PART-I

BHARAT HEAVY ELECTRICALS LIMITED

INDUSTRIAL SYSTEMS GROUP BANGALORE

JOB NO - IS – 1 - 10 - 2000

TECHNICAL SPECIFICATION FOR ENGINEERING SERVICES FOR CIVIL, STRUCTURAL & ARCHITECTURAL WORKS OF CHP PACKAGE

HINDUJA NATIONAL POWER CORPORATION LTD.
2X 520 MW VIZAG THERMAL POWER PROJECT

Note: - In case any clarification is required, with regard to technical specification, please contact us over
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SECTION – I
SITE DATA.

1.0 GENERAL PROJECT INFORMATION:

Design Basis

Hinduja national Power Corporation Ltd (HNPCL) is setting up a Coal fired Thermal Power plant at Vishakapatanam , Andra Pradesh. The capacity of the proposed thermal power project is 1040 MW with 2 x 520 MW configurations with sub – critical steam parameters. The power generated from the plant will be sold to Andra Pradesh as well as to other states through interstate transmission system. **BHEL is the EPC contractor for the above plant and M/s HNPCL has appointed M/S Mott MacDonald (MM) as the owners Engineer for the project.**

1.1 *Ambient condition*

Longitude / latitude Average elevation Mean Sea Level	- -	$83^0$07’30” / $17^0$34’30”N RL(+)9 m approximately) for main plant block.
Maximum Monthly average temperature	-	44.4 deg C
Minimum monthly temperature	-	12.8 Deg C
Maximum relative Humidity	-	84 %
Minimum Relative Humidity	-	68 %
Design relative Humidity	-	80 %
Annual Mean Wind speed		10.8 m/ sec
Maximum rainfall	-	293.3 mm in 24 hrs

Ambient Air Quality: Laden with coal and steel dust particles, fumes, chemical gases.

1.2 Topographical survey

The terrain of the proposed plant site is undulating. The level of natural ground generally varies between reduces level RL (+) 1 M to RL (+) 17 m

1.3 Sesmological Parmeters

The proposed project is located in seismic Zone III , as per IS :1893 , Seismic forces would be considered as per the IS accordingly.

1.4 Wind loading

The various design parameters, as defined in IS: 875 (part 3), to be applied for the project site shall be as follows

(a) The basic wind speed "Vb" at ten mtrs above the mean ground level – 50 m/sec
(b) Other parameters or coefficients shall be as per IS: 875 (part 3) stipulations.

1.5 Construction Material

It is expected that all necessary construction material should be available from nearby sources. However, bidders are requested to satisfy themselves in this regard.

1.6 Construction Power

The requirement of construction Power shall be indicated by the contractor. 415 V , 3 phase , 4 wire supply will be made available at one point at the construction site . There after the distribution of power supply for contractors use shall be in contractor's scope. The construction power will be charged as per state electricity rules prevailing at the time.

1.7 Construction water

The requirement of construction water shall be indicated by the contractor. The construction water will be made available at one point near to the contractor's site.

1.8 Raw Water Source

The source of water for the proposed project will be taken from two sources, yelluru canal for sweet water and the other is sea water (saline water) from Bay of Bengal. The sweet water will meet the requirement for DM plant, HVAC makeup and potable water for the plant and coal dust suppression at various structures. Sea water is proposed to be used for meeting the requirement of condenser cooling water system make up, Ash handling system and Coal dust suppression for coal stack yard.

1.9 The water Analysis / Coal characteristics/ Ash Characteristics

The Water Analysis, Coal Characteristics and the Ash characteristics are enclosed in Annexure -1, Annexure 2 and Annexure 3 respectively.

2.0 Power Supply Characteristics

Parameter	LT
Power Supply	415V, 3phase, 50 Hz, 4 wire
Voltage variations	+ 10% - *10%*
Frequency variation	+ 6% - 6%
Combined V& F variation	+/-10%
System neutral	solidly grounded
System short circuit level	50 kA rms. at 415V for 1 second

SECTION – II

APPLICABLE STANDARDS

LIST OF CODES AND STANDARDS

Indian standards	Title	International Standards
IS:277	Galvanised steel sheets (plain or corrugated)	
IS:655	Specification for metal air duct	
IS:800	Code of practice for use of structural steel in general building construction	BS 449:1969 BS 5950 ASA A57, 1-1952
IS:807	Code of practice for design, manufacture, erection and testing (Structural portion) of cranes and hoists	Draft Revision of A.S. NO. CS.2 SAA Crane and Hoist code Doc:No. BU/4 Rev 6588 (Issued by Standards Association of Australia). DIN 120:1936 (Sheet 1) DIN 120:1936 (Sheet 2) 327 part-I, 1951 BS 466 part-II, 1960 BS 644:1960 BS 1757:1951 BS 2573:part-I:1960
IS:875	Code of practice for design loads (other than earthquake) for buildings and structures Leading standards	National Building code of Canada (1953)-Part-IV Design section 4.1 (issued by Canadian Standard) DIN-1055-1955 (Issued by ASA)

IS:1239 Part-I	Mild steel tubes	(ISO/R-64-1958) (ISO/R-65-1958) (BS 1387 : 1957)
IS:1239 Part-II	MILD STEEL TUBULARS	BS 1387 : 1967
	Other wrought steel pipe	BS 1387 : 1967
	Fittings	BS 1740 : 1965
IS:1893	Criteria for earthquake resistant design of structures	
IS1978-1971	Line Pipe	API Standards 5L April 1969.

