SECTION - E

GENERAL TECHNICAL REQUIREMENT - CIVIL

KHARGONE SUPER THERMAL POWER PROJECT

2 X 660 MW

TECHNICAL SPECIFICATIONS
(MAKE UP WATER PIPE LINE)

CIVIL , STRUCTURAL & ARCHITECTURAL WORKS

FOR MAKE UP WATER PIPE LINE

Bharat Heavy Electricals Limited
Project Engineering Management
Power Sector, PPEI BUILDING
SECTOR 16A, NOIDA-201301

PREAMBLE

Standard technical details as indicated in specification shall be agreed upon between BHEL & Bidder.

Technical requirements are stipulated in this Volume which comprises of

Section C : This section indicates the technical requirements specific to the contract not covered in Section D

Section D : This section comprises of general technical specification(s)

Annexures I : Topographic survey detail of Main Plant

Annexures II : Preliminary topographic survey detail of make up water pipe line (12 sheets)

Annexures III : Typical detail of make up water pipe line crossings

The requirements mentioned in the Section C shall prevail and govern in case of conflict between the same and the corresponding requirements mentioned in the Section D in the specification.

SECTION C

1.0 **SCOPE OF WORK**

All Civil works complete, as per the specification of Laying of make-up Water pipeline from Intake Water Pump House to Raw Water Reservoir including Thrust blocks, crossings across rivers/ railway line/ NH/SH/Pucca roads/ village road crossing/ canals/ drains/nallahs etc. by constructing bridges, culverts, pedestals, underground crossing with concrete encasement etc.

For perennial rivers/ waterways, the pipeline crossing shall be through over ground bridges with provision for walkway for pipe maintenance. For nonperennial waterways, the crossing shall be either with over ground bridges or buried at least 2M below the bed with concrete encasement. Railway line crossing will be by box pushing or by pipe pushing as per requirement/approval of Railways. NH/SH/Pucca road crossing will be by open cut & fill method or by pipe pushing as per requirement/approval of concerned authorities (i.e. NHAI/PWD/R&B etc.). Kuccha village road crossings will be through hume pipe / box culverts by open cut & fill method. Canal crossing will be through over ground bridges, on pedestals or can be buried below bed with concrete encasement as per approval/requirement of the concerned authority. Bidder to note that obtaining necessary approvals from Railways, NHAI, State WRD, PWD & Irrigation departments etc. for all rail, road, river and canal crossings is in the scope of Bidder. The contractor shall appoint a railway approved consultant for design/execution/supervision of box/pipe culvert as per requirement/approval of Railways and for obtaining approval from Railways for rail crossing. However, expediting and obtaining all approvals shall be the responsibility of the Bidder. All statutory fees/payments required to be deposited to the concern authorities for approval/permissions of rail/road/canal crossings shall be paid by NTPC on submission of demand letters from concerned authorities.

Further it shall be noted that :

a) Geotechnical data mentioned in the specification are solely for the guidance of the bidder, the bidder shall fully satisfy himself about the nature of substrata expected to be encountered including methodology of construction, type of foundation, ground water table etc. before submission of the bid. Any variation in the data between the one furnished and to that found during execution of work at site shall not constitute a valid reason in affecting the terms and condition of this contract and nothing extra shall be payable on this account.

b) The scope of work shall also include designing, preparation of design documents and drawings (including fabrication and as built drawings) complete as per the scope of the work. BHEL however also reserve the rights to check the detailed calculations at any stage of design/execution BHEL interpretation shall be final in the event of any conflict. Further it shall be the responsibility of the bidder to get the design calculations and drawings approved from BHEL and NTPC, for the scope of work complete, and execute the work as per the approved drawings, during the contract stage of the project.

c) The scope of work shall also include topographical survey, detailed geotechnical investigation, site clearance and site levelling by cutting/filling borrow earth, disposal of earth as specified by engineer in charge, handing over of fertile land on “as it was basis”, sheet piling wherever required, construction of man holes/pits, structure for cathodic protection, dewatering, backfilling around completed structures etc.

d) The scope also includes any other civil, structural and architectural work required from systems point of view.

e) Furthermore it should be noted that all enabling works required for the execution of the subject scope of work shall be in the bidders scope.

For ready reference the drawings are attached, however for further details regarding the job, the bidders are advised to visit the subject site, to carefully examine the site and surroundings, and to satisfy themselves about the nature of the existing general site conditions. Claims due to ignorance of any of the above will not be considered after submission of bid.

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1.00.00 **GENERAL**

1.01.00 This specification is to cover, survey works , site leveling works, design, preparation of general arrangement drawings, construction and fabrication drawings, supply of labour & materials and construction of all civil, structural and architectural works by the Bidder.

Description of various items of work under this specification and nature of work in detail are given hereinafter. The complete work under this scope is referred to as civil works. Various buildings, structures, plant and systems, facilities, etc., covered under the scope is given in Part-A and herein.

The work to be performed under this specification consists of design, engineering, construction, erection and providing all labour, materials, consumables, equipment, temporary works, temporary storage sheds, temporary colony for labour and staff, temporary site offices, constructional plants, fuel supply, transportation and all incidental items not shown or specified but reasonably implied or necessary for the completion and proper functioning of the plant, all in strict accordance with the specifications including revisions and amendments thereto as may be required during the execution of work.

All construction materials including cement, reinforcement steel, coarse & fine aggregate, structural steel and construction water etc., shall be arranged by the Bidder.

The scope shall also include setting up by the Bidder a complete testing laboratory in the field to carry out all relevant tests for structural steel, reinforcement steel & reinforced concrete (RCC) works.

Preliminary geotechnical investigation in the proposed area has been carried out by the Owner and the borelog data is furnished in Annexure 'C'. Detailed Geotechnical Investigation shall be carried out by the bidder. The foundation system shall be evaluated by the bidder based on the above mentioned detailed geotechnical investigation.

The work shall be carried out according to the design/drawings to be developed by the Bidder and approved by the Employer. For all buildings, facilities, systems, structures, etc., necessary layout and details are to be developed by the Bidder keeping in view the statutory and functional requirements and providing enough space and access for operation, use and maintenance. The Bidder's work shall cover the complete requirements as per IS codes, fire safety norms, requirements of various statutory bodies, International Standards, best prevailing practices and to the complete satisfaction of the Employer.

The Bidder shall make the layout and levels of all structures from the general grid of the plot and the nearest GSI benchmark or other acceptable benchmark of Govt. deptt. As per the directions of the Engineer. The Bidder shall be solely responsible for the correctness of the layout and levels and shall also provide necessary instruments, materials, access to works, etc., to the Engineer for general checking of the correctness of the civil works.

All the quality standards, tolerances, welding standards and other technical requirements shall be strictly adhered to.

The Bidder shall fully apprise himself of the prevailing conditions at the proposed site, climatic conditions including monsoon pattern, soil conditions, local conditions and site specific parameters and shall include for all such conditions and contingent measures in the bid, including those which may not have been specifically brought out in the specifications.

In case of any conflict between stipulations in various portions of the specification, most stringent stipulation would be applicable for implementation by the Bidder without any extra cost to the Employer.

Wherever there is an anomaly in the design concept between the data furnished in the General Design Criteria & Design Concept of Buildings, the data furnished in the design concept of buildings shall be treated as final.

2.00.00 SCOPE OF WORK

2.01.01 The scope of work for the EPC contractor shall include the analysis, design, construction, erection of all civil, structural & architectural works and all other items mentioned in Part-A of this Specification.

2.02 Construction Facilities

For details of construction facilities refer to Part-A of this specification.

2.03 Exclusions:

The details of exclusions and terminal points, refer to Part-A of this specification.

3.00.00 SUBMISSIONS

3.00.01 The documents and drawings as listed below are to be submitted for the approval of the Employer unless specified otherwise. The list given below is not exhaustive but indicative only.

Project design intent document giving the basis of design, which shall cover all the aspects, parameters, assumptions, references, structural idealization / mathematical model, loading cases, load combinations, basis of analysis and design of all buildings, facilities, systems and structures etc. shall be furnished and got approved before commencement of detailed engineering.

a) Structural analysis, design calculations and drawings of substructure and super structures for all buildings, structures, facilities, and systems including cooling water ducts/pipes.

b) Analysis, design calculations and drawings for all services like roads, culverts, bridges, road/rail crossings, drainage pump houses (if required), drains, sewers, sewage pump house, water supply, water tank, coal conveyor galleries, trestles, transfer points, trenches, ducts, etc.

c) Survey drawings indicating spot levels for the area under the scope of work and L-section along pipe corridors outside plant boundary.

d) Plant 'General Layout Plan' drawing with coordinates of roads, boundary wall, buildings *and facilities, piping/cable corridors, railway lines, green belt, etc.

e) Drawings showing underground facilities with co-ordinates and invert levels of the facilities like buried pipes, buried cables, trenches, ducts, sewers, drains, sumps, pits, culverts, manholes, etc.

f) Architectural Design and Detailing aspect of all the Building shall be rendered through professional services of a registered Architect. The Architect consultant shall be of National/ International repute, having experience in similar kind of works. The consultant shall evolve the design based on employer's guidelines and shall present it in the form of Presentation Drawings, Detail Drawings, Perspective View& 3D Model/ Walk through. All drawing and document shall be duly stamped by the Registered Architect.

h) All architectural drawings required for execution of construction work such as detail floor plans, detail elevations, detail sections and other miscellaneous architectural

details such as finish schedule(internal & external), colour schemes (both internal and external), doors and windows, flooring details & pattern, north/sky light in the roof, false flooring, false ceiling, etc., architectural facia and projections, miscellaneous stair details & architectural details like, coping, flashing, khurras, water proofing, fillet, roof decking, wall cladding, surface drains, rain water down comers, sanitary, plumbing, etc.

i) Design criteria and design calculations including dynamic analysis and drawings for all foundations subjected to dynamic loads like foundation for TG, BFP, Mills, Fans (PA, FD, ID & Seal Air), Crusher etc.

j) Write-up on various statutory requirements and their compliance for various buildings, facilities, structures and systems, etc.

k) As Built- Final Shop drawings/fabrication drawings of all structural steel works(only for reference) on CDs and design calculations for important joints/connections

l) Construction and erection procedure for all major structures such as Main Plant building including Control tower, Mill and Bunker building including coal bunkers, Transfer Points, Conveyor Galleries, Boiler/ ESP structures, Chimney, C.W.PH, Intake Water Pump House, Cooling Towers, Switchyard Structures, Ash Slurry PH, Ash Water PH, TG foundation and other machine foundations, C.W. Clarifiers, etc. covered under the Bidder's scope.

m) In case of piling, scheme for initial pile load tests in vertical, lateral and uplift modes along with supporting design calculations, scheme of routine load test of piles, High Strain Dynamic Load Test, Pile Integrity Tests and methodology for installation of working piles.

n) In case of piling, the design of piles in terms of type, rated capacity, length, diameter and termination criteria to locate the founding level.

o) Marking scheme identifying the equipment lay-down areas, with distinctive colour scheme.

p) Material test certificates.

q) Design criteria (for approval) and drawings (for information only) for Boiler/ESP supporting structures.

r) As built drawings with quantities of various items of work system wise, building wise, structure wise, etc. duly certified by Site after execution of work for information/record.

s) Details of corrosion protection measures for all structures.

t) One complete set of applicable standards, references, specifications, code of practice along with soft copy (wherever required with minimum 2 years license fee) to the Engineer for use at site.

u) Wherever applicable, scheme for dewatering, shoring, strutting/sheet piling.

v) All other design details/drawings or any other submission as indicated elsewhere in this specification and as required by the Employer.

w) In case of Raw Water Reservoir, the design and drawings of reservoir embankment including analysis of slope stability, seepage analysis, inlet and outlet arrangement,

road & spillways along with supporting calculation & methodology of construction & laying of HDPE liner.

