing together with new coal Silos and Hammer crusher building extension. Contractor has to ensure that all proposed facilities should not interfere with the any of the existing facilities.

Relative locations of units have been shown on drawing no. MEC/S/9101/11/14/0/A/00/064.2522/R2.

New coke fines conveyor from New Coke sorting plant (CSP) has been also envisaged for evacuation of fines. This will also form part of the scope of work of the Contractor.

An internal road network has been planned to cater to the needs of various plant units and auxiliary services. These roads will be connected to main plant roads which are outside the scope of this package. A railway network has been planned for evacuation of coke breeze from the coke breeze bunker building.

**04.05.02 Transportation**

**Railway Track Work**

Contractor will include supply of rails, sleepers, turnouts, all necessary permanent way materials, ballast and laying of all railway tracks within the Coke sorting area basically coke loading track of about 500m length with one no. of turnout & buffer stop. Apart from this certain portion of existing tracks has to be provided with temporary diversion during construction period which is also included in the scope of work of the Contractor. The tracks will extended and connected to the main track as shown on general layout drawing. The portion of main track between the connection points and beyond by a rail length will be within the scope of supplier (this is marked up in the layout drawing MEC/S/9101/11/14/0/A/00/064.2522/R2.

All materials and track work will conform to the relevant latest Indian Railway Standards (IRS). Some salient features are given below:

Rails : 60 kg / m IRS rails as per IRS T-12.
Sleepers : Pre-stressed concrete sleepers as per relevant standards below normal tracks, turnouts and level crossings.

Sleeper density : 18 sleepers per rail length (13 m) for Coke Car track connection with the existing RMHS Station No. 1 tracks.

Ballast cushion : 250 mm

Turnouts : Standard 1 in 8.5 turnouts (crossing angle 60° 42’ 35” and lead radius 232.26 m) with Cast Manganese Steel (CMS) crossing, 6400 mm long curved switches made from T-12 specification rail on pre-stressed concrete sleepers.

Curvature : 200 m radius preferred. However, smaller radius upto 130 m may be provided in case of space constraint with prior approval of BSP.

Track centres : 5.5 m minimum

Min. horizontal clearance from centre of track to face of structure : 2.75 m

Min. vertical clearance from top of rail : 6.0 m
04.08 WATER SYSTEM

04.08.00 Scope of work

The scope of work shall include design, engineering, fabrication, manufacturing, assembly & supply, erection/construction/laying, commissioning, testing & performance guarantee tests etc of plant & equipment and piping etc of complete water supply facilities including pump house buildings, civil & structural work & technological structures, electrics, instrumentation, automation, telecommunication, air-conditioning & ventilation, material handling & hoisting equipment etc as specified and required for complete water systems technological structures, pipe-support structures, etc as specified and required for the complete water system for proposed plant as specified in this chapter as well as various chapters of this contract specification in line with General Technical Specification (GTS) and subject to Employer’s approval, complete in all respect on turnkey basis. (Tapping from main pipe line and connection of drinking water supply to plant buildings with all pipes fittings, Water tank etc for drinking water system are covered in the scope of work).

The scope of work shall include the following activities.

i) Design, engineering, manufacture /fabrication, assembly, shop testing, painting, packing sequential delivery FOR site, unloading, unpacking, storage at site, preparation & submission of all drawings for civil, mechanical, structural, piping, construction & erection drawings, construction & erection as per approved drawings, site-testing, painting, commissioning and fulfillment of guarantee performance of all plant & equipment of water supply facilities for the proposed plant including drinking water system, industrial service/make-up water system and water based fire-fighting system, in accordance with the water system requirements of the proposed plant.

ii) Supply of pipeline supports, thrust blocks/ anchor blocks, R.C.C. pedestals etc. for over head / on-ground /underground pipelines.

iii) Supply of all technical literature, drawings & documents, general arrangement drawings, assembly & sub-assembly drawings of all the plant & equipment, construction & erection drawings, as-built drawings, operation & maintenance manuals, manufacturing drawings, etc.

iv) Submission of all drawings at (iii) above, design calculations, data sheets for various equipments, pipeline sizing calculation and for approval of Employer/ Consultant and finalizing the same as per
approval of Employer/ Consultant. The approval of the same however does not absolve the contractor from his responsibilities.