CODE AND STANDARD FOR CIVIL WORKS

Some of the applicable Standards, Codes and references are as follows:

Excavation & Filling

IS: 2720 (Part-II, IV TO VIII, XIV, XXI, XXIII, XXIV, XXVII TO XXIX, XL) Methods of test for soils-determination for water content etc.

IS: 4701 **Code of practice for earth work on canals.**

IS: 9758 **Guide lines for Dewatering during construction.**

IS: 10379 **Code of practice for field control of moisture and compaction of soils for embankment and sub-grade.**

Properties, Storage and Handling of Common Building Materials

IS: 269 **Specification for ordinary Portland cement, 33 grade.**

IS: 383 **Specification for coarse and fine aggregates from natural sources for concrete.**

IS: 432 **Specification for mild steel and (Parts 1&2) medium tensile steel bars and hard-drawn steel wires for concrete reinforcement.**

IS: 455 **Specification for Portland slag cement.**

IS: 702 Specification for Industrial bitumen.

IS: 712 Specification for building limes.

IS: 808 Rolled steel Beam channel and angle sections.

IS: 1077 Specification for common burnt clay building bricks.

IS: 1161 Specification of steel tubes for structural purposes.

IS: 1363 Hexagon head Bolts, Screws and nuts of production grade C.

IS: 1364 Hexagon head Bolts, Screws and Nuts of Production grade A & B.

IS: 1367 Technical supply conditions for Threaded fasteners.

IS: 1489 Specification for Portland-pozzolana cement:

(Part-I) Fly ash based.

(Part-II) Calcined clay based.

IS: 1542 Specification for sand for plaster.

IS: 1566 Specification for hard-drawn steel wire fabric for concrete reinforcement.

IS: 1786 Specification for high strength deformed bars for concrete reinforcement.

IS: 2062 Specification for steel for general structural purposes.

IS: 2116 Specification for sand for masonry mortars.

IS: 2386 Testing of aggregates for concrete.
(Parts-I to VIII)

IS: 3150 Hexagonal wire netting for general purpose.

IS: 3495 Methods of tests of burnt clay building bricks.
(Parts-I to IV)

IS: 3812 Specification for fly ash, for use as pozzolana and admixture.

IS: 4031 Methods of physical tests for hydraulic cement.

IS: 4032 Methods of chemical analysis of hydraulic cement.

IS: 4082	**Recommendations on stacking and storage of construction materials at site.**
IS: 8112	**Specification for 43 grade ordinary portland cement.**
IS: 8500	**Medium and high strength structural steel.**
IS: 12269	**53 grade ordinary portland cement.**
IS: 12894	**Specification for Fly ash lime bricks.**

Cast-In-Situ Concrete and Allied Works

IS: 280	**Specification for mild steel wire for general engineering purposes.**
IS: 456	**Code of practice for plain and reinforced concrete.**
IS: 457	**Code of practice for general construction of plain & reinforced concrete for dams & other massive structures.**
IS: 516	**Method of test for strength of concrete.**
IS: 650	**Specification for standard sand for testing of cement.**
IS: 1199	**Methods of sampling and analysis of concrete.**
IS: 1791	**General requirements for batch type concrete mixers.**
IS: 1838 (Part-I)	**Specification for preformed fillers for expansion joints in concrete pavements and structures (non-extruding and resilient type).**
IS: 2204	**Code of practice for construction of reinforced concrete shell roof.**
IS: 2210	**Criteria for the design of reinforced concrete shell structures and folded plates.**
IS: 2438	**Specification for roller pan mixer.**
IS: 2502	**Code of practice for bending and fixing of bars for concrete reinforcement.**
IS: 2505	**General requirements for concrete vibrators, immersion type.**
IS: 2506	**General requirements for concrete vibrators, screed board type.**

IS: 2514 **Specification for concrete vibrating tables.**

IS: 2645 **Specification for Integral cement water proofing compounds.**

IS: 2722 **Specification for portable swing weigh batches for concrete. (single and double bucket type)**

IS: 2750 **Specification for Steel scaffolding.**

IS: 2751 **Code of practice for welding of mild steel plain and deformed bars for reinforced concrete construction.**

IS: 3025 **Methods of sampling and test waste water.**

IS: 3366 **Specification for Pan vibrators.**

IS: 3370 (Part I to IV) **Code of practice for concrete structures for the storage of liquids.**