Commencement of fabrication and erection and construction shall be done after approval of the relevant documents and drawings. All drawings shall be of standard sizes (Metric System) and shall be made on AutoCAD. All documents shall be made using MS office. Bidder shall submit all documents and drawings as per the followings:

Drawings: - Soft copy via C-folder for all drawings.

- After approval of drawings 6 Hard copies of each construction drawing shall be submitted to Owners site office

As Built Drawings: - In CD.

Design/Document: - Soft copy via e-mail/ C-folder and two set of hardcopies.

In general 3D modeling and structural frame analysis and design for the plant structures shall be submitted by the bidder for Employer's review and approval. Soft copy of 3D modeling (including input and output files shall be submitted

All construction drawings shall include total quantity of concrete (grade wise), reinforcement (diameter wise) and structural steel (section wise).

4.00.00 GENERAL LAYOUT PLAN

4.01.00 The preliminary layout plan proposed for the project is shown in the drawing no. 9578-999-POC-F-001 titled "General layout plan". It shall form the basis for further elaboration by the Bidder for the plant facilities, which are in his scope.

Bidder shall prepare the detailed layout of the plant facilities which are in his scope and shall submit the same for Owner's approval.

While preparing the detailed layout, planning his facilities and deciding upon the transportation and erection strategy he shall ensure the following aspects.

a) All Statutory requirements including safe distances between various facilities as per applicable rules/acts/laws including local bye-laws are met.

b) Face of the buildings and facilities are located in such a way so as to have an offset of minimum 20m with respect to centre line of double lane road and 15 metre with respect to centre line of single lane road.

c) The entire construction activity shall take into account the commissioning of the units in phases matching with the phased commissioning of the plant.

d) The interface requirements with the plant construction/erection activities of other contracting agencies engaged by Owner. These agencies engaged will be working parallely with the Bidder within the plant premises.

e) The area for construction/erection facilities like lay-down, pre-assembly, offices and stores have been earmarked on the General Layout Plan.

f) No permanent facility shall be located within the safety zone limit around the fuel Oil storage tanks, Hydrogen plant complex, etc., except those permitted by Owner.

g) Transportation of all equipment and materials shall be by road as envisaged. Any other mode envisaged by the bidder may be proposed. However the same may be adopted subject to approval of the Employer.

h) All the buildings and facilities shall be approachable by fire tenders.

4.02.00 Technical Specifications for Watch Tower

Watch Towers shall be RCC construction with all weather enclosure at 6M height. Watch Towers shall be provided at 600 m interval along the Boundary as well as at corner turning points of the plant boundary. Watch Towers shall be provided with caged MS ladders.

4.03.00 Site Levelling And Slope Protection Work

4.03.01 Complete levelling of entire plant area including the area earmarked for administration building, ash based units, ash silos, railyard and raw water pumphouse and associated facilities shall be done by the Bidder. Filling in reservoir area below the bed of reservoir and for the reservoir embankment shall also be done by the Bidder. Detailed requirements for the same are specified under head 'Raw Water Reservoir' elsewhere in the specifications.

Bidder shall carry out the topographical survey before he commences detailed design and site leveling. This survey shall cover the entire plant area including the areas earmarked for administration building, ash based units, ash silos, railyard, raw water pumphouse & associated facilities, reservoir and the diversion drains in Bidder's scope of work. Based on field observations the contractor shall prepare and submit for Owners review the survey maps of the surveyed sited on suitable scale, indicating grid lines, contour lines and demarcating all permanent features like roads, railways, water-ways, buildings, power lines, natural streams, trees etc. For each area two sets of survey maps shall be prepared and submitted, one showing the spot levels and contours with grid lines and the other showing the grid lines, contours and permanent features.

Established methods of surveying like triangulation, traversing, fly leveling etc. shall be adopted for the survey work. Spot levels shall be taken at 25 metres interval and at closer intervals where pits, undulations etc. are met with. these levels shall be taken in two orthogonal directions. Contours shall be plotted at 0.5m interval.

It is proposed that for the purposes of site leveling the entire plant and associated areas will be divided into various blocks as defined in the drawing no. 9578-001-POC-A-001 titled, "Site Levelling Works ". Each block shall be finished to the formation level as specified in drawing. Bidder shall deploy adequate number of experienced site leveling contracting agency(s) with requisite earth moving and compacting equipment to complete the work as per schedule.

Since the construction of roads and drains for the entire plant is included in the scope of Bidder, it shall be the responsibility of the Bidder to ensure that these facilities are also constructed along with site leveling works. Bidder shall ensure that road access and drainage facilities for each block is available when site leveling in that block is completed. Unless otherwise instructed by the Engineers, all roads and drains within a block shall be constructed by the bidder within a month from the date of completion of site leveling of that block.

The specified formation level(s) shall be achieved either by excavation where the existing ground levels are higher than the specified formation level or by raising by controlled filling with borrowed earth where the existing ground levels are lower than the specified level.

The excavation shall be in all types of soils or rock or a mixture of these. Bidder should assess and satisfy himself about the actual nature of soil present at site, before submitting his bid.

All materials arising out of site clearance and excavation shall be the property of owner. They shall be dealt with in the manner specified by the Engineer. Earth / boulders / rock etc. excavated and useful portion (serviceable materials) of trees cut shall be stacked at suitable places within Owner's acquired land for the plant including the reservoir and the ash disposal area in a manner as directed by the engineer. Woods, branches, trunks of trees shall be termed as serviceable material. Other materials like twigs, leaves, roots, vegetable and organic matters etc. shall be termed as unserviceable material and shall be sorted out from the serviceable materials before disposal. They shall be cleared from the area and disposed off at places within Owner's acquired land for the plant including the reservoir and the ash disposal area in a manner as directed by the engineer.

If the excavated material is suitable and accepted by the Engineer as fill material, the same can be used for filling in other areas where raising by filling is required. Otherwise the same shall be taken and stacked at places(s) within the plant boundary as directed by the Engineer.

Filling with rock shall be done only after the written permission of the Engineer in the following manner:

- Filling with rock shall be done only in areas identified for laydown and preassembly and ash based units.

- Original ground after removal of all organic and vegetable matters shall be consolidated by rolling as directed by the engineer subject to a minimum of six passes of 8-10 tonnes roller.

- Excavated rock shall be laid (on original ground or after filling 300 mm thick layers of soil as specified), in layers not exceeding 1000 mm and rolled with with vibratory roller (10-15 tonnes static weight) with minimum six passes.

- Over the compacted layer of rock, soil shall be filled in horizontal layers not exceeding 300mm in compacted thickness. The soil shall be compacted as specified elsewhere.

- It shall be ensured that the top soil layer is in minimum 3 layers of 300 mm each. To achieve this the thickness and number of rockfill layers below can be suitably adjusted.

Contour map and spot levels of the area based on the preliminary survey carried out by Owner is enclosed for the purpose of guidance of Bidder. Refer tender drawing no. "9578-001-POC-A-001. However, Owner does not lake any responsibility about the accuracy of the survey details furnished and any variation of the said data shall not constitute a valid reason for changing the terms and conditions of the contract. Bidder is requested to carry out his independent assessment of the existing ground levels before furnishing his. bid Detailed survey shall be carried out by Bidder after award of work and all findings as stated earlier shall be submitted for Owner's review.

4.03.02	All existing drains/channels in the plant and other areas associated with the plant except those proposed to be constructed by the Owner shall be suitably diverted by the Bidder before taking up any construction. These diversions shall be so designed as to ensure effective disposal of water without any accumulation or flooding within the limits of overall land acquisition line and in adjoining areas.
4.03.03	Before commencement of cutting/filling, all organic and vegetable matters like grass. plants shrubs bushes, weeds, trees etc. in the areas to be filled, shall be completely removed along with their roots and disposed off. It shall also be ensured that the area to be filled is clear of any water, slush etc. Original ground shall be compacted by rolling as directed by the Engineer subject to a minimum of six passes of 8 to 10 tonne roller The earth shall then be spread in horizontal layers not exceeding 300 mm in compacted thickness. Each layer shall be watered and compacted with proper moisture content and with such equipment as may by required to obtain a compaction of 95% or more of Standard Proctor's maximum dry density. The moisture content of the fill material shall be controlled to obtain near optimum moisture content during compaction. The fill material shall be tested for determining optimum moisture content and maximum dry density by Standard Proctor Test as per IS : 2720 (Part-VII). The fill material shall also be tested for determining moisture content before compaction as per IS:2720 (Part-II) For each of the above tests, one sample for every 10,000 cubic metre of fill material shall be tested. Additional samples shall be tested, whenever there is a change in the source or type of fill material. The compacted soil shall be tested for its dry density as per IS2720 (Part-XXIX) or Part-XXVIII). Samples shall be taken at the rate of one sample for every 10,000 sq.m. area for each compacted layer. In addition random checks shall be carried out in compacted soils by means of Proctor needle penetration. Bidder shall submit to the Engineer, the test results immediately after completion of the tests. A sample shall be deemed to have passed the test when the in-situ dry density is equal to or more than the specified percentage of maximum dry density. If a sample taken from a layer fails to pass the test, the layer shall be further compacted till two samples taken and tested from this layer pass without any negative deviation. Only after this. spreading of further layers shall be taken up.
4.03.04	Before start of filling, the Bidder shall submit to the Owner his proposal for the methodology to be adopted for compaction for each type of fill material. The Bidder shall also carry out compaction trials to establish the proposed methodology. The Bidder shall start the compaction work only after approval of the methodology by the Owner
4.03.05	The surface of the cut/filled up areas after reaching final level shall be dressed to the required levels and slopes. The difference in levels shall not be more than +/- 10cm locally.
4.03.06	The borrow areas outside the overall plant boundary limits for obtaining suitable fill material which is required over and above the earth available after cutting high grounds within the plant area, for site levelling shall be arranged by the Bidder himself and all expenses in respect of royalties, taxes, duties, etc. for borrow areas/fill material shall be borne by him. He shall also obtain and submit to the Owner the necessary clearances/permission from the concerned authorities for the borrow areas/fill material.
4.03.07	Material suitable for filling shall be loaded and transported to the filling site by the Bidder. Any coarse grained or fine grained low plastic soil, free from shingle, salts, organic

matter, sod or any other foreign substances, may be used for filling. The Bidder shall test the fill material to establish its suitability and submit its results to the Owner. Fill material shall be approved by the Owner. The following types of materials shall not be used for filling:

a) Material from swamps, marshes and bogs.

b) Expansive clays

c) Peat, logs, stumps, sod and perishable materials.

d) Materials susceptible to combustion

e) Any material or industrial and domestic produce which will adversely affect other materials in the work.

f) Materials from prohibited areas

4.03.08 Bidder shall include in his offer any extra filling that may be required on account of subsidence of the original ground due to overburden of filling above and/or compaction works for site levelling.

4.03.09 After levelling, the contractor shall establish concrete pillars at the intersection points of the grid lines for future reference. These pillars shall project at least 450 mm above the formation level and shall be labeled permanently with their respective coordinates and reduced levels.

4.03.10 Filling upto the specified formation level shall extend at least 2.0 m beyond the outside face of boundary wall/fence. Thereafter, it shall be finished at a suitable slope (not steeper than 1 Vertical: 2 Horizontal) and provided with good quality dry stone pitching minimum 300mm thick.