v) Supply of commissioning spares & consumables; a list there of shall be submitted by the Contractor.

vi) Contractor shall submit an itemized price-list of two years operation and maintenance spares.

vii) Supply of special tools, tackles for construction, erection operation and repair & maintenance of the plant & equipment.

viii) Supply of special tools and tackles, spares as mentioned in GTS shall be in the scope of Contractor.

ix) All necessary connections for hook-up with Employer’s system at battery limits.

x) Supply of erection, testing & commissioning equipment and material.

xi) Piping network flushing fluids, chemicals & consumables.

xii) First fill of oils, lubricants, filter media, resins, chemicals reagents and other consumables.

xiii) Inspection and performance testing of individual equipment and system as a whole.

xiv) Participation in design conference with the Employer & Consultant as and when called for.

xv) Contractor shall provide two nos drainage pumps for each underground premises, one working, one standby, of suitable capacity and head to drain out the seepage water and rain water from the underground premises. The pumps shall be capable of handling slurry water. The exact numbers, capacity and type of pump shall be finalised during engineering stage.

The Contractor’s scope also covers extension of fire-fighting line, drinking water line and industrial water line from the battery limits to various consumer points of the proposed plant in line with the present Contract technical specification and GTS.

Water supply system/ sub-systems shall be complete in all respects and any equipment or material not specifically mentioned in this specification, but required for safe, efficient & smooth operation and
guaranteed performance of the plant shall be deemed to be included under the scope of work of the Contractor. Diversion of existing overhead / underground water pipelines (including those identified during package execution) required for installation of the proposed units covered under this package is included in the scope of work of the Contractor. However, the price & other terms and conditions shall be mutually discussed and agreed during the execution of job by the Contractor.

04.08.01 Battery Limit

a) Industrial water

Industrial quality make-up water (quality as indicated in GTS, Maroda-I) will be made available to the Contractor at only one point within 100m from the proposed plant at a pressure of approx 1.5 to 2.0 kgf/ cm² (g). The top of the pipeline (carbon steel) shall be approximately 1.2 m below the area ground level. Tapping of industrial make-up water shall be based on two points feeding and shall conform to provisions of GTS. Contractor shall extend the same through isolation gate valves in valve-pit along with flow meter (complete with isolation valves and by-pass arrangement) to his proposed systems for service/make-up water requirement for the entire plant area.

Contractor shall indicate the make-up water quantity requirement, pipe size, end connection, MOC of pipeline, etc. at the battery limit.

b) Drinking water

Drinking water will be made available to the Contractor at only one point within 100m from the proposed plant at a pressure of approx 1.0 kgf/cm² (g). The top of the pipeline (carbon steel) shall be approximately 1.2 m below the area ground level. Tapping of drinking water shall be based on two points feeding and shall conform to provisions of GTS. Contractor shall extend the same from the battery limit through isolation gate valves in valve-pit to his proposed systems/shops, offices, toilets, drinking water platforms, water coolers, etc. for the entire plant area.

The Contractor shall indicate the drinking water quantity requirement, pipe size, end connection, MOC of pipeline, etc. at the battery limit.

c) Fire-fighting water

Industrial quality water (quality as indicated in GTS) will be made available to the Contractor at one point within 100m from the proposed
plant at requisite pressure. The top of the pipeline (carbon steel) shall be approximately 1.2 m below the area ground level. Tapping of industrial make-up water shall be based on two points feeding and shall conform to provisions of GTS. Contractor shall extend the same from battery limit through isolation gate valves in valve-pit to the entire plant area.

d) Construction Water

Construction water arrangement shall be in the scope of contractor. The location of borewells, if planned by the Contractor for construction water requirement would require clearance / approval from BSP/MECON.

04.08.02 Specification and Description of Work

Water System Facilities:

Water system shall in general include the following facilities:-

a) Cooling water system,
b) Make-up water system,
c) Water conditioning system,
d) Water supply system for air conditioning & ventilation system,
e) Drinking water system,
f) Water based fire-fighting system,
g) Service Water System,
h) Dewatering system for underground premises
i) Interplant pipelines,
j) Water pollution control & conservation.

a) Cooling Water System

1. For cooling of plant and equipment of the air-compressor unit there shall be a separate cooling water re-circulation system for each unit / sub-system with pumps, cooling towers and piping network. Contractor shall provide a separate pump house to house compatible group of pumps. Separate group of pumps and separate piping shall be provided for each sub-system to enable flexibility in operation.