IS: 3414 **Code of practice for design and installation of joints in buildings.**

IS: 3550 **Methods of test for routine control for water used in industry.**

IS: 3558 **Code of practice for use of immersion vibrators for consolidating concrete.**

IS: 4014 (Parts I & II) **Code of practice for steel tubular scaffolding.**

IS: 4326 **Code of practice for earthquake resistant design and construction of buildings.**

IS: 4461 **Code of practice for joints in surface hydro-electric power stations.**

IS: 4656 **Specification for form vibrators for concrete.**

IS: 4925 **Specification for batching and mixing plant.**

IS: 4990 **Specification for plywood for concrete shuttering work.**

IS: 4995 (Parts I & II) **Criteria for design of reinforced concrete bins for the storage of granular and powdery materials.**

IS: 5256 **Code or practice for sealing joints in concrete lining on**

canals.

IS: 5525	Recommendations for detailing of reinforcement in reinforced concrete work.
IS: 5624	Specification for foundation bolts.
IS: 6461	Glossary of terms relating to cement concrete.
IS: 6494	Code of practice for water proofing of underground water reservoirs and swimming pools.
IS: 6509	Code of practice for installation of joints in concrete pavements.
IS: 7861	Code of practice for extreme weather concreting. (Parts I & II)
IS: 9012	Recommended practice for shot concreting.
IS: 9103	Specification for admixtures for concrete.
IS: 9417	Recommendations for welding cold worked steel bars for reinforced concrete construction.
IS: 10262	Recommended guidelines for concrete mix design.
IS: 11384	Code of practice for composite construction in structural steel and concrete.
IS: 11504	Criteria for structural design of reinforced concrete natural draught cooling towers.
IS: 12118	Specification for two-parts poly sulphide.
IS: 12200	Code of practice for provision of water stops at transverse contraction joints in masonry and concrete dams.
IS: 13311	Method of non-destructive testing of concrete.
Part-1	Ultrasonic pulse velocity.
Part-2	Rebound hammer.
SP:23	Handbook of concrete mixes
SP: 24	Explanatory Handbook on IS: 456-1978
SP: 34	Handbook on concrete reinforcement and detailing.

Precast Concrete Works

SP: 7(PartVI/ National Building Code- Structural design of prefabrication and Sec.7) systems building.

IS: 10297 Code of practice for design and construction of floors and roofs using precast reinforced/prestressed concrete ribbed or cored slab units.

IS: 10505 Code of practice for construction of floors and roofs using pre-cast reinforced concrete units.

Masonary and Allied Works

IS: 1905 Code of Practice for Structural Safety of Buildings-Masonry walls.

IS: 2212 Code of Practice for Brickwork.

IS: 2250 Code of Practice for Preparation and use of Masonry Mortar.

SP: 20 Explanatory hand book on masonry code.

Sheeting Works

IS:277 Galvanised steel sheets (plain or corrugated).

IS: 459 Unreinforced corrugated and semi-corrugated asbestos cement sheets.

IS: 513 Cold-rolled carbon steel sheets.

IS: 730 Specification for fixing accessories for corrugated sheet roofing.

IS: 1626 Specification for Asbestos Cement building pipes and pipe fittings, gutters and gutter fittings and roofing fittings.

IS: 2527 Code of practice for fixing rain water gutters and down pipe for roof drainage.

IS: 3007 Code of practice for laying of asbestos cement sheets.

IS: 5913 Methods of test for asbestos cement products.

IS: 7178 Technical supply conditions for tapping screw.

IS: 8183 Bonded mineral wool.

IS: 8869 **Washers for corrugated sheet roofing.**

IS: 12093 **Code of practice for laying and fixing of sloped roof covering using plain and corrugated galvanised steel sheets.**

IS: 12866 **Plastic translucent sheets made from thermosetting polyster resin (glass fibre reinforced).**

IS: 14246 **Specification for continuously pre-painted galvanised steel sheets and coils.**

Fabrication and Erection of Structural Steel Work

IS: 2016 **Specification for plain washers.**

IS: 814 **Specification for covered Electrodes for Metal Arc Welding for weld steel.**

IS: 1852 **Specification for Rolling and Cutting Tolerances for Hot rolled steel products.**

IS: 3502 **Specifications for chequered plate.**

IS: 6911 **Specification for stainless steel plate, sheet and strip.**

IS: 3757 **Specification for high strength structural bolts**

IS: 6623 **Specification for high strength structural nuts.**

IS: 6649 **High Tensile friction grip washers.**

IS: 800 **Code of practice for use of structural steel in general building construction.**

IS: 816 **Code of practice for use of Metal Arc Welding for General Construction.**

IS: 4000 **Code of practice for assembly of structural joints using high tensile friction grip fasteners.**

IS: 9595 **Code of procedure of Manual Metal Arc Welding of Mild Steel.**

IS: 817 **Code of practice for Training and Testing of Metal Arc Welders.**

IS: 1811 **Qualifying tests for Metal Arc Welders (engaged in welding**

structures other than pipes).