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6.00.00 **DESIGN CRITERIA**

6.01.01 **General**

The design criteria given herein is applicable for all structures and buildings including Main Plant buildings, Control building, office/service building, Mill and Bunker building, Coal Conveyor Galleries/Trestles, Transfer Points, Track hopper, Tunnel, Pent house, Stacker-reclaimer supporting structure, Crusher house, Chimney, Cooling towers, Fuel Oil Handling Plant, Light Diesel Oil Handling System, Pump Houses, C.W. ducts, Compressor house, D.G. Set building, switch gear and other miscellaneous buildings, Culverts, Bridges, Water retaining/carrying structures, Boiler/ESP supporting structures, Switchyard structures, Ash Silos, Roads, Drains, Sewers, Cables and pipe trestles, all ash handling/ ash water recirculation system buildings / facilities and various other works included in the scope of the bidder.

6.01.02 Structures shall be designed for the most critical combinations of dead loads, imposed loads, equipment loads, crane loads, piping loads (static, friction and dynamic), earth pressure & surcharge loads, Hydrostatic & Hydrodynamic loads, wind loads, seismic loads and temperature loads. In addition, Erection loads, loads and forces developed due to differential settlement shall also be considered.

6.01.03 i) All the buildings shall have framed super structure. If the superstructure of building is a steel structure, the framed superstructure shall be moment resisting sway frame in the lateral direction and axially braced in the orthogonal direction. Columns having depth of 400mm & less shall have bracing in single plane and at the centerline of column. For columns having depth of 500mm & above, the longitudinal bracings shall comprise a pair of members (spaced) with spacing equal to the column depth. Only where axial bracing to one vertical plane is to be waived due to functional requirement, columns in that vertical plane may be allowed to undergo biaxial bending. Beam column joints shall be detailed as per seismic resistant joint with adequate ductility.

All 2-legged structural steel trestles shall be completely braced in the vertical plane. All 4-legged structural steel trestles shall be completely braced in all four vertical planes. In addition, specified horizontal planes shall be completely braced to provide stiffness against torsional sway.

If the superstructure is RCC structure, the superstructure shall be moment resisting sway frame in both orthogonal direction and all the members shall be designed for biaxial bending. Detailing for ductility shall be followed as per guidelines of IS13920 to be effective against seismic load.

ii) The Main Plant building, Bunker building, transfer towers, conveyor galleries and

trestles, crusher house, boiler, ESP Control Building, ESP supporting structures, including inlet and exhaust duct support structures, Air Washer Building, Compressor House, Pipe cable Gallery shall have structural steel framed super structure.

iii) All other buildings may have either RCC or structural steel framework.

iv) All buildings having RCC framing shall have masonry cladding of minimum one masonry unit thickness (not less than 225 mm.) on exterior face.

v) All buildings, having structural steel frame work shall have non insulated metal cladding on exterior face above the masonry work and RCC roof over permanent metal deck shuttering, except in areas subjected to heavy loads where RCC roofing without metal deck shall be provided. For Mill & bunker buildings and TPs, insulated metal sheeting roof shall be provided.

6.02.00 **Loading**

6.02.01 **Dead loads**

Dead loads shall include the weight of structure complete with finishes, fixtures and partitions and shall be taken as per IS: 875 (Part-I)

6.02.02 **Imposed loads**

Imposed loads in different areas shall include live loads, erection, operation and maintenance loads. Equipment loads (which constitute all loads of equipment to be supported on the building frame) are not included in the imposed loads furnished below and shall be considered in addition to imposed loads.

For consideration of imposed loads on structures, IS:875 (Part-2) “Code of practice for design loads (other than earthquake) for buildings and structures” shall be followed. The following minimum imposed loads as indicated for some of the important areas shall however be considered for the design. If actual expected load is more than the specified minimum load, then actual load is to be considered.

Sl.No.	Location	Imposed Loads (T/Sq.m.)
A)	Turbine Building	
i)	Ground floor (general)	2.50
ii)	Ground floor (heavy equipment storage area)	5.00
iii)	Mezzanine floor	1.00
iv)	Operating floor	
	a) Rotor Removal area	5.00
	b) Equipment lay-down area	3.50
	c) Other areas (corridors, etc.)	1.50

	v)	Gratings, chequered floors, walkways, platforms, stairs, etc.,	0.50
	vi)	Roof (Where no equipment is located)	0.15
	vii)	Roof (where equipment are located)	0.50
B)	Deaerator and Heater Bay		
	i)	H.P/L.P. heater floor	1.00
	ii)	Deaerator floor	1.00
	iii)	Cable gallery (In addition to this, actual cable load shall be considered)	0.50
	iv)	MCC, switchgear and Control building floors	1.00
	v)	Roof (Where no equipment are located)	0.15
		(Where equipment are located)	0.5
	vi)	A.H.U Room, Battery Room, Air Washer Room	1.0
C)	Mill and Bunker Bay		
	i)	Ground floor	2.5
	ii)	Feeder floor	0.50
	iii)	Tripper floor	0.50
	iv)	Roof	0.15 (Where no equipment are located) 0.50 (Where equipment are located) 0.075 (For Inaccessible roof)
D)	Pump Houses		
	Operating floor		1.50
E)	Maintenance bay (CWPH & RWPH)		3.0

F) Underground Structures such as Channels, Sumps, Underground Pump House, Tanks, Trenches, Reservoirs, C.W. ducts etc.

In addition to earth pressure and ground water pressure, the surcharge load of

2T/sq.m. shall also be considered for design of all underground structures.

G) Road Culverts/Bridges and its allied structures including RCC Pipe Crossings and Road Crossing of Trenches.

Design for class 'AA' loading (wheeled and tracked both) and checked for class 'A' loading as per IRC Standard.

H)	Covers for Channels/trenches	0.40 (General) or central point load of 75 kg whichever is higher As per IRC Standard (at road crossings for vehicular traffic)
I)	Railway Supporting Structures, Rail Culverts	As per Railway 'Bridge Rules'
J)	Boiler/ ESP Support Structures	0.50
K)	Conveyor Galleries	In addition to the live loads, loads due to cable trays, fire fighting / service water pipes shall also be considered @125Kg/m(minimum) on each of the longitudinal girder. Roof-truss members are to be checked for supporting fire fighting pipes/ Service water pipes. Tentative locations and diameter for pipes
L)	General (Unless Specified Otherwise)	
i)	Stairs, Landings and Balconies	0.50
ii)	Toilets	0.20
iii)	Chequered plates, grating floors, etc.,	0.50
iv)	RCC floors (General)	0.50
v) a)	Flat Roofs (where no equipment are located)	0.15
b)	Flat Roofs (where equipment are located)	0.50
c)	Inaccessible roof	0.075
vi)	Inclined Roofs	As per IS : 875 (Part-II)
vii)	Dust load on roof	Equivalent to 0.30 M of ash deposit
viii)	Walkways (General)	0.50
ix)	Walkways of conveyor galleries, DM & PT	0.30

	x)	Floor of control room of switchyard control building	1.00
	xi)	Cable and pipe trestles addition, friction loads	0.40 for walkway and in as applicable

Notes:

a) If erection load is higher than the specified imposed loads on any floor or part thereof, then the erection loads are to be considered for the design.

b) Additional load for cable, piping/ducting, shall be considered as applicable. For any other structures, the loads specified for those structures elsewhere in the specification shall be followed.

6.02.03 **Equipment, piping and associated loads**

Equipment loads shall be considered over and above the imposed loads. Equipment loads shall be considered as given by equipment supplier.

6.02.04 **Crane load**

For crane loads, an impact factor of 25% and lateral crane surge of 10% (of lifted weight + trolley weight) shall be considered in the analysis of frame according to the provisions of IS:875. The longitudinal crane surge shall be 5% of the static wheel load. Longitudinal surge and lateral surge shall not be considered to act simultaneously.

6.02.05 **Seismic load**

For design of all structures, the site specific seismic spectrum as attached in Annexure-(e) shall be followed.

6.02.06 **Wind load**

For design of all structures, the wind loads shall be taken as per the site specific wind data specified in Annexure–(d) of this specification.

6.02.07 **Temperature load**

For temperature loading, the total temperature variation shall be considered as 2/3 of the average maximum annual variation in temperature. The average maximum annual variation in temperature for this purpose shall be taken as the difference between the mean of the daily minimum ambient temperature during the coldest month of the year and mean of daily maximum ambient temperature during the hottest month of the year. The structure shall be designed to withstand stresses due to 50% of the total temperature variation.

Suitable expansion joints shall be provided in the longitudinal direction wherever necessary with provision of twin columns. The maximum distance of the expansion joint shall be as per the provisions of IS: 800 and IS: 456 for steel and concrete structures respectively.

6.02.08 **Differential settlement Loads**

Structures shall be designed considering an additional load on account of differential settlement of 1 in 1000 between any two adjacent columns, subject to a maximum differential

settlement of 8 mm.

6.02.09 **Additional Loads**

Following Minimum additional Loads shall be considered in the design of Steam generator structures, Mill & bunker buildings, Coal handling Transfer points and Trestles.

(a) Cantilever Loads of not less than 2000 Kg / M at a distance of 1200 mm from the external face of the columns, on both sides of the ESP, for Cable trays and Walkways.

(b) Cantilever Loads of not less than 500 Kg / M at a distance of 1200 mm from the external face of the columns, on both sides of the Steam Generator, for Cable trays and Walkways.

(c) Cantilever Loads of not less than 2000 Kg / M at a distance of 2500 mm from the external face of the Mill & Bunker Building columns, CHP transfer point columns/ VGTU columns & conveyor gallery trestles (on one side) for Cable trays and Walkways.

(d) Dry Fly Ash Piping Loads.

(e) Ash Water Piping Loads.

(f) Supply Air and Instrument Air Piping.

(g) Service Water Piping

(h) Loads associated with Coal Handling Plant equipment

6.03.00 **Civil Design Concepts**

6.03.01 Individual members of the frame shall be designed for the worst combination of forces such as bending moment, axial force, shear force, torsion, etc.,

6.03.02 The different load combinations shall be taken as per IS: 875 (Part-5) and other relevant IS Codes.

a) Wind and seismic forces shall not be considered to act simultaneously.

b) For the design of main plant structures during seismic condition, the deaerator feed water tank shall be considered full upto operating level. However, for other load combinations, deaerator feed water tank in flooded condition shall be considered.

c) 'Lifted load' of crane shall not be considered during seismic condition.

d) In case two cranes are provided and tandem operation is not envisaged, the load shall be taken as one crane fully loaded and second crane without lifted load but standing idle adjacent to first crane.

e) In case two cranes are provided and tandem operation is envisaged for some bays, then the load shall be taken as both the cranes fully loaded and travelling side by side for these bays. For other bays, load shall be taken as one crane fully loaded and second crane without lifted load but standing idle adjacent to first crane.

f) Permissible stresses for different load combinations shall be taken as per relevant IS

and IRS codes.

g) For the design of pipe/cable supporting structure, the soil weight shall be considered as backfilled up to grade level for the condition of pipe running full/cables in position.

h) Frictional forces between the pipes and supporting structure in longitudinal direction need not be considered along with seismic or wind forces.

i) Paving in crane corridor shall be designed for the maximum load due to movement of crane.

j) In TG bay at crane rail level, chequered plate walkway with handrails shall be provided for entire column sectional depth for full length of the building. Walkway width clearance from the face of the column to the edge of the crane shall be as specified elsewhere in the specification.

k) For checking against uplift / tension case, 90% of Dead Loads with no Imposed Loads shall be considered along with other Loads

l) In all Loading Combinations, the Loads that have reduction effect on design condition shall not be taken into account in the Combination concerned.

m) Where Wind is the main Load acting on the Structure, no increase in Stresses is to be considered for Design of Structures and Foundation Bolts.