2. The cooling water system shall be supplied in line with the GTS with regard to design norms (including no. of standby pumps, type of pumps, valves and piping design) and subject to Employer's approval.
3. The cooling water circuits shall be provided with chemical conditioning system to control corrosion and scaling and prevent bio-fouling. To reduce blow-down higher cycle of concentration shall be targeted.

4. Pump houses shall be provided with air-washer based air-conditioning and ventilation system.

5. With a view to conserve and save upon fresh water requirement, the Contractor will plan to utilize/reuse/recycle the reject/blow-down from the cooling water systems in the plant with necessary treatment etc. as specified by the Employer.

b) Make-up Water System

1. Make-up water for various usage including cold sump of cooling water circuit for air-compressor, air-conditioning and ventilation systems etc. and for supply of industrial service water will be tapped from the existing industrial water network and will be conveyed to the various consumers through a pipe network, preferably over-ground.

2. Quality of industrial make-up water is furnished in the GTS. This water will be supplied as make-up water to proposed plant unit for process & cooling needs at only one point for the entire needs of the proposed plant unit at battery limit as specified. The Contractor shall provide necessary treatment facility, wherever required, to make the water suitable for cooling and other purposes.

3. The water loss in the various processes in evaporation, process/system, minor leakages including service water requirement etc. shall be replenished by a separate common make-up water system to be provided by the Contractor.

4. The Contractor shall indicate make-up water requirement duly corroborated by back-up calculation.

5. Make up water system will include extension of pipelines from the battery limit with isolation gate valves in valve pit, along with pumps (if required), valves, valve pits, sumps etc., to the cooling water recirculation system, ACVS, service water requirement as well as process needs.
6. Online booster shall not be accepted. A makeup water sump with pumps and piping (pump house and sump are to be provided by the Contractor), if required, shall be provided.

c) Water Conditioning System

1. To prevent the circulation water system from corrosion and scale formation and to bring the make up water to the condition suitable for the cooling water requirement in the proposed plant there shall be a water conditioning facility as per system requirement and inline with the details given in GTS.

2. It shall consist of dosing tanks, pumps, valves, pipes, fitting, pipe supports and associated civil, structural, electrical, instrumentation, material handling, air-conditioning & ventilation etc. The scope of work for all these remains the same as specified for cooling water system.

3. These pumps may also be housed in the same pump-house for cooling water system or separately.

4. The Contractor shall furnish the details of chemical dosing proposed for the system.

5. The Contractor shall include in the scope of supply three months chemicals requirement for the chemical conditioning system.

d) Water Supply System for air-conditioning & ventilation

1. The entire piping network for water supply for air-conditioning and ventilation and other Systems/ Sub-systems is in the scope of the Contractor.

2. It shall consist of pumps, valves, pipes, fitting, pipe supports and associated civil, structural, electrical, instrumentation, material handling, air-conditioning & ventilation etc.

3. The details and specification of pumps, valves, pipes, fitting, pipe supports and associated civil, structural, electrical, instrumentation, material handling, air-conditioning & ventilation etc. as specified for cooling water system is applicable for this system also.
4. Makeup water for the system shall be provided by the Contractor from the make-up water network provided for the main plant. No separate connection at battery limit will be provided for this purpose.

5. Pumphouses shall be provided with air-washer based air-conditioning and ventilation system.

e) Drinking Water System

1. The drinking water shall be made available at one point near proposed plant within battery limit as specified. The Contractor shall extend the pipeline from battery limit with isolation gate valves in valve-pit upto various drinking water consumers.

2. The Contractor shall indicate drinking water requirement duly corroborated by back-up calculation.

3. If the pressure, as indicated in battery limit parameters, is felt inadequate for the area under the scope of the Contractor. Contractor shall provide separate sump and drinking water pumps along with piping and electrics etc. to meet the requirement. Online booster shall not be accepted.

4. The details and specification of pumps, valves, pipes, fitting, pipe supports and associated civil, structural, electrical, instrumentation, material handling, air-conditioning & ventilation etc. for cooling water system is applicable for this system also.

f) Water based Fire-Fighting System

To cater to the needs of water based fire-fighting system, a fire water piping network shall be planned with provision of yard hydrants and internal hydrants at regular intervals. The proposed network shall be connected with the existing network at the battery limits with isolation gate valves in valve-pit.