IS: 9178 **Criteria for Design of steel bins for storage of Bulk Materials.**

IS: 9006 **Recommended Practice for Welding of Clad Steel.**

IS: 7215 **Tolerances for fabrication steel structures.**

IS: 12843 **Tolerance for erection of structural steel.**

IS: 4353 **Recommendations for submerged arc welding of mild steel and low alloy steels.**

SP: 6 (Part 1 to 7) **ISI Hand book for structural Engineers.**

IS: 1608 **Method of Tensile Testing of Steel products other than sheets, strip, wire and tube.**

IS: 1599 **Method of Bend Tests for Steel products other than sheet, strip, wire and tube**

IS : 228 **Methods of chemical Analysis of pig iron, cast iron and plain carbon and low alloy steel.**

IS : 2595 **Code of Practice for Radio graphic testing.**

IS : 1182 **Recommended practice for Radiographic Examination of fusion welded butt joints in steel plates.**

IS : 3664 **Code of practice for Ultra sonic Testing by pulse echo method.**

IS : 3613 **Acceptance tests for wire flux combination for submerged Arc Welding.**

IS : 3658 **Code of practice for Liquid penetrant Flaw Detection.**

IS : 5334 **Code of practice for Magnetic Particle Flaw Detection of Welds.**

Piling and Foundation

IS:1080 Code of practice for design and construction of simple spread foundations.

IS:1904 Code of practice for design and construction of foundations in Soils; General Requirements.

IS:2911 Code of practice for designs and construction of Pile foundations (Relevant Parts).

IS:2950 Code of practice for designs and construction of Raft (Part-I) foundation.

IS:2974 Code of practice for design and construction of machine

(Part-I TO V) foundations.

IS:6403 Code of practice for determination of Allowable Bearing pressure on Shallow foundation.

IS:8009 Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads.

Part-I Shallow foundations.

Part-II Deep foundations.

IS:12070 Code of practice for design and construction of shallow foundations on rocks.

DIN:4024 Flexible supporting structures for machines with rotating machines.

VDI:2056 Criteria for assessing mechanical vibrations of machines.

VDI:2060 Criteria for assessing rotating imbalances in machines.

Roads

IRC:05 Standard specifications and Code of practice for road bridges, section-I general Features of Design.

IRC:14 Recommended practice of 2cm thick bitumen and tar carpets.

IRC:16 Specification for priming of base course with bituminous primers.

IRC:19 Standard specifications and code of practice for water bound macadam.

IRC:21 Standard specifications and Code of practice for road bridges, section-III - Cement concrete (plain and reinforced).

IRC:34 Recommendations for road construction in waterlogged areas.

IRC:36 Recommended practice for the construction of earth embankments for road works.

	IRC:37	Guidelines for the Design of flexible pavements.
	IRC:56	Recommended practice for treatment of embankment slopes for erosion control.
	IRC:73	Geometric design standards for rural (non-urban) highways.
	IRC:86	Geometric Design standards for urban roads in plains.
	IRC:SP:13	Guidelines for the design of small bridges & culverts.
	IRC - Public- ation	Ministry of Surface Transport (Roads Wing), Specifications for road and bridge works.
	IS:73	Specification for paving bitumen
	Loadings	
	IS:875 (Pt. I to V)	Code of practice for design loads other than earthquake) for buildings and structures.
	IS:1893	Criteria for earthquake resistant design of structures.
	IS:4091	Code of Practice for design and construction of foundation for transmission line towers & poles.
	IRC:6	Standard specifications & code of practice for road bridges, Section-II Loads and stresses.
	M.O.T.	Deptt. of railways Bridge Rules.
Safety		
	IS:3696 (Part I & II)	Safety code for scaffolds and ladders.
	IS:3764	Safety code for excavation work.
	IS:4081	Safety code for blasting and related drilling operations.
	IS:4130	Safety code for demolition of buildings.
	IS:5121	Safety code for piling and other deep foundations.
	IS:5916	Safety code for construction involving use of hot bituminous materials.
	IS:7205	Safety code for erection on structural steelwork.
	IS:7293	Safety code for working with construction machinery.
	IS:7969	Safety code for handling and storage of building materials
	IS:11769	Guidelines for safe use of products containing asbestos.
	-	Indian Explosives Act. 1940 as updated.
	-	

23.19.1 Architectural design of buildings

SP:7	**National Building Code of India**
SP:41	**Hand book on functional requirements of buildings (other than industrial buildings)**

23.20.00 Miscellaneous

IS:802	**Code of practice for use of structural steel in**
(Relevant parts)	**overhead transmission line towers.**
IS:803	**Code of practice for design, fabrication and erection of vertical mild steel cylindrically welded in storage tanks.**
IS:10430	**Creteria for design of lined canals and liner for selection of type of lining.**
IS:11592	**Code of practice for selection and design of belt conveyors.**
IS:12867	**PVC handrails covers.**
CIRIA	**Design and construction of buried thin-wall pipes.**
Publication	

If any part, whole or specific aspect of equipment is not being covered under the above standards, the supplier shall specifically bring out such aspects in the offer and decide during tender scrutiny / evaluation stage as to the specific standards which shall be applicable*. Otherwise, the successful tenderer shall be liable to abide by the specific requirement* of the purchaser at detailing stage without any additional cost to the Purchaser.