6.03.03 Design of steel structures shall be done by the Working stress method. Design shall be as per provisions of IS:800 :1984 and other relevant IS standards. For design of coal bins and loading hopper IS:9178 (part I to III) shall be followed.

6.03.04 Shop connections will be all welded type and field connections shall be either bolted or welded depending on site difficulties. Field bolts wherever provided will be high tensile friction grip bolts of 20 mm dia or higher and of property class 8.8(min) as per 1367 for all major connections. The bolted joints will be designed for friction type connection and H.T. bolts will be tightened to develop the required pretension during their installation. However, nominal connections in the field like purlins, stairs, wall beams will be done by means of M.S. black bolts of grade 4.6 conforming to IS-1367.

Following connections will be provided during erection

1. Welded connection

   a) connection of secondary beam to main beam

   b) connection of bracing to column

   c) connection of bracing to the longitudinal beam

   d) connection of longitudinal tie beam to column

   e) connection of spandrel beam to column

   f) connection of their secondary structures

2. HSFG connection

   a) splicing of column/transverse frame beam/longitudinal tie beam

b) connection of frame beam to column

c) connection of crane girder to column

d) connection between crane girders

e) connection of brackets from columns

f) connection of members where tension will be in the fasteners

g) other major connections

3. Bearing Type connection (H.T. bolts grade 8.8)

All removable type connections.

4. M.S. bolts (Grade 4.6) shall be used for purlins, stairs, wall beams etc.

For HSS bolt connection, IS: 4000, IS: 3757, IS: 6623 and IS: 6649 shall be followed. IS: 814, IS: 816, IS: 1024, IS: 4353 and IS: 9595 shall be followed for welding of structures.

6.03.05 For calculation of coal load on moving conveyor, a multiplication factor of 1.6 shall be used to take care of inertia force, casual over burden and impact factor, etc. Thus coal load per unit length of each moving conveyor shall be

$$\frac{1.6 \times (\text{rated capacity of conveyor system})}{\text{Conveyor speed}} \times \frac{1100}{800}$$

6.03.06 a) Conveyor gallery structure and trestles shall be designed considering both conveyors operating simultaneously

b) Dynamic analysis of conveyor galleries and conveyor supporting system shall be carried out for spans greater than 25 m.

c) All structures close to railway line shall have clearances conforming to Railway norms.

6.03.07 Horizontal Deflection criteria

The maximum Horizontal Deflection for various structures shall not exceed and be limited to the following:

Sl. No.	Description	Maximum value of
1.	For Trestles and transfer points (Transverse deflection at Conveyor gallery supporting level)	Height/1000 (For Wind load by Peak Wind Speed Method / Seismic Load)
2.	For Mill & Bunker Building (at Tripper floor level)	Height/500 (For wind load by Gust Factor Method / Seismic Load)
3.	For Main Power House (Turbine Bldg),	Height /325

	ESP Control Building, Air Washer Building, Comressor House, Service Building, Workshop Building, Balance of Plant Buildings and all other buildings envisaged in this specification
	4. Vertical Metal Sheeting in Cladding Span/250
6.03.08	a) Dispersion of load in any direction through soil shall be as per IS: 8009 (relevant part).
	b) Dispersion of load through concrete shall be considered at an angle of 45 degrees with horizontal from the edge of contact area.
6.03.09	a) Permissible deflection (unless specified otherwise in this specification) for latticed framework and beams of floors other than drive floor shall be span/325.
	b) The allowable deflection for beams directly supporting drive machinery shall be restricted to span/500 unless specified otherwise in this specification.
	c) The deflection for manually operated cranes & monorail supporting beams shall not exceed span/500. For electric overhead cranes : 1) upto 50 t capacity : span/750 2)over 50 t capacity : span/1000
	d) The vertical deflection of beams supporting LP Heater, HP Heater and Deaerator shall be limited to Span/500.
	e) The vertical deflection of metal deck sheet for floor shall be limited to span/250.
	f) Permissible deflection for all purlins, cladding runners, roofing/cladding sheets and grating / chequered plates shall be span/250. However, the maximum vertical deflection of Grating/ Chequered plate shall be limited to 6 mm.
6.03.10	Transverse coal pressure on Bunker/Silo/Hopper walls shall be calculated as per IS: 9178. The Coal Bunker/Silo/Hopper shall be designed for the following conditions
	i) The Bunker/Silo/Hopper is full up to its full capacity with top surface nearly horizontal.
	ii) The Bunker/Silo/Hopper is partially empty with the top surface of coal at an angle of repose of 37 degrees.
6.03.11	Design criteria for ash silo
	1. The pressure due to ash filling on the side wall and the bottom portion of ash bins/silos shall be taken as the maximum of (a) static pressure determined in accordance with the Jansen's formula multiplied by an impact factor of 1.4 and (b) pressure determined as per Walker's formula for static as well as dynamic conditions. The silo shall be designed for the following conditions:

(a) The silo is full up to its full height / capacity

(b) The silo is partially empty with top surface of ash, at an angle of repose less than 30 degrees.

2. The following loads are to be considered for design.

a) Density of bottom ash to be considered for volume calculation shall be 650 kg./cu.m.

b) Density of bottom ash to be considered for load calculation shall be 1600 kg/cu.m.

c) Density of fly ash to be considered for volume calculation shall be 750 kg/cu.m.

d) Density of fly ash to be considered for load calculation shall be 1600 kg./cu.m.

e) Density of dry fly ash, to be considered for the design of supporting structures for dry fly ash conveying pipes, shall be taken as 1000 kg/cum. The pipe shall be considered full with dry fly ash.

3. Other requirements are as follows:

a) Independent supporting structure shall be provided for each silo.

b) The joint between the wall and roof of the silo shall be properly sealed by welding or by any other approved means.

c) Operating platform covering total plan areawise in silo structure made of grating shall be provided below the hopper outlet.

d) The bracing system shall be provided in such a way that the trucks and closed tankers can have a clear passage to approach the underside of the silos for unloading dry ash from the silos.

4. Trestles supporting ash pipes shall be so proportioned that the transverse deflection of trestles due to wind/seismic load shall not exceed trestle height/325.

5. The corrosion allowance for design of Silo, Buffer Hopper, Bottom ash hopper, tanks etc. shall be considered as per IS:9178 considering structure exposed to atmosphere. The corrosion allowance shall be provided in addition to the requirement of minimum thickness of steel plate as per IS:9178.

6.03.12 Coal Bunker (inside Mill Bunker Building) shall be of MS while the hopper shall be of MS with stainless steel (grade SS 304) lining. The minimum thickness of MS plate and SS lining in hopper portion shall be as specified in the design concept of Mill Bunker Building in the previous chapter. Pre-formed flexible open ended bellow strap of neoprene is to be provided between top of bunker and bottom of tripper floor to avoid coal dust leakage / escape. The bellow strap shall be of minimum 200 mm wide under un-stretched condition and shall be of minimum 2mm thick.

The hopper angle with the horizontal plane be as specified in the previous chapter.

6.03.13 The live storage capacity of each bunker shall be greater of the following:

a) Total 10 hours coal requirement of the boiler for BMCR duty with worst coal firing, equally distributed over the number of bunkers (i.e. the coal mills) required in service for this duty condition as specified elsewhere.

b) Total 10 hours coal requirement of the boiler for BMCR duty with design coal firing, equally distributed over the number of bunkers (i.e. the coal mills) required in service for this duty condition as specified elsewhere.

c) Total 10 hours coal requirement of the boiler for TMCR duty with worst coal firing, equally distributed over the number of bunkers (i.e. the coal mills) required to be in service for this duty condition as specified elsewhere.

6.03.14 For all capacity (volume) calculation and structural design (load calculation) unit weight of coal shall be assumed as 800 Kg/cu.m. and 1100 Kg/cu.m respectively.

6.03.15 Design pressure on coal bunker/hopper walls shall take into account all possible flow regimes (core flow, mass flow, etc.), and different aeration regimes (radial, diametrical, radial and core, impulsive, etc).

6.03.16 a) The design and construction of RCC structures shall be carried out as per IS: 456. Working stress method shall be adopted for the design wherever specifically mentioned in this specification.

b) For design and construction of steel-concrete composite members, IS: 11384 shall be followed.

c) For reinforcement detailing, IS: 5525 and SP: 34 shall be followed.

d) Two layers of reinforcement (on both inner and outer faces) shall be provided for RCC wall sections having thickness 150 mm or more.

6.03.17 a) All RCC liquid retaining/conveying shall be designed by working stress method as outlined in clause no. 4.5 of IS 3370 (Part-2) 2009 unless specified other wise.

b) Water proofing treatment shall be provided for liquid retaining/ carrying structures and basement type structures (requiring dry working condition). Dense and durable concrete with water cement ratio not more than 0.45 shall be used. Plasticiser /super-plasticiser cum water proofing compound shall be added to the concrete. All the construction/expansion joints shall be provided with PVC water bar and chemical injection grouting as per IS:6494. As applicable internal/external surface of such structures shall be provided with acrylic based polymer modified cementitious composite coating system for critical structures. For liquid carrying/retaining structures, minimum two coats of such coating shall be applied. For external application wherever the surface is in contact with the earth, fine silica/quartz sand of 0.6 mm nominal size shall be added in the coating mix for better abrasion resistance and total nominal thickness of such coating shall be minimum 1.5 mm. For non critical structures minimum two coats of bitumen grade 85/25 as per IS:702, mixed with 1% of anti-stripping compound meeting the requirement of IS:6241, shall be applied. The total application of bitumen shall not be less than 1.7 kg/sq.m.

Bidder shall submit a comprehensive scheme for water proofing treatment based on above or any other alternative scheme, internationally accepted for Employer's approval prior to commencement of work.

c) All liquid retaining/carrying structures shall be tested for water tightness as per the provisions of IS: 3370 and IS: 6494 and in case of leakage, the same shall be

rectified by chemical injection grouting through nozzles.

6.03.18 For design of all underground structures, foundations, C.W. ducts, etc. ground water table shall be assumed at the finished ground level unless specified otherwise.

6.03.19 Earth pressure for all underground structures shall be calculated using coefficient of earth pressure at rest or co-efficient of active earth pressure, whichever is applicable, depending upon the structural configuration. However, for the design of substructure of pump houses, earth pressure at rest shall be considered. Co-efficient of passive earth pressure shall be used only in design of shear keys for stability against sliding.

6.03.20 a) Following loading conditions shall be considered in addition to the loading from super structure for the design of substructure of pump house, channels, sumps, tanks, trenches and other underground structures containing liquid

i) Water pressure from inside and no outside pressure, like earth pressure, ground water and surcharge pressure (applicable only to structures, which are liable to be filled up with water or any other liquid.)

ii) Earth pressure, surcharge pressure and ground water pressure from outside and no water pressure from inside.

iii) Design shall also be checked against buoyancy due to the ground water during construction as well as after construction stages. Minimum factor of safety of 1.2 against buoyancy shall be ensured considering empty condition inside and ignoring the superimposed loadings. Provision of pressure relief valves/flap valves, etc., shall not be permitted to counter the buoyancy unless specified otherwise.

iv) Base slab and piers of the pump houses shall also be designed for the condition of different combination of pump sumps being empty during maintenance stages with maximum ground water level.

b) Intermediate dividing pier of pump sumps and partition wall (if applicable) in channel shall be designed considering water on one side only and other side being empty for maintenance.

c) All pump houses and other substructures (wherever applicable) shall be checked for stability against sliding and overturning during construction as well as operating conditions for various combinations of loads.