The following specification of work shall be considered:-

i) Category of hazard - ordinary (as par TAC)
ii) Yard hydrants - at 45 m intervals
iii) Internal hydrants - at 30 m intervals
iv) Min. pressure at remotest hydrant - 3.5 kg/cm²
Two nos. of 15 m long hose shall be provided alongwith fittings for each yard hydrant and 2 nos. of 15 m long hose shall be provided along with fittings for each internal hydrant.

The water based fire fighting system shall be designed, supplied & erected in line with the stipulations under various clauses of GTS-02 and subject to Employer’s / Consultant’s approval. The details of the MVWS system have been dealt with separately.

The Contractor shall indicate fire fighting water requirement duly corroborated by back-up calculation.

g) Service Water System

For Service Water, pipeline network shall start from common pump house to all the transfer points of each floor and conveyor gallery. In each floor, 1 no. tapping point will be provided and for the conveyor gallery the tapping point shall be provided at every 50 metre interval. For each tapping point 1 no. gate valve, hose and quick fix connection shall be provided.

For service water line each tapping point discharge rate will be 2m³/hr. and maximum 6 Nos. points can be operated at a time.

Service water system shall be supplied in line with the GTS with regard to design norms (including no. of standby pumps, type of pumps, valves and piping design) and subject to Employer’s approval.

h) Dewatering system for underground premises

Dewatering system for underground sumps shall be provided for underground portion of the proposed plant. The water from the sumps will be pumped to the nearest surface drainage system through pumping arrangement to be provided as per GTS and subject to Employer’s approval.

i) Interplant Pipelines

Industrial water for make-up water supply and general plant usage will be met through the proposed pipeline to be laid from the tapping point to these units.

Drinking water network and fire water network will be provided to various consumption points in the proposed industrial premises.
All the water lines including make-up water, fire water and drinking water lines, process and cooling water lines will generally be laid over-ground preferably on structural trestles.

j) Water Pollution Control and Conservation

Extensive recycling shall be adopted in the design of plant water systems. Quality of circulating water will be maintained through dosing of conditioning chemicals for controlling corrosion, scale deposit and microbial growth.

Through cascaded reuse of blow down, the water scheme will ensure minimization of waste water discharge from the industrial water circuits.

Any discharge being made into the Employer’s existing network shall conform to the local pollution control norms fulfilling the statutory requirements.

The cooling water systems will generally comprise the following main units:

a) Open Indirect Industrial Water Cycle:
   - Cooling tower,
   - Pumpsets,
   - Strainers,
   - Interconnecting piping,
   - Chemical conditioning System,
   - Electrics, instrumentation & control system.

b) Miscellaneous and Common Facilities:
   - Make-up water system,
   - Interplant pipelines,
   - Water based Fire Fighting system,
   - Drinking Water System.

04.08.03 Design Criteria

Efficiency, reliability and flexibility of operation and maintenance will be the guiding criteria of the design of the water system for the proposed
plant. Following design criteria in addition to GTS provisions shall be followed:

1. Water System will be designed as per the provisions of GTS in respect of various design aspects including type of pumps, no. of standby pumps, piping, pipe specification, type of valves, cooling tower, side-stream filtration, handling & hoisting facilities, air-conditioning and ventilation facilities etc.

2. Each circulation system shall be connected with two nos. of delivery headers from the pumphouse and two nos hot return water headers from the consumers to the cooling tower/ pumphouse / treatment unit. The water carrying capacity of each header shall be such that incase one of the headers is under maintenance the other header should be in a position to carry the required quantity of water to the consumers, i.e., 100% of designed flow so that normal production of unit is not affected with only one delivery / return header in operation. There shall be proper isolating facilities in these headers so that supply of water in any circuit or to any area of the Complex is not affected due to leakage in one of header line.

3. All sumps shall be compartmentalised as per GTS and each pump shall have independent suction.

4. Each pump shall have independent suction. Each pump shall be provided with a gate valve on the suction side and a non-return valve and gate valve on delivery side. The delivery line of each pump shall be connected to the main header with isolating header gate valves for isolating pumps’ delivery valves. Motorised gate valves shall be provided in automated pumping system for pumps’ suction & delivery.