The equipment & system shall also conform to the latest Indian Electricity Rules as regards safety, earthing and other essential provisions specified therein for installation and operation.

All equipment & system shall also comply with the statutory requirement of the Government of India and the State Government in which the plant is located.

SECTION- III

PREQUALIFICATION

Prequalification Criteria for detail engineering of Civil & structural Design works:-

The consultant should have prior experience in design of civil and structural works associated with at least one bulk CHP or material handling plant of minimum capacity of 1000TPH covering the below mentioned areas within the preceding seven (7) years reckoned as on date of bid opening.

I. STRUCTURAL WORKS
   1. Wagon tippler House
   2. Track hopper shed with machine hatches shed

II. R.C.C / CIVIL WORKS
   1. Double conveyor tunnel
   2. Raft foundations & Pile foundations.
   3. Minimum 4 no's substructure of wagon tippler.
   4. Minimum 2 no's of track hopper of minimum 200M length.
   5. ROADS , DRAINS
   6. VIS supported crusher mounted R.C.C block.
   7. Reclaim hopper
   8. Underground transfer point.
   9. Coal stock yard with drains for stock yard of not less than 400 M construction.

PREPARATION AND REVIEW OF DESIGN DOCUMENTS/ DRAWINGS

Consultant should be capable of Designing and preparation of design documents / design drawings / civil drawings related to following areas of the Coal handling plant using latest Software tools for design and documentation. Necessary Civil assignment inputs related to various areas will be provided by BHEL. The consultant shall depute qualified design engineers within seven days from the date of LOI and shall clarity the design drawings/documents submitted to them if required in the premises of BHEL ISG, Bangalore. Suitable space will be provided for the engineers to work at BHEL office, whenever required. However the required computer/equipments, Design & Analysis software's, etc shall be arranged by consultant himself.

SECTION- IV

BRIEF DESCRIPTION OF COAL HANDLING PLANT

1.0 System Description

(Refer Contour Plan layout Dwg. No 253292 – HNPCL-GEN-002 REV 0, Overall Plot plan drg no 253292-HNPCL-DPRG-001 REV 07, Bore hole location Layout drawing no 253292- HNPCL-GEN-003 R1, Flow Diagram for Coal handling System IS-0-FL-647-111-A001 rev 0. Brief description of the coal handing system proposed is furnished below.

1.1 Brief Description of Coal handling System

The battery limit for the coal handling job under the scope is from the wagon tippler house, track hopper, reclaim hopper to the discharge end of conveyors up to bunker building (including submission of the civil assignments required for the bunker floor for the feeding conveyors above bunker floor).

1.2 Duty of Coal & Ash Handling System Equipment

Normally one stream of equipment will operate for about 14 hours in a day to meet the requirements of 2x 520 MW. However coal handling system/equipment will be designed to operate continuously for 24 hours per day and 365 days per year. It will also be possible to operate on load (both mechanically and electrically) both the streams simultaneously and continuously for any duration of time, if required.

SECTION- V

SCOPE OF SERVICES

Summary Scope – Study of customer specification, attached soft copy in Annexure-IV, Preparation of detailed civil and structural drawings / Review of Civil & Structural Work of other sub contractor, participation in discussions. **And provide technical assistance during technical discussions** with contractors and customer for approval of drawing / documents etc. Visit to site for assistance to BHEL during construction work for solutions to design problems if any While executing the works, the consultant shall make efforts and ensure optimum design of the systems leading to saving in cost by BHEL and are leading to saving in completion time of the project meeting customer technical requirement and following the structural codes / good construction practices.

For designing the system, the plant plot plan, Track hopper, wagon Tippler details, conveyor profile and conveyor loading details, the crusher house profile, the Stock yard profile, the stacker reclaimer load details with civil assignment details, will be provided by BHEL

Major Buildings / Structure considered for design and consultancy in CHP Scope are as follows. For ash handling system the consultancy & engineering design is not envisaged. :

a) Track hopper with machine hatch including rail foundation and shed over track hopper.
b) Wagon Tippler House: Wagon Tippler foundation, Side arm charger foundations including rail foundation and shed over wagon tippler and side arm charger.
c) Foundation including rail foundation for Side arm charger
d) Drain work in wagon tippler area
e) Lighting tower foundation in wagon tippler area
f) Tunnel from wagon tippler and track hopper to pent houses.
g) Pent house foundation and pent house proper
h) Crusher House foundation and crusher house civil work for various floors.
i) Various Conveyor galleries foundation.
j) Junction house foundation and civil work and motor foundations at Junction towers.
k) Drive house foundation and drive house civil work
l) Stock yard foundation
m) Stacker & Reclaimer foundation including rail foundation.
n) Drains around Stock pile area and interconnection to plant N/W.
o) Truck tipper house civil & foundation and roof structure
p) Tunnel from truck tripper house to Pent house
q) Pent house at TRUCK Tripper route.

r) MCC rooms for CHP area foundation civil structure.
s) Foundation and building for DS / DE ventilation facility including pump house & compressor house.
t) Other miscellaneous substructure / superstructure building required for completion of CHP package.