6.03.21 **a) Design of Foundation for TG, TDBFP, MDBFP & Fan foundations**

(ii) Scope of Work for Bidder

The scope of work for the design shall consist of the following:

- Finalization of the general arrangement layout and levels of the foundation for TG, TDBFP, MDBFP & FAN foundations based on the equipment layout keeping in view the layout constraint and limitations of available space.
- Submission of design criteria and loading data of the equipment foundations.
- Analysis of the top deck, design and detailing of the reinforcement and finalization of the spring arrangement.

- Submission of all design calculation, all loading drawings, general arrangement drawings, embedment drawings, spring arrangement drawings and reinforcement drawings for the foundations under the scope for the approval of the Owner. Carrying out revisions / alterations based on the comments of the Owner. In addition to hard copies, the final soft copy of all drawings (in Autocad and pdf format) and documents shall also to be submitted.

- Submission of construction methodology / casting sequence and special requirements (if any) for the top of deck.

Structural Arrangement of foundations for various machine foundations like TG, TDBFP & MDBFP & FAN and shall be as specified in Chapter-5 of this specification.

(iii) Analysis for the foundation

For the foundations of the all equipments, details static and dynamic analysis shall be done. The static analysis shall include all operating condition, load cases and abnormal loads like short circuit, loss of blades & unbalance and seismic forces as per IS:1893. The dynamic analysis shall consist of free vibration analysis and forced vibration analysis. A minimum fatigue factor of 2.0 shall be considered for dynamic forces.

The vibration amplitudes shall be calculated at the machine bearing locations and at any other points of interest by a forced response analysis. The unbalance forces used for this analysis shall correspond to the balance quality grade of the machine as per VDI 2060 or the unbalance forces as provided by the machine manufacturer which ever is higher. It shall be ensured that the calculated amplitudes do not exceed the limits specified by the machine manufacturer and relevant Standards such as VDI 2056.

Bidder to consider the acceleration at the top of the deck for the design of supporting / fixing arrangement of machine.

(iv) Design criteria for steel helical springs and viscous dampers

The isolation efficiency for steel helical springs and viscous dampers shall be at least 90%. The ratio of actual spring supported weight to the nominal spring capacity shall not exceed 0.80. At least 3% to 5% of critical damping shall be provided in the form of viscous dampers.

(v) Grade of Concrete and reinforcement

Grade of concrete for Top deck shall be minimum M35 conforming to IS:456-2000. The grade of reinforcement for Top deck shall be Fe500 (TMT) conforming to IS:1786.

(vi) Reinforcement Design

Working stress method as per IS: 456-2000 shall be used for reinforcement design. The design shall be done for the worst load combination. Minimum reinforcement shall be provided as per IS:456-2000 and IS:2974 (Part-III), if the calculated reinforcement is less than the minimum.

Block Foundations:

a) Block foundation resting on soil shall be analyzed using elastic half space theory. In case the foundation is supported over piles, Novak's approximation shall be used for determining the spring constant and damping ratio of pile groups. The mass of the

RCC block shall be at least three times the mass of machine. Free vibration analysis of the foundation shall be carried out to evaluate the natural frequencies. The fundamental natural frequency shall be kept at least 20% away from the operating frequency (speed). Forced vibration analysis shall be carried out if the dynamic forces are made available by the machine supplier in which case the amplitude limits stipulated by the machine supplier and VDI 2056, whichever is lower, shall be satisfied.

Reinforcement design shall be done by working stress method as per IS:456-2000 and IS:2974 (Part-IV).

b) For the foundations supporting minor rotating equipment weighing less than one ton or if the mass of the rotating parts is less than one hundredth of the mass of the foundation, no dynamic analysis is necessary. However, if such minor equipment is to be supported on building structure, floors, etc., suitable vibration isolation shall be provided by means of springs, neoprene pads, etc., and such vibration isolation system shall be designed suitably.

6.03.22 If RCC floor/roof is assumed to act as diaphragm, transmitting lateral loads to braced bays, it shall be provided with shear connectors. However, whenever large / more number of cut-outs are provided in the floor slab, horizontal floor bracings shall be provided below slab to transfer horizontal force to columns without considering diaphragm action from slab.

6.03.23 All roads shall be rigid pavements specified elsewhere in this specification. The design traffic load shall be a minimum 4 million cumulative standard axle. The design of concrete pavement shall be carried out as per IRC-58.

6.03.24 a) No cable/pipe trench is envisaged in the plant area. However, if required, pipe/cable trench can be provided inside the buildings and inside switchyard or some other localised areas.

b) All pipes and cable shall generally be routed above ground.

c) A minimum clearance (clear headroom) of 8 m shall be kept for all over-ground pipe/cable trestles for all road/rail crossings. For other areas, the requirement of trestle height is specified elsewhere in the specifications. All trestles shall be provided with continuous walkway of minimum 600mm width with hand-rails and toe-guards all along the length of the trestle along with approach ladders near roads, passageways, etc. Before and after the road/rail crossings, a barrier of suitable height shall be constructed so as to prevent the approach of cranes (having height more than 8 m) etc, upto the pipe/cable racks/trestles.

d) Within AB bay in Main plant area, generally grating shall be provided for Mezzanine floor except for valve room area, cable spreader floor, etc. where the floor shall be of RCC. Oil equipment room shall also have RCC floor below the grating floor.

6.03.25 The plant storm water drainage shall be designed taking into account the finished grade levels of the plant area, drainage pattern, intensity of rainfall, etc., The storm water drainage shall cater to storm water run off resulting from one hour rainfall intensity, with a return period of 50 years. These values shall be based on the "Detailed Area Drainage Study" subject to minimum rainfall intensity of 75mm/hr. The maximum velocity for pipe drains and open drains shall be limited to 2.4m/sec and 1.8 m/sec. respectively. However, minimum velocity of 0.6m/sec. for self-cleansing shall be ensured. Bed slope not milder than 1 in 1000 shall be provided. The open drains shall be open rectangular drains of RCC unless required otherwise due to functional requirement. RC box culverts shall be provided at rail, road or

other crossings.

6.03.26 Sewers shall be designed for a minimum self-cleansing velocity of 0.75m/sec and the maximum velocity shall not exceed 2.4m/sec.

Manual on sewerage and sewage treatment (published by Central Public Health Environment Engineering Organisation, Government of India) shall be followed for design purpose.

6.03.27 Roof decking sheets shall be designed as per IS: 801 to carry the self load, dead load due to RCC slab and finishes and imposed load. The deflection of metal deck shall be limited as per BS: 5950. In case composite action is considered in the design, suitable shear studs shall be provided as per BS: 5950.

6.03.28 Foundations for all tanks shall be designed for as per IS: 803.

6.03.29 Footings shall be so proportioned to as to minimise the differential settlement.

6.03.30 **Boiler/ ESP support structures shall be designed for:**

i) Live/Imposed loads.

ii) Dead load

iii) Static and dynamic loads of piping, movable equipment and maintenance parts.

iv) Loads from cable trays and walkways supported on columns.

v) Ash water piping supported on the outermost row of boiler columns.

vi) All ESP hoppers filled up with ash upto the top of the hoppers or the bottom of electrodes (whichever is more) using a bulk density of not less than 1350 kg/cu.m. for the ash, along with additional ash build-up from the end of the third field upto the inlet duct bottom level at a natural repose angle (not less than 30 degree to horizontal in any case).

vii) Ash load at bottom ash hopper and pent house of the boiler shall be as mentioned in the mechanical chapter of the specifications.

viii) Seismic and wind loads as specified elsewhere in the specifications.

ix) Temperature variation of +/-25°C for atmospheric temperature variations.

x) Temperature variations under ESP operating condition.

xi) The loads listed above indicate the minimum requirements.

6.03.31 Boiler supporting structures shall be so configured that the temperature of steel does not exceed 60 °C unless specified otherwise. Brackets shall be provided on both sides of the outermost row of columns of both the boiler and ESP for supporting cable trays and walkways, at a height not exceeding 10.0 m. The exact levels shall, however, be decided during detailed engineering. Each ESP hopper shall be supported at four corners by providing four columns from the ground.

6.03.32 The bracings in boiler structure shall be provided such that under no circumstance normal/convenient access to all points in the boiler is blocked or obstructed.

6.03.33 In design of boiler/ ESP support structures, dynamic piping loads need not be considered acting simultaneously with wind or seismic loads. Increase in permissible stresses shall be allowed in load combinations where dynamic piping loads are considered and shall be as permitted under seismic load conditions.

6.03.34 Design Criteria for foundations and some other facilities/areas are covered separately in this specification.

6.03.35 Plinth level of all buildings shall be kept at least 500 mm above the finished grade/formation level.

Finished floor level of boiler area paving shall be kept about 200 mm lower than the finished floor level of Main Plant buildings.

6.03.36 Joints/Connections in steel structures:

Steel structures shall be detailed and connection and joints provided as per the provisions of IS:800, IS:816, IS:9595, IS:1367, and IS:9178 and as per following requirements.

a) Connection of vertical bracings with connection members and diagonals of truss members shall be designed for full tensile capacity of the bracings unless actual loads are indicated on the drawings.

b) Size of fillet weld for flange to web connection for built up section shall be as follows:

i) For box section weld size shall be designed for full shear capacity or actual shear whichever is more. Where fillet weld is not possible, full penetration butt weld shall be provided.

ii) For built up I section, weld size shall be designed for 80% of full shear capacity or actual shear, (if indicated, in drawings) whichever is more. However, weld size shall not be less than 0.5 times the web thickness. Weld shall be double fillet.

iii) All welds shall be continuous unless otherwise specifically approved. The minimum size of the fillet weld shall be 6mm.

c) Shear connections shall be designed for 60% of section strength for rolled sections and 80% of section strength for built up section or rolled section with cover plates. However, if load is more than above, the connection shall be designed for actual load.

d) Moment connections between beam and column shall be designed for 100% of moment capacity of the beam section. This can achieved either by direct butt welding of the top flange of beam with column flange or by providing top moment plate with suitable notch for additional weld length.

e) All butt welds shall be full penetration butt welds.

f) The connection between top flange and web of crane girder shall be full penetration butt weld. Bottom flange, connection with web can be fillet weld or butt weld as directed by Engineer.

g) Connection of base plate and associated stiffeners with the columns shall be designed considering the total load transferred through welds. However, minimum

weld size (double fillet) shall not be less than 0.6 times the thickness of stiffeners.

h) Splicing: All work shall be full strength. Field splicing shall be done with web and flange cover plates for full strength. In exceptional cases, the field splicing shall be designed for 50% of load carried by the cover plates and remaining 50% load through full penetration butt weld. Shop splicing for all sections other than rolled shall be carried out by full penetration butt welds with no cover plates. Splicing for all rolled sections shall be carried out using web and flange cover plate.

6.03.37 Pipe Pedestals, pipe supports and other structures for Ash handling/ash water recirculation system:

a) The design of Pipe Pedestal and pipe supports shall be carried out considering Dead load, live load & seismic load / wind load. In addition to above, longitudinal forces equal to product of Co - efficient of friction (between contact surface of pipe and pedestal) with the load coming on each pedestal shall also be considered for the design of pedestal. In bends, suitable thrust block shall be provided to withstand the thrusts transferred from the pipelines.

b) All RCC pipes carrying water under gravity shall be designed for earth pressure, water and surcharge. Minimum grade of pipe shall be of NP - 2 class or heavier required as per design / specification.

c) The design and construction of RCC structures shall be carried out as per IS: 456. In general, limit state theory shall be followed for the design of RCC structures, however, working stress method shall be adopted for the design, wherever specifically mentioned in this specification.

d) Two layers of reinforcement (on inner and outer face) shall be provided for RCC wall sections having thickness 150mm and above.