5. Suitable number of header valves shall be provided such that delivery valve of a pump can be isolated for maintenance without affecting other stand-by pump’s availability.

6. All the valves of diameter 450 mm and above and the valves requiring remote control operation shall be electrically / pneumatically operated. Electrically operated valves shall be provided with limit switches as a safety measure. Electrically operated valves shall have provision for manual operation also. All manual valves of sizes DN 350 and above shall be gear
operated. Frequently operated delivery valves and header valves below diameter 450 mm shall also be electrically operated.

7. Total no. of pumps in a pumping circuit shall be as per GTS. Pump type shall be as per the provisions of the GTS. Pump rpm shall be governed by the kW rating in line with the provisions of the GTS.

8. Drainage pumps (split casing, self priming and horizontal centrifugal pumps) will be one reserve pump for one working pump. The pumps shall not be of mono-block design.

9. All gate valves shall be cast steel with SS internals, NRVs shall have SS internals, rest of the design features shall be as per GTS.

10. Following MOC to be considered for valves:

   a) Gate valve:


   b) Butterfly valve:

   Body: ASTM A216 Gr WCB, Disc: CF8, Seat: EPDM (integral with the body), shaft: AISI 410 self-lubricated PTFE lined bearings for both drive end and non-drive end, hand lever /hand wheel: pressed/forged steel, end connection: Flanged to IS6392, T-17.

11. Pipe materials shall be as per CRLA,RSP,SAIL.

12. Sluice gates will have SS internals.

13. Butterfly valves usage shall be accepted for non-critical applications for flow modulation purpose at the express approval of the Employer.

14. Contractor will consider provision of strainers in each header as follows:
• open industrial water circuit: for 100% flow, simplex strainers, 1W+1S,

15. Material handling facility for the units of the Water System shall be as per GTS.

16. Pump houses shall be provided with air-washer based air-conditioning and ventilation system.

17. Design criteria of the cooling tower shall be as per GTS.

18. Special maintenance tools and spares as mentioned in cl. no. 01.05 in ‘Design Criteria for Cooling Towers’, list of spares & tools & tackles as listed in cl. no. 8.18, list of tools and tackles as listed in cl. no. 8.18.02 of GTS for Water System shall be supplied by the Contractor.

19. Tapping of industrial make up water, drinking water & fire-fighting water shall be based on two points feeding as explained elsewhere in this chapter and shall conform to provisions of GTS.

20. Pipe thicknesses shall be as per GTS provisions.

21. As far as possible pipelines shall be laid above ground or in concrete trenches / tunnels. Wherever, it is not possible then only pipelines shall be laid underground.

04.08.04 Description of Cooling Water System

Open Industrial Water Cycle

Open industrial water circuits with filtered industrial water as the cooling medium shall be provided for indirect cooling of compressor unit.

Hot industrial cooling water after cooling compressor unit will reach the cooling towers under residual pressure for cooling. Cold water from the cooling tower basin will flow into the cold well of the pump house. From the cold well separate group of pumps shall pump water to the various consumers.

Make-up water shall be added in the cold well to make-up the losses in the system.

04.08.05 Erection, Testing and Commissioning
i. The erection of all plant and equipment shall be carried out according to the latest engineering practices and according to the drawings, specifications, Instructions etc. duly approved by the Employer/Consultant.

ii. The welding work should be carried out as per the approved WPS and PQR.

iii. The Contractor shall supply all required manpower, tools and related equipment, all hoisting equipment, all necessary scaffoldings, all necessary transporting equipment, consumables. Construction and erection materials, petrol, diesel oil, kerosene, solvents, sealing compound, tapes, brazing and soldering materials, welding and brazing gases, erection bolts, nuts and packing sheets/compounds, temporary supports, wooden blocks, spacers, templates, jute and cotton wastes, sand/emery paper etc. as required for the satisfactory completion of work.

iv. After erection, all equipment having moving part, subject to pressures or voltages shall be given trial operation. The trial operation shall consist of 72 hours of continuous operation. All modifications and rectifications required during the trial operation or required for proper operation shall be done at his own cost by the Contractor as accepted by the Employer/Consultant.