SCOPE OF WORK FOR DESIGN OF CIVIL & STRUCTURAL ENGINEERING

A- Scope Related to Civil / structural consultant.

The Consultant shall provide Design memorandum /Design data and complete Design documents of superstructure / substructure of CHP system including control building and auxiliary electrical facility. The consultant shall provide the BOQ of Structural material required for various structures and also the reinforcement steel required in advance so that the employer can plan and supply the structural and reinforcement steel in stages.

B- Scope Related to Civil & Structural Works

1. Method of design/analysis, design parameters, various load details and critical load combinations, level of water table for design, maximum span limitations and slide /roller joint arrangement for conveyor trestle, TPs & Crusher House including vibro-isolation system, minimum size structural members, minimum grade of concrete, minimum thickness of concrete members, allowable stresses, method and sequence of construction including staging, details of proposed site testing facilities etc. strictly as per project requirement & specifications for the BHEL/ Owner's review and approval within 7 days from the date of receipt of the CHP conveyor profile and other load details..
2. Design data for civil & structural works as mentioned below for various buildings of CHP:

   i. Foundation details, Structural details
   ii. Brick works – internal and external
   iii. Half brick thick wall
   iv. One third brick thick wall
   v. Damp proof course
   vi. Plaster : exterior & rough side of interior brick wall
   vii. Plaster of Paris punning
   viii. Piling Works
   ix. Stacker Reclaimers, CH, Junction tower, TPs, Conveyor Gallery & Trestle, Pipe & Cable Trestle, etc.
   x. Cladding for conveyor gallery, TPs JNT, CH and other similar structures
   xi. False ceiling
   xii. Floor finish

xiii. Doors and windows
xiv. Rolling shutters
xv. Glazing
xvi. Roof
xvii. Painting
xviii. Stairs
xix. Rain water down covers & dust chutes
xx. Roads & Drains , culverts

3. The computer analysis/designs and a list of validated computer programs to be used by the contractor for the analysis and design.

4. The computer output listing requirements of all input data covering the loads and load combinations.

5. The various criteria required for design of various temporary works.

6. For temporary staging work the design calculations made on normally accepted practice for the structural forms etc.

b- The consultant will render various technical services to BHEL/ ISG involving provision of basic documents for civil works and for structural work:

1. The Consultant shall provide the detailed technical specification for the following:
   1) Cement concrete (plain and reinforced)
   2) Concrete piles
   3) Fabrication of structural steel work
   4) Erection of structural steel work
   5) Roads, drains, pipe culverts, box culverts etc.

2. The consultant shall provide all necessary information including but not limited to following for the civil works , structural works and related indents and technical evaluation thereof :
   a- General plant layout drawing with coordinates of roads, buildings and facilities, piping/cable corridors, pipe and cable trestles and diversion roads and drains, equipment lay down areas etc.
   b- Structure / building wise civil assignment drawings, showing plan, elevation/section as required with complete load data for various loads and load combinations prepared by Mechanical vendor / their consultant.
   c- Site grading and storm water drainage study furnishing levels of various terraces arrangement and details of drains, culverts etc. for storm water drainage system.
   d- Floor plans, elevations, cross sections and perspective view of all buildings.
   e- Construction and erection procedure for all major structure with specific reference to main structure, transfer towers, conveyor galleries, CH, and other machine foundations of CHP.
   f- Write up on various statutory requirements and their compliance for various buildings and facilities.

g- Interface with structures /building/services under other's scope / existing structures.
h- Recommendation of sequence of work to be followed during execution.
i- Minimum requirement of pedestals of steel columns, thickness of structural elements, guidelines on liquid retaining over ground/ underground structure.
j- Criteria for design and construction of equipment foundations.
k- Broad restrictions of technical requirement of conveyor galleries, trestles, CH, junction tower, and transfer points, control room / switchgear room etc.
l- Types of trenches, paving, fencing and approach roads, interconnecting roads, ponds and sewage water and waste water drainage system.
m- Details of corrosion protection measures for all structures.
n- Detail BOQ for civil, structural works of CHP furnished by CIVIL package vendor/ BHEL.

c- Consultant shall provide all the design calculations, data sheets & drawings, detailed /review fabrication drawings for civil and structural works of their scope of CHP of the project based on the agreed project requirement / design memorandum, mechanical/structural interface requirement and assist BHEL for getting approval of the same from the customer as required, which shall include (but not limited to) the following:

1. Detailed design drawings/designs/ review fabrication drawings/ prepare bar bending schedule of the foundation (detailed general arrangement drawings) and super structure within 7 to 15 days from the date of submission of the drawings / input data.
2. All the revised design and drawings in a progressive manner as per our **L_2** plan from the date of award of contract.
3. As built drawings progressively after completion of the construction as per our **L_2** plan
4. Method of shoring/ strutting sheet piling etc. for deep foundation.
5. The design and drawings of the temporary staging at all critical structures including the live load and dead load considered in the design of temporary work.
6. Method of specialized dewatering in deep foundation like well point system etc.
7. The construction methods which include special forms for staging if any:
8. Treatment at construction joints during unplanned interruption etc.
9. The design calculations and drawings for foundations/substructure and superstructure of all structures/buildings including pump houses and other structures.
10. The design calculations including dynamic analysis and drawings for all foundations subjected to dynamic loads. Design and drawing of vibration isolation system shall also be scrutinized.
11. The design calculations and drawings for all facilities and services like roads, culverts, bridges, pavings, road/rail crossings, drainage pump house (if required), drains, sewers, water tank, sumps, tunnels, trenches, ducts etc.
12. The design calculations and drawings for plumbing and building drainage.
13. All other designs, details/drawings or any other submissions as indicated elsewhere in this specification and as required by the owner/BHEL as part of CHP package.

14. Review Shop /fabrication drawings of all structural steel works and preparation of design calculations for important joint connections.

15. To prepare as built design and drawings to be submitted on completion of the project.
16. Drawing showing underground facilities with coordinates of these facilities like buried pipes, buried cables, trenches, ducts, sewer drawings, sumps pits, culverts, foundations etc.
17. Checks for stability calculations for wind, earthquake and hydro static forces to be considered along with recommendations on factor of safety.

D- SCOPE RELATED TO VISITS FOR ENGINEERING CONSULTANCY WORK

Out station visits for discussions & meetings for execution of the project to BHEL ISG unit at Bangalore/ customer's consultants and any other place as required for carrying out work as specified in points in scope above, shall be included by the party subject to a maximum of 30 man-visits of 3 working days as per the requirement.

E- GENERAL

The consultant shall also cover the following:

a. Man hour and Computer hour as per the requirement for completion of activities as detailed in point's related to above scope is included as part of scope.
b. Design of all drawings and documents as mentioned in points B above, which are prepared by the contractor each time for review till final approval both hard & soft copies each time.
c. Design of as-built drawings final distribution (in the scope of the consultant in points A & B above)
d. Overall review of interfacing between existing Civil & structural work.
e. Drawings and documents submitted to customer / consultants for review as mentioned in the scope shall be checked thoroughly by the consultant with respect to contract specifications, parameters, MOC, plant layout, co ordinates, flow diagram etc.
f. The drawings prepared by the consultant shall be duly stamped & signed by consultants with stamp with date of preparation. Required copies of these drawings/documents after stamping shall be sent to BHEL-ISG as per agreed schedule.
g. Flow of submission of various design drawings/documents at various stages of project shall be worked out after placement of P.O.
h. The Consultant shall include any specific technical services not mentioned in the specification but considered essential for completion of the project.
i. Any revision and repetition of the works specified above in points B on account of project requirement, revision shall be done by the consultant without any additional cost to BHEL.
j. The Design-consultant shall also be required to prepare the already approved design / drawings and / or include the substitution in steel sections depending upon

material availability and project time schedule requirements. These may have to be resorted to even after completion and approval of construction / fabrication drawings, without any extra cost to BHEL.

k. The estimated Bill of Materials of major Civil and Structural items to be prepared as per for Construction drawings for one time.

l. Design-Consultant shall be also responsible for the adequacy of the design and detailing.

E. Design Considerations for RCC & Steel structures:

The design documents & drawings shall generally as per following guidelines.

1.1.0 General

1.1.01 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. Under no circumstances shall normal access to all points in the equipment be blocked or obstructed by diagonal bracing.

1.1.02 The structures shall be designed confirming to the relevant safety regulations, Indian Factory Acts, Factory Rules of State Government, Fire safety rules, Pollution control board, 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 Purchaser.

1.1.03 All the T.P. / Junction Towers shall house the required coal conveyor as per coal flow diagram. The consultant shall design at all the floor beams/building considering the loads from conveyor short post and head end frame work etc. The exact load data and arrangement for coal conveyors, Wagon Tippler, Track hopper, Stacker Reclaimer, Dust extraction system and other plant and equipment of coal handling plant shall be furnished by equipment supplier / their consultant to the consultant during detailed engineering and minor variation in the equipment loads is likely and consultant to recheck the design / drawings without any additional / extra commercial implication to BHEL. However during detail engineering stage for preparation of CHP related structure of Coal Handling package supplier input like, profile of conveyors and inclination, etc will be furnished. Design of finished junction houses and galleries to be submitted by the consultant based on approved design memorandum customer. Bidder shall note that all structure related to track hopper, conveyor galleries, transfer towers, trestles, CH, SRC, etc & PH, Control buildings and all other auxiliary structure and their substructure to be included in the scope of consultancy.