6.03.38 Design Criteria of RCC Floors

a) For Main Power House, Mill Bunker Building, ESP Control Building, Transfer Houses of CHP, Air Washer Building and other structural steel framed buildings:

These buildings being steel framed structure, all RCC floors shall comprise RCC slab supported on troughed, profiled metal deck sheet of minimum thickness 0.80mm (to be used as permanent shuttering). The RCC slab shall be minimum 150mm thick above the top surface (crest) of the metal deck sheet. The spacing of structural steel secondary beams shall be based on the bending capacity of the metal deck sheet for self weight of green concrete and additional construction load of 100 kg/m2.

The permanent metal deck sheets shall be fixed to the top flange of secondary beams by means of drawn arc welding of headed shear anchor studs directly through the metal sheet. The details of shear anchor studs are specified elsewhere in this specification.

The RCC slab shall be designed without considering any composite action effect of metal deck sheet (ie the structural strength of metal deck sheet shall not be considered for RCC slab design).

(b) For Administrative Building, Service Building, CISF building & other RCC buildings.

These buildings being complete RCC framed structures, conventional RCC slabs of minimum thickness 125mm shall be provided. The RCC slabs shall be monolithic with RCC beams and RCC columns

6.03.39 **Design Criteria of RCC roofs:**

a) For Main Power House, Compressor House, Air Washer Building, ESP Control Building:

The roof system shall comprise minimum 40mm thick RCC slab on top of profiled permanent metal deck sheet. The permanent metal deck sheets shall be fixed to the top flange of secondary beams by means of arc welding of headed shear anchor studs to the purlins directly through the metal sheet. The details of shear anchor studs are specified elsewhere in this specification. Water proofing treatment to roof slab shall be provided as per details specified elsewhere in this specification).

The RCC slab shall be designed without considering any composite action effect of metal deck sheet (ie the structural strength of metal deck sheet shall not be considered for RCC slab design.

b) For Mill Bunker Building, Transfer Houses.

Insulated sandwiched metal sheet for roofing shall be provided comprising troughed permanently colour coated sheet at top and plain permanently colour coated sheet at bottom with 50mm thick insulation sandwiched between the two sheets, the details of which are specified elsewhere in this specification.

c) Other RCC Buildings.

Cast-in-Situ RCC slab shall be provided using removable plywood shuttering. Water proofing treatment to roof slab shall be provided as per details specified elsewhere in this specification).

6.03.40 Design Criteria For Foundation

The founding depth / cut off level of piles shall be decided based on functional requirement.

Where structural steel columns are envisaged, the bottom of the base plate shall be kept suitably below the paving level such that the top level of the gusset plate and foundation bolt remain at least 200 mm below the top level of paving except for Main power House Building columns, Boiler Structure, Bunker Building Columns, TP & Trestle Columns, ESP Control Building Columns for which the requirement of levels for bottom of base plates is specified elsewhere in this specification. Further the gusset plate and foundation bolts are to be encased in concrete up to the top of the paving level. For outdoor structural steel columns, about 300 mm height of steel columns above the top of paving level shall be provided with at lease 125 mm thick encasement with minimum reinforcement to prevent corrosion of the steel columns from surface water

a) OPEN Foundations

For all major foundations, the minimum founding depth and the minimum size of foundation shall be as per foundation system and geotechnical data specified in the foundation chapter include hereafter in this specification.

For open foundations, the total permissible settlement shall be as per the criteria furnished under the foundation system specified elsewhere in this specification.

The sizing of foundation, design criteria & clear cover shall conform to IS:1904, IS:456 and other relevant Indian codes. However minimum 0.12% of reinforcement shall be provided on the top face of the foundation concrete on either direction and minimum percentage of reinforcement at bottom face of foundation shall be same as that stipulated for beam as per IS:456.

No major foundation shall rest on filled up soil. Loose soil if any below foundation is to be removed and replaced with PCC of grade M7.5.

b) PILE Foundations

Minimum centre to centre spacing of the piles shall be 3 times the diameter of pile. Incase single piles are used, these piles are to be interconnected with tie beams along both orthogonal directions perpendicular to each other.

Minimum penetration of piles into Pilecap shall be 75 mm and clear cover to the main reinforcement at the bottom face of the pile cap shall be 100 mm. Structural design of pile cap and reinforcement shall conform to IS:2911 and IS:456. However minimum 0.12% of cross section of the pile cap shall be provided on the top face of the pile cap along two orthogonal directions and minimum percentage of reinforcement at bottom face of pile cap shall be same as that stipulated for beam as per IS:456.

Detailed requirement of pile foundation have been presented in the foundation chapter specified hereafter in this specification.

6.03.41 **Coal Handling Plant structures**

a) The loads for all railway load bearing structures e. g. track hopper including machinery hatches, tunnel, culverts and under ground transfer houses etc. and the analysis and the design of these structures shall be made strictly in accordance with the provisions of Indian Railway Bridge rules (latest edition), and Indian Railway Codes of practice (latest edition) with all amendments up .to the date of opening of bids. However, the axle load for analysis and design shall be considered as 30 MT. Coal heap of 1.2m height shall be considered above hopper top for design of coal tray, hopper and supporting elements of track hopper. The analysis, design and detailed drawing for the structure coming below the railway track shall be got approved by the Bidder from the concerned railway authorities before taking up construction. All necessary payment for the above work shall be made by the bidder to the railway authority.

b) The crusher and transfer house structures shall be so designed that transverse deflection at places where conveyor galleries meet, should be equal to the respective transverse deflection of conveyor supporting trestles.

c) Design of Hopper walls shall be done for both Static & Dynamic flow condition using Walker's theory

d) Minimum size of the angle section to be used as structural members shall be 50 X 50 X 6. Minimum weld size shall be 6 mm.

e) The buildings shall conform to local bye - laws, rules and regulations for industrial buildings and also B. I. S. publications, SP 32 and 41.

f) Slotted holes shall not be assumed to act as expansion joint for relieving of stresses and suitable bearings shall be provided at the supports.

g) Shear force in steel columns shall be transferred to the pedestals / foundations exclusively either through foundation bolts or the shear key arrangement.

h) For design of R. C. C. pipes for culverts, latest editions of IS : 458, IS : 783 should be followed.

i) Design of masonry walls shall be made as per IS : 1905.

j) Minimum reinforcement shall be provided at the top face of the footing, even if, no reinforcement is required as per design.

6.04.00 **Corrosion Protection**

6.04.01 **General**

(a) All equipments, pipes, etc. shall be painted as per the requirements specified in the relevant section of the specification.

(b) All Steel structures (except those embedded in Concrete) shall be provided with Painting as given below which is designed for a minimum maintenance free life of Ten (10) years (expected life, long range Ten (10) to Twenty (20) years, as per BS : 5493.

(c) All Paints shall be of high build constitution.

(d) All Painting shall be done as per approved Painting scheme of the Vendors / Manufacturers, which shall be submitted by the Bidder and as approved by the Employer. Painting scheme shall also include Item codification / Description of all Coats of Paints for manufacturer's, from whom the Paint is intended to be procured.

6.04.02 Painting of Steel Surfaces embedded in Concrete:

(a) For the portion of Steel surfaces embedded in Concrete, the surface shall be prepared by Manual Cleaning and provided with Primer Coat of Chlorinated Rubber based Zinc Phosphate Primer of Minimum 50 Micron Dry Film Thickness (DFT).

(b) All threaded and other surfaces of foundation bolts and its materials, insulation pins, Anchor channels, sleeves, etc. shall be coated with temporary rust preventive fluid and during execution of civil works, the dried film of coating shall be removed using organic solvents.

6.04.03 Painting of Steel Surfaces (other than those embedded in Concrete)

(a) All Steel surfaces shall be provided with self curing Inorganic Zinc Silicate Primer Coat (Solid by Volume Minimum 60%) of Minimum 75 Micron Dry Film Thickness (DFT) applied over shot blast cleaned surface to near white metal conforming to Sa 2 ½ finish of Swedish standard SIS-05-5900. The Primer Coat shall be applied in Shop immediately after blast cleaning by Airless spray technique.

(b) Primer Coat shall be followed with the application of Intermediate Coat of Polyamide Cured pigmented Titanium Dioxide (TiO_2) or Micaceous Iron Oxide (MIO) Epoxy based Paint (Solid by Volume Minimum 60%) of Minimum 75 Micron DFT. This Coat shall be applied in Shop after an interval of Minimum overnight (from the application of Primer Coat) by Airless spray technique.

(c) Intermediate Coat shall be followed with the application of Finish Coat of Polyamide Cured colour pigmented Epoxy based Paint (Solid by Volume Minimum 60%) of Minimum 75 Micron DFT. This Coat shall be applied after an interval of Minimum overnight and maximum indefinite (from the application of Intermediate Coat) either before Erection by Airless spray technique or after Erection by brush and / or airless spray. Colour and shade of the Coat shall be as approved by the Employer.

(d) Finish Coat shall be followed with the application of Final Finish Coat of Polyurethane based colour pigmented Paint (Solid by Volume Minimum 40%) of Minimum 25 Micron DFT. This Coat shall be applied within Seven (7) days (from the completion of Finish Coat), after Erection by brush and / or airless spray. Colour and shade of the Coat shall be as approved by the Employer.

6.04.04 Touch-up Painting on damaged areas

(a) For Coatings damaged up to metal surface

Surface preparation shall be carried out by Manual Cleaning. Minimum 6 inches adjoining area with existing Coating shall be roughened by Wire brushing, emery paper rubbing etc., for best adhesion of patch Primer.

Over this Primer Coat, Intermediate Coat, Finish Coat and Final Finish Coat shall be applied as covered above by brush with Intermediate Coat applied within maximum seven (7) days of application of touch up Primer.

(b) For Coatings damaged upto Intermediate Coatings (i.e. where Primer Coat is intact).

Damaged area including Minimum 6 inches adjoining area with existing Coating should be roughened by wire brushing, emery paper rubbing etc., for best adhesion of patch Primer without damaging the Primer Coat.

Touch-up Primer, Intermediate, Finish and Final Finish Coats shall be applied as specified above for Coatings damaged up to metal surface.

6.04.05 Painting of Welded areas / Painting of areas exposed after removal of temporary supports / Touch-up Painting on damaged areas Structures, where inter-connection, Welding / modification etc. has been carried out by the Bidder.

(a) Clean the surface to remove flux spatters and loose rust, loose Coatings in the adjoining areas of Weld seams by wire brush and emery paper.

(b) Painting procedure to be followed as mentioned above for Touch-up Painting on damaged areas.

6.04.06 Dry film thickness of each coat shall be checked and measured as per the procedure specified in paint application standard no. 2 by SSPC: The Society for Protective Coating. The thickness as measured shall not be less than the minimum thickness specified for the coat of paint under relevant clauses of technical specification.

6.04.07 Coating for Mild Steel parts in contact with Water.

(a) All mild Steel parts coming in contact with water or water vapour shall be hot dip galvanised. The Minimum Coating of Zinc shall be 610 Gms / Sq. M. for galvanised Structures and shall comply with IS : 4759 and other relevant Codes. Galvanising shall be checked and tested in accordance with IS : 2629.

(b) The galvanising shall be followed by the application of an etching Primer and dipping in black bitumen in accordance with BS : 3416, unless otherwise specified.

6.04.08 Gratings

All gratings shall be blast cleaned to Sa 2 ½ finish of Swedish standard SIS-05-5900 and shall be hot dip galvanised at the rate of 610 Gms / Sq. M.

6.04.09 Hand Railings and Ladders

All handrails and ladders shall be galvanised at the rate of 610 Gms / Sq. as per IS : 4736.