v. Rotating equipment shall be checked for proper direction of rotation and shaft alignment. Equipment subject to pressures shall be carefully examined for leakage. All equipment, such as pressure taps, temperature measurement connections, flow measurement devices etc. shall be provided by the Contractor.

vi. On completion of the work, the Contractor shall remove and dispose off all rubbish and other unsightly materials caused by his working to a distance of five kilometer from the proposed plant area or as directed by the Employer and thereby leaving the premises in good, clean, safe and operable condition.

vii. Before giving call for final inspection, all the documents shall be furnished to the Employer. The record of manufacturing details, inspection and tests carried out by the Contractor shall be made available to the final inspecting authority. However, approval and final inspection at the manufacturing works shall not relieve the Contractor of responsibility of replacing at his cost any defective part/material which
may be detected by the employer during erection and commissioning or guarantee period.

viii. All materials required for fabrication, construction, testing and inspection shall be supplied by the Contractor. No material shall be free issue to the Contractor.

ix. No equipment or part item shall be dispatched without final inspection and issuance of inspection certificate.

x. All equipment, assemblies, sub-assemblies shall be shop tested as per relevant standards and the test certificates shall be submitted by the supplier.

xi. Erection, testing & commissioning of various equipments and piping etc shall be done also inline with details given in various chapters of GTS.

04.08.06 Painting

The Contractor shall follow the painting procedure as mentioned in GTS.

04.08.07 Drawings & documents

04.08.08 Drawings/documents to be furnished by the Contractor for approval

1. Process flow diagram indicating the water consumption figures complete with temperature, pressure and quality requirements.
2. Process & instrumentation diagrams for the water systems indicating location of all instruments, alarms and interlocks functions using ISA symbols.
3. General arrangement and cross-sectional drawings, characteristics curves and technical details of all the equipments (pumps, diesel engine, cooling tower, sluice gates, fire hydrants, etc.) , valves and piping including GA drawings showing plan, elevation and sectional views of the water system.
4. List of instruments comprising bill of materials and instrumentation data sheets.
5. Layout of piping system indicating pipe routing, location of supports, valves and other fittings as required.
6. General arrangement drawings of pump houses and sump / tank (including civil, structural and other facilities) showing dispositions of various equipment and piping.

7. Data sheets, characteristic curves and technical details of all the equipments, valves and piping.

8. List of safety interlocks.

9. Test procedures for preliminary and final acceptance tests.


11. All equipment and piping sizing calculations.

12. GA drawings and details of air conditioning & ventilation facilities.

13. Test certificates for the following:

14. Material test certificate for all major equipment and their components.

15. Hydraulic test of equipment, pipe fittings & valves.

16. Static and dynamic balancing of all rotary parts/ equipments.

17. Any other drawing/ documents as required by the Employer.

**04.08.09 Drawings / documents to be furnished by the Contractor for reference and record**

1. The Contractor shall submit required sets of all the approved drawings, documents and manuals for Employer’s record and use. After erection of equipment, the Contractor shall submit one set of linen tracings/ reproducible in required number of prints along with soft copies in CD (in AutoCAD format) of each “As built drawings”.

2. Operating and maintenance manual.

3. Spare parts recommendation and price list.

4. Instruction for erection, testing and commissioning.

5. Manufacturer’s test certificates.

6. Lubrication schedule and quantity and quality of lubricant for one year’s normal operation.

7. Various equipment assembly drawings and bill of material.

8. Welding procedure.


11. Characteristics curves of the pumps, motors and other equipments.

12. Operation and maintenance manuals for all equipments, valves and complete water system along with soft copies.

13. Test and calibration certificates.

15. Technical literature, catalogues and manufacturer’s drawings for all brought out equipment, valves and other items.
16. All inspection/ test report/ certificates.
17. Any other drawing/ documents as required by the Employer/Consultant.