The consultant shall also design of the track beam necessary for supporting electric / manual hoist in WT building, bunkers buildings, Transfer Houses etc. The necessary design data for the hoists shall be provided by equipment supplier / their Consultants during detail engineering stage. Consultant shall note that the hoists beam etc as mentioned above all detailed engineering documents shall be prepared for approval by BHEL/ customer.

1.1.04 Consultant to check and ensure that no Loads other than the vertical loads of interconnecting platforms / structures shall be transferred to any nearby structure that is covered under different package.

1.1.05 Design for all the civil & structural buildings covered under the scope shall be done based on detailed specifications **mentioned in** different Sections.

SECTION -VI

SCOPE OF SITE SUPERVISION WORK:

The following shall be in consultants' scope:

The consultant shall depute qualified one graduate civil engineer and one graduated mechanical engineer with relevant work experience of not less than 5 years for supervision of site work of civil and structural work as required till completion of commissioning and PG tests / Operational acceptance test and handing over of the CHP to customer.

Supervision related to civil works ;

The scope of site Supervision of civil works of the complete CHP shall include but not limited to the following:

1- Preparation of over-all site work plan for civil work in co-ordination with the agencies working at site.

2- Preparation of detailed resource requirement plan on continuous basis, including requirement of machinery, labour, drawings, documents, equipment and material availability in co-ordination with various agencies involved hi the project.

3 Ensure, witness and certify the civil works and testing thereof as per approved drawings, documents, FQP and standard practices. ,

4- Site inspection of material *&* equipments received and preparation of inspection reports with non-conformities, if any.

5- Resolving problems and issues arising due to site work including mismatch /misalignment at interfacing between equipments, structures and civil work etc.

6- Witness various qualification and quality tests.

7- Monitoring and reporting the progress of site work and recommend corrective measures to be taken, if any, for timely and cost effective completion of the project.

8- Ensure successful integration of the systems, equipments and works for complete CHP.

9- Supervision of railway siding including points & crossing embankment work, ballast/sleepers etc if required for CHP package.

10- Any other technical and advisory assistance required for successful completion of the project.

Supervision related to structural works ;

The scope of site supervision of structural works of the complete CHP shall include but not limited to the following:

1- Preparation of over-all site work plan for civil work in co-ordination with the agencies working at site.

2- To maintain all documents and all quality control procedure followed periodically during each month of execution.

3- To resolve field engineering problems during execution arising out of site requirements including mismatch /misalignment etc.

4- To ensure that the cutting plans generated by the fabricator leads to maximum utilization of steel with minimum wastage and indicate utilization of generated cut bits.

5- To recommend proper use of jigs and fixtures during welding to avoid distortions.

6- Approve structural erection schemes.

7- Witness various qualification and quality tests.

8- Preparation of detailed resource requirement plan on continuous basis, including requirement of machinery, labour, drawings, documents, equipment and material availability in co-ordination with various agencies involved in the project.

9- Ensure witness and certify the structural works and testing thereof as per approved drawings, documents, and FQP and standard practices.

10- Ensure successful integration of the systems, equipments and works for complete CHP.

11- Any other technical and advisory assistance required for successful completion of the project.

For the above works the consultant shall depute their engineers as per following, in addition to providing the engineering consultancy support mentioned elsewhere during the execution of the project:

a. For site supervision of civil work - One civil engineer minimum 5 years relevant experience.

b. For supervision of site structural works - One mechanical / structural engineer with minimum 5 years relevant experience.

The total man-months for the services covered under this section are estimated to be 72 man-months and the same shall be considered for evaluation of the bids.

SECTION -VII

Instructions & Procedure:-

Bidder shall submit the bid in two parts .i.e., Technical part in one envelope & duly filled Price Bid part in one envelope. Both the envelopes shall be put in master envelope with Enquiry Number, Job details and the bid part it contains shall be written on top of the every envelope. Technical part shall contain all the documents (except price schedule) duly signed & stamped by the bidder. However the blank price schedule duly signed also shall be submitted along with Technical part. Price bid shall consist of price schedule duly filled in with rates & quantity against each item. Bidder should ensure that all the envelopes are properly sealed.

ANNEXURE - 1

LIST OF DRAWINGS ENCLOSED.

	DRAWING DESCRIPTION	DRG NO
1	Contour Plan layout	253292 – HNPCL-GEN-002 REV 0
2	Overall Plot plan	253292-HNPCL-DPRG-001 REV 07
3	Bore hole location Layout	253292- HNPCL-GEN-003 R1
4	Coal Flow Diagram	IS-0-FL-647-111-A001 REV 0