6.04.10 Sea Worthiness

All Steel Sections and fabricated Structures, which are required to be transported on sea, shall be provided with anti corrosive Paint before shipment to take care of sea worthiness.

6.04.11 All structural steel members in switchyard (excluding fencing and gate) shall be hot dip galvanised as specified elsewhere.

6.04.12 **For reinforced concrete work.**

i) The protection for concrete sub-structure shall be provided based on aggressiveness of the soil, chemical analysis of soil/sub-soil water and presence of harmful chemicals/salts.

ii) The protection to super structure shall depend on exposure condition and degree of atmospheric corrosion.

This shall require use of dense and durable concrete, control of water cement ratio, increase in clear cover, use of special type of cement and reinforcement, etc., coating of concrete surface, etc.,

Bidder shall furnish the details of corrosion protection measures.

7.00.0 FOUNDATION SYSTEM SOIL DATA AND GEOTECHNICAL INVESTIGATION

7.01.0 Soil Data

Owner has carried out preliminary geotechnical investigation in the plant area, pipe line corridor from plant to intake well including crossings (river/ nallah/ canal/ road/ railway track etc.) and intake well location of project site and the borelog are enclosed at Annexure-c for Bidder's reference. The onus of correct assessment / interpretation and understanding of the existing subsoil condition / data is on the Bidder.

7.01.02 Contractor shall carry out detailed geotechnical investigation for structures under his scope as per scheme given at Annexure-I

7.01.03

The geotechnical investigation report shall be prepared with detailed recommendations regarding type of foundations and allowable bearing pressure/pile capacity for various structures/facilities and other soil parameters. The report shall be submitted for Owner's approval prior to commencement of design of foundations.

7.01.04 Tank Foundations

a) The tanks shall rest on flexible tank pad foundation, resting on sand with concrete ring wall to retain sand. Base of the concrete ring wall shall not rest on the expansive soil.

b) Entire expansive soil inside the concrete ring wall shall be removed and shall be filled with sand. Sand for filling shall be clean and well graded conforming to IS 383 with grading Zone I to III.

c) Sand shall be spread in layers not exceeding 30cm compacted thickness over the area. Each layer shall be uniformly compacted by mechanical means like plate vibrators, small vibratory rollers etc to achieve a relative density of not less than 80%.

d) Other requirements of tank foundations shall be as per IS 803 and as specified elsewhere in the specifications.

7.02.00 **Foundation System**

The requirements for the foundation system to be adopted are as given in subsequent clauses.

7.02.01 General Requirements

a) All structures/equipment shall be supported either on suitable open foundations (isolated, combined, raft) or pile foundations.

b) The roads, ground floor slabs, trenches, pipe pedestals, channels/drains and staircase foundation with foundation loading intensity less than 4 T / M2 may be supported on open / shallow foundations resting on virgin / controlled compacted filled up soil. If the encountered sub-strata is black cotton soil, the same shall be

either replaced upto the full depth or black cotton soil shall be stabilized by suitable treatment.

c) No other foundation shall rest on the filled up ground / soil.

d) All foundations shall be designed in accordance with relevant parts of the latest revisions of Indian Standards. The water table for design purpose shall be considered at Finished Ground Level.

e) A combination of open and pile foundations shall not be permitted under the same equipment / structure / building.

f) Foundation for equipments on ground floor

For equipments of static weight upto 1.5T, the equipment may be supported on the ground floor slab by locally thickening the slab. Thickening of the ground floor slab may be done upto an extent of about 0.6 m beyond the plan area of the equipment on all the sides. Further, the load intensity below the equipment shall be limited to 5T/m^2. Other requirements of floor slab and compaction below the floor slab shall be adhered, as specified elsewhere in the specifications.

For equipment of static weight more than 1.5T, the equipment foundation shall be taken to below the Natural Ground Level (NGL) or built up with PCC upto the specified level as per functional requirement. The equipment foundation shall be isolated from the adjoining floor slab by providing bitumen impregnated fiber board of minimum 50 mm thick, conforming to IS: 1838 all around the equipment foundation for the full depth of the floor slab. However, in no case, the foundation depth shall be less than 1.0 m.

7.02.02 **Open Foundations**

In case open foundations are adopted, following shall be adhered to.

a) The minimum width of foundation shall be 1.0 m.

b) Minimum depth of foundation shall be 1.0m below Ground Level.

c) It shall be ensured that all foundations of a particular structure/ buildings facility shall rest on one bearing stratum.

d) Wherever the intended bearing sub-strata is virgin soil stratum but the actual stratum encountered during foundation excavation consists of filled up soil at founding level, under such cases either the foundation shall be lowered completely into the virgin stratum or the filled up soil upto the virgin layers shall be removed and built up through PCC up to designed foundation level.

e) No foundation shall rest in black cotton soil.

f) During design the Allowable Bearing Pressure shall be adopted after approval of detailed geotechnical investigation report. However, the maximum allowable bearing

pressure shall be as per approved geotechnical report and shall be limited to the values as furnished in Table-1.

Table-1

Founding Depth/ Stratum	Net Allowable Bearing Pressure T/m2	
	Isolated and combined footings width upto 6.0 m	Rafts (width > 6m)
1m below NGL in Silty Sand / Sandy Silty Clay	8.0	10.0
2m below NGL in Silty Sand / Sandy Silty Clay	12.0	15.0
0.30m Embedment in silty sand with boulders/completely weathered rock.	25.0	25.0
0.60m Embedment in silty sand with boulders/completely weathered rock.	35.0	35.0
1.00m Embedment in rock with core recovery > 20%.	45.0	45.0
1.20m Embedment in rock with core recovery > 20%.	55.0	55.0

In case any loose/soft pockets in rocky strata is encountered at founding level, the same shall be removed completely upto the hard strata and filled up with PCC (1:4:8).

g) For open foundations, the total permissible settlement and differential settlement shall be governed by IS: 1904 / IS: 13063 and from functional requirements whichever is more stringent. However, total settlement shall be restricted to the following:

Isolated & Raft (BTG Area Footings except ESP Footings)	25 mm
Isolated & Strip (Other than BTG Area)	40 mm

Raft (ESP Foundations and other Offsite Structures footings)	75 mm
Foundations in Weathered rock / rock	12 mm

Incase pile foundations are to be adopted the requirements under para "Pile Foundations" shall be adhered to.

7.02.03 Pile Foundations –

In case piles are adopted, following shall be adhered to :

i) The pile foundation shall be of RCC, Cast-in-situ bored piles as per IS:2911. Pile boring shall be done using Rotary Hydraulic Rigs. Two stage flushing of pile bore shall be ensured by airlift technique duly approved by the Employer.

The piling work in river/water body shall be carried out with temporary or permanent MS liner and approved construction methodology. If piles are extending, above bed level of river/water body, in water, permanent MS liner of minimum 8mm thickness shall be provided.

ii) The minimum diameter of pile shall be 600 mm. The allowable load capacity of the pile in different modes (vertical compression, lateral and pullout) shall be as per approved geotechnical report & shall be limited to the values given below:

Pile	Dia. (mm)	Vertical compression capacity (T)
Bored cast-in-situ pile	600	140
	760	250
	1000	310
	1200	375

Cut Off Level (COL) is considered as 3.0 m below Finished Ground Level (FGL)

Termination criteria of piles shall be as per the approved geotechnical investigation report.

The uplift and lateral load capacity shall be respectively restricted to 35% and 5% of the allowable load capacity in vertical compression.

However, the pile capacities to be adopted shall be the least of the estimated design values and that obtained from the initial pile load tests.

iii) Only straight shaft piles shall be used. Minimum cast length of pile above cutoff level shall be 1.0 m.

iv) The bidder shall furnish design of piles (in terms of rated capacity, length, diameter, termination criteria to locate the founding level for construction of pile in terms of measurable parameter, reinforcement for job as well as test piles, locations of initial test piles etc.) for Engineer's approval.

v) The piling work shall be carried out in accordance with IS:2911 (Relevant part) and accepted construction methodology. The construction methodology shall be submitted by the Contractor for Engineer's approval.

vi) Number of initial load tests to be performed for each diameter and rated capacity of pile shall be subject to minimum as under.

Vertical

Lateral Minimum of 2 Nos. in each mode.

Uplift

vii) The initial pile load test shall be conducted with test load upto three times the estimated pile capacity. In case of vertical compression test (initial test) the method of loading shall be cyclic as per IS:2911 (relevant part).

viii) Load test shall be conducted at pile cut of level (COL). If the water table is above the COL the test pit shall be kept dry through out the test period by suitable de-watering methods. Alternatively the vertical load test may be conducted at a level higher than COL. In such a case, an annular space shall be created to remove the effect of skin friction above COL by providing an outer casing of suitable diameter larger than the pile diameter.

ix) Number of routine pile load tests to be performed for each diameter/allowable capacity of pile shall be as under :

i) Vertical : 0.5% of the total number of piles provided.

ii) Lateral : 0.5% of the total number of piles provided.

x) The routine tests on piles shall be conducted upto test load of one and half times the allowable pile capacity. Piles for routine load tests shall be approved by the Employer.

xi) In case, routine pile load test shows that the pile has not achieved the desired capacity or pile(s) have been rejected due to any other reason, then the Contractor shall install additional pile(s) as required and the pile cap design shall accordingly be reviewed and modified, if required.

xii) Testing of piles and interpretation of pile load test results shall be carried out as per IS:2911 (Part-4). Contractor shall ensure that all the measuring equipment and instruments are properly calibrated at a reputed laboratory / institute prior to their use. Settlement / movement of the pile top shall be made by Linear Variable Differential Transducers (LVDT) having a least count of 0.01mm.

xiii) The test load on initial test piles shall be applied by means of reaction from anchor piles / rock anchors alone or combination of anchor piles / rock anchors and kentledge.

xiv) Low Strain Pile Integrity test shall be conducted on all test piles and job piles. This test shall be used to identify the routine load test and not intended to replace the use of static load test. This test is limited to assess the imperfection of the pile shaft and shall be undertaken by an independent specialist agency to be approved by Engineering department of Owner. The test equipment shall be of TNO or PDI make or equivalent. The process shall confirm to ASTM.

xv) From load considerations, single pile may be used under a column/tower. In that case, pile shall be connected with tie beams at pile cut off level in both directions.

xvi) Contribution of frictional resistance of filled up soil if any, shall not be considered for computation of frictional resistance of piles.

xvii) Reinforcement for job piles shall be designed for the allowable safe pile capacities with combinations i.e. compression+bending case or tension+bending case, irrespective of the actual load on each job pile.

7.03.00 Special Requirements

7.03.01 Chemicals in subsoil, as observed during preliminary geotechnical investigation are:

Chemical	SO_3 (%)	Chlorides	pH
Sub-soil	0.0091-0.0880	0.022-0.040	6.75-7.03

The above values are for information, however, details of treatment for foundations / underground structures required to counteract soil / water chemical environment, cement type, grade of concrete, type of reinforcement, cover to reinforcement and protective coating to foundations, etc. shall be as per detailed geotechnical investigation to be carried out by bidder.

Bidder shall carry out chemical analysis during detailed geotechnical investigation and required treatment shall be provided accordingly.

7.04.00 Excavation, Filling and Dewatering

7.04.01 For excavation works, comprehensive dewatering with well point or deep wells arrangement, if required, shall be adopted. Scheme for dewatering and design with all computations and back up data for dewatering shall be submitted for the owner's information. The water table shall be maintained at 0.5m below the founding depth .

7.04.02 Excavation for shallow foundations shall be covered with PCC immediately after reaching the founding level. In case of any local loosening of soil or pockets are encountered at founding level during excavation the same shall be removed and compensated by PCC M 7.5. The final layer of about 300 mm thickness above the founding level shall be excavated by suitable means, so as to avoid disturbance to founding stratum.

7.04.03 Backfilling around foundations, pipes, trenches, sumps, pits, plinths, etc. shall be carried out with approved material in layers not exceeding 300 mm compacted thickness (higher thickness of layers upto 500mm with heavy mechanical compacting equipment) and each

layer shall be compacted to 90% of standard proctor density for cohesive soils and to 75% of relative density for non cohesive soils. In any case, black cotton soil shall not be used in back filling without providing cusion of 1m of non expansive cohesive soil/moorum around the footings. In case of roads in the area of black cotton soil, minimum 0.4m moorum shall be provided.

7.04.04 The founding level for trenches/channels shall be decided as per functional requirement. The bottom of excavation shall be properly compacted prior to casting of bottom slab of trenches / channels.

7.04.05 CBR tests for pavement/road design shall be carried out by the Contractor after earth filling (if applicable) has been completed upto the formation level.

7.05.00 Sheeting & Shoring

The contractor shall ascertain for himself the nature of materials to be excavated and difficulties, if any, likely to be encountered in excavation, executing the work. Sheet piling, sheeting and shoring, bracing and maintaining suitable slopes, draining etc. shall be provided and installed by the Contractor, to the satisfaction of the Engineer.

7.06.00 Special requirements for river side/submergence facilities

Bidder may provide suitable foundations as per IRC. The design of river/water body side foundations shall account for local scour around foundations, which shall be assessed by Contractor. Scour depth calculation shall be as per IRC.
During design the Allowable Bearing Pressure/pile capacity shall be adopted after approval of detailed geotechnical investigation report.

A) Bridge/ Approach bridge piles (Incase pile foundations are to be adopted)

i) The design of river/water body side piles shall account for local scour around pile, which shall be assessed by Contractor. Scour depth calculation shall be as per IRC.

ii) Contribution of frictional resistance from bed level upto maximum scour depth shall not be considered for computation of frictional resistance of river/water body side piles.

iii) All piles shall be located using Total Station Laser Operated Instrument.

iv) Initial pile load test under vertical (compression) & lateral loads shall be conducted on initial test piles installed river/water body side. If it is not feasible, initial load tests in simulated conditions (removal of skin friction from pile cut of level to the river bed level) may be conducted on river/water body bank with the approval of the Engineer.

v) All the river/water body work safety norms shall be adhered to.

vi) Diameter of piles for bridge/ approach bridges shall be 1200mm. The vertical capacity, uplift & lateral load carrying capacity shall be as per clause no. 7.02.03.

B) For Intake well

The termination of river intake well shall be decided based on the following criterion :

a) Depth of sinking of well into soil/rock shall be as per IRC-78 considering, scour depth, overall long term safety and stability of intake well.
b) In case of well foundation (caissons resting on rock), the stipulations of IRC:78 shall be compiled to.

7.07.00 ANNEXURE-I

7.07.00.00 **Geotechnical Investigation**

The Contractor shall carry out detailed geotechnical investigation in the areas under his scope for establishing the sub-surface conditions and to decide type of foundations for the structures envisaged, construction methods, any special requirements/treatment called for remedial measures for sub-soil/ foundations etc. in view of soft sub-soils, aggressive sub-soils and water, expansive/swelling soils etc. prior to commencement of detailed design/drawings. The Contractor shall obtain the approval for the field testing scheme proposed by him from the Owner before undertaking the geotechnical investigation work.

7.07.01.00 **Scheme of geotechnical Investigation**

7.07.02.01 Field test shall include but not be limited to the following:

Boreholes, Standard Penetration Test (SPT), Dynamic Cone Penetration Test (DCPT), collection of disturbed samples (DS) and undisturbed soil samples (UDS), Trial Pits (TP), Plate Load Tests (PLT),Cyclic Plate Load Test(CPLT) , Electrical Resistivity Test (ERT), Seismic Refraction Test (SRT) or Cross Hole Test, Pressure Meter Test (PMT), In situ field permeability tests, collection of water samples, etc.

7.07.02.02 The diameter of borehole shall be minimum 150 mm in soil and 76 mm in rock. The diameter of UDS sampler shall be 100 mm minimum.

7.07.02.03 The minimum tests are indicated in **Appendix A**. Adequate number of tests shall be conducted up to sufficient depth for complete determination of subsoil conditions. The depth of boreholes shall be as specified in Appendix A. SPT shall be carried out in all types of soil deposits and in all rock formations with core recovery up to 20%, met within a borehole. This test shall be conducted at every 3.0 m interval or at change of strata, up to the final depth. SPT 'N' of 100 and above shall be referred as refusal. UDS shall be collected at every 3.0 m interval or at change of strata up to depth of borehole. UDS may be replaced by additional SPT, if SPT'N' value in the strata is above 50.

7.07.02.04 Laboratory tests shall be done as per relevant IS codes. The laboratory tests, not be limited to the following shall be conducted on disturbed and undisturbed soil samples, rock samples & water samples collected during field investigations in sufficient numbers.

Laboratory Tests on Soil Samples

Laboratory tests shall be carried out on disturbed and undisturbed soil samples for Grain Size Analysis, Hydrometer Analysis, Atterberg Limits, Triaxial Shear Tests (UU), Natural Moisture Content, Specific Gravity and Bulk Unit Weight, Consolidation Tests, Unconfined Compression Test, Free swell Index, Shrinkage Limit, Swell

Pressure Test, Chemical Analysis test on soil and water samples to determine the carbonates, sulphates, chlorides, nitrates, pH, organic matter and any other chemicals harmful to concrete and reinforcement/ steel.

Laboratory Tests on Rock Samples

Moisture content, porosity & density, Specific Gravity, Hardness, Soundness, Slake durability index, Unconfined compression test (Both at saturated and in-situ water content), Point load strength index and deformability test (Both at saturated and in-situ water content) shall be carried out on rock samples.

7.07.02.05 Geotechnical investigation (field & laboratory) shall be carried out in accordance with the provisions of relevant Indian Standards.

On completion of all field & laboratory work, geotechnical investigation report shall be submitted for Owner's review/approval. The Geotechnical investigation report shall contain geological information of the region, procedure adopted for investigation, field & laboratory observations/ data/ records, analysis of results & recommendations on type of foundation for different type of structures envisaged for all areas of work with supporting calculations. Recommendations on treatment for soil, foundation, based on subsoil characteristics, soft soils, aggressive chemicals, expansive soils, etc.

Recommendations on foundation system and the net allowable bearing pressures and pile capacity shall be based on the conservative values of geotechnical investigation data.

7.07.03.00 Geotechnical investigation work shall be got executed by the Contractor through the following agencies.

1. C.E.TESTING COMPANY Pvt. Ltd, Kolkata
2. Cengrs Geotechnica Pvt. Ltd, New Delhi
3. DBM Geotechnics & Constructions Pvt. Ltd, Mumbai
4. SECON Pvt Ltd, Bangalore
5. Soil Engineering Consultants, New Delhi
6. Consulting Engineers Group Ltd, Jaipur
7. KCT Consultancy Services, Ahemdabad
8. Sohams Foundation Engineering Pvt Ltd, Navi Mumbai

7.08.00 **APPENDIX – A**

i) **In Plant Area**

a) Boreholes

S.No	Structure	Spacing/Number of borehole	Depth of borehole	Remarks

1	Main Plant structures (Transformer Yard, Main power house, Boiler, ESP, Chimney, Mills, Fans etc)	40 to 50 m along the rows of main power house columns. Minimum 3 boreholes under each Boiler, Mill & Bunker, ESP structure and 3 boreholes under Chimney, Minimum 2 boreholes under each TG, ESP Control Room, TPs. 4 boreholes in Transformer yard	Depth of boreholes shall be 25m to 30m.	Depth of boreholes shall be as mentioned in column "Depth of Borehole" or 5m continuous in rock with RQD > 50% whichever is earlier.
2	Switch yard area	Minimum 6 no of boreholes	15 to 20 m	
3	Water Treatment plant area	Minimum 5 no of boreholes	20 to 25m	
4	Cooling towers	Minimum 3 boreholes under each cooling tower	20 to 25 m	
5	CW Pump House Area	Minimum 3 boreholes	15 to 20 m	
6	Coal handling area	Minimum one borehole under each TP and one under each crusher house. 2 boreholes under track hopper and wagon tippler and one borehole under each structure. Minimum 3 Nos. of boreholes in each Coal Stock Pile area.	25 to 30 m	
7	Raw Water Reservoir Area	Minimum 5 boreholes	10 to 15 m	

8	Ash Handling Structures	Minimum 5 boreholes	20 to 25 m	
9	Corridors for Ash pipe routes	One borehole @ 750 m c/c along the identified corridor	10 m	
10	Crossings along the pipeline corridor like road, river, nallah/ canal	2 no. of boreholes at each crossing (one on each side) and 2 nos (min) of boreholes inside the river/ nallah of width more than 10.0m	Depth of borehole shall be 25m	
11	Transmission line from Plant to Intake Pump House	One borehole @ 750 m c/c along the identified corridor	10 to 15 m	
12	Other Off site Structure/Facility	Minimum Two boreholes under each area / facility	20 to 25 m	

b) Other Field Tests (Minimum)

1	Plate Load Test (PLT)	1 no each in ESP, transformer yard area and other area, where open foundations are feasible.	Test Depth from 3 to 4 m	
2	Cyclic Plate Load Test (CPLT)	1 no in each TG, Mill and ID fans	Test Depth from 2.5 to 4 m	
3	Trial Pit (TP)	About 20 Nos.	Depth - 4 m	
4	In Situ Permeability Test In Boreholes	In minimum 10 Nos. of boreholes in plant, 4 Nos. of boreholes in Raw Waster Reservoir and 8 Nos. of boreholes in ash disposal area	Tests shall be conducted at depths of 1.0m, 3.0m, 5.0m, 8.0m and 12.0m.	

5	DCPT	About 10-20% of boreholes up to refusal depth		
6	ERT	2 Nos. each in Transformer yard, TG, Boiler, Chimney, water treatment plant area, ESP Control Room, 6 Nos. in switchyard, CHP area 1No near each Pump House other than mentioned above		
7	SRT	In Grid covering the Main Power Block from Chimney to Transformer Yard (about 2000 to 2200 m)		
8	PMT	50 no of tests in main power house area covering power house to to chimney, TP/Crusher Houses.	Depths covering from 1.0 m to 20.0 m	

- Depth and location of Boreholes and other field tests (DCPT, PLT, CPLT, SRT, ERT, PMT, field permeability tests etc.) shall be approved by Owner before execution of geotechnical investigation work.

Investigation in any other building / structure / facilities / trestles and associated works / items, which are not listed above shall also be carried

ii) **At Intake location in river/water body and make up water pipe line corridor**

S.No	Structure	Tests
1	Intake well (river side / water body)	Three boreholes along periphery and One borehole at centre of the Intake well Depth of borehole shall be

		i) 1.5 times the dia / width of intake well below the founding depth of intake well. ii) 5 m into rock with RQD ≥ 50% continuously Whichever above occurs earlier.
2	Bridge/ Approach bridge (river side / water body)	One borehole at 100 - 150m c/c distance along proposed approach bridge / walkway or at each pier location. Depth of borehole shall be i) 50 m below river bed level ii) 5 m into rock with RQD ≥ 50% continuously Whichever above occurs earlier.
3	Control room building, swgr room etc. (river bank/ water body)	Three boreholes, two ERT and one PLT Depth of borehole shall be 30m or 5 m into rock with RQD ≥ 50% continuously, whichever occurs earlier.
4	Approach road to make-up water facilities from nearby existing road and road all round the make-up water facilities