04.08.10 Preferred Makes

The Contractor shall follow the list of proffered makes as per the following:

<table>
<thead>
<tr>
<th>SI No.</th>
<th>Item Description</th>
<th>Manufactures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Horizontal centrifugal Pumps</td>
<td>Kirloskar Brothers, KSB, Beacon Weir, Voltas, Mather &amp; Platt, Jyoti, WPIL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Worthington).</td>
</tr>
<tr>
<td>2.</td>
<td>Submersible pumps</td>
<td>KSB, SU Motors, Kirloskar Brothers.</td>
</tr>
<tr>
<td>3.</td>
<td>Dosing Pump</td>
<td>Shapo Tools, Asia LMI (Madras), Toshniwal, Milton Roy India.</td>
</tr>
<tr>
<td>5.</td>
<td>Sluice Gates</td>
<td>Jash, IVPL.</td>
</tr>
<tr>
<td>7.</td>
<td>Rubber expansion joints</td>
<td>BDK, CORI Engineers.</td>
</tr>
<tr>
<td>8.</td>
<td>Hoses</td>
<td>Senior Flexonics, Hydrocirm</td>
</tr>
<tr>
<td>9.</td>
<td>Pipe a) MS/GI</td>
<td>SAIL, TATA, Jindal, MAN, SAW, Welspun, Prakash, PSL, MSL.</td>
</tr>
<tr>
<td></td>
<td>b) DI</td>
<td>Electro Steel Casting</td>
</tr>
<tr>
<td>10.</td>
<td>MS/GI Pipe Fittings</td>
<td>Tube bends, Stewards &amp; Lloyds, BST, Jindal.</td>
</tr>
<tr>
<td>12.</td>
<td>Fire hydrants</td>
<td>New Age Industries, Steelage Industires, ASCO, Strumech, Vijay Fire, Zenith</td>
</tr>
</tbody>
</table>
Valves

1. C.S. Gate / Globe Valve
   A. (Non-IBR- for all Sizes and Ratings):
      - M/s. BHEL, Tiruchirapalli.
      - M/s. K.S.B. Pumps Ltd, Kolkata.
      - M/s. Leader Valves Ltd., Jalandhar.
      - M/s. Oswal Industries Ltd., Ahmedabad.

2. Butterfly Valve:
   - M/s. Avcon Control Pvt. Ltd., Mumbai (For Actuator operated Valves)
   - M/s. Fisher Xomox Sanmar, Trichinapalli.
   - M/s. Inter Valves (Pvt.) Ltd., Pune.
   - M/s. Tyco Valves, Baroda.
   - M/s. Virgo Engineers Ltd., Pune.

3. Ball Valve:
   - M/s. Fisher Xomox Sanmar., Trichinapalli.
   - M/s. Flowchem Ind., Ahmedabad.
   - M/s. Inter Valves, Pune.
   - M/s. Oswal Industries Ltd., Ahmedabad.
   - M/s. Virgo Engineers Ltd., Pune.

4. CI/Sluice Gate Valves
   A. For all Sizes and Ratings:
      - M/s. Calsens Private Ltd., Kolkata.
B. For Sizes upto NB 100 mm & PN 10 Rating:

- M/s. Ronex Engg. Company, Kolkata
- M/s. Upadhyaya Valve Manuf. Pvt. Ltd., Kolkata
- M/s. Steam & Mining Industries, Kolkata.

(Vendors appearing under ‘A’ shall be eligible for ‘B’ also)

5. Plug Valve:

- M/s. Fisher Xomox Sanmar Ltd., Chennai.
- M/s. Larsen & Toubro Ltd., (Audco), Chennai.

6. Cock Valve for Gas applications:

- M/s. Larsen & Toubro Ltd., (Audco), Chennai.

7. Check Valve/Non Return Valve:

- M/s. Inter Valves (Pvt.) Ltd., Pune.
- M/s. K.S.B. Pumps Ltd, Kolkata.
- M/s. Larsen & Toubro Ltd., (Audco), Chennai.
- M/s. Oswal Industries Ltd., Ahmedabad.

8. Fabricated Gate Valve:

- M/s. Larsen & Toubro Ltd., (Audco), Chennai.
- M/s. Zimmermann & Janseen, Duren, Germany.

9. Piston Valve:

- M/s. Uni -Klinger Ltd., Pune.
10. **Knife Edge Gate Valve**:

- M/s. Energo Engg., Delhi.
- M/s. Orbinox India Pvt. Ltd., Coimbatore.

11. **Non-Ferrous Valve**:

- M/s. Leader Valves Ltd., Jalandhar.
- M/s. Zoloto Ind., Jalandhar.
# LIST OF DRAWINGS

List of drawings enclosed with this Contract Specification is furnished below:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>CS Drawing Number</th>
<th>REV</th>
<th>Description of Drawing</th>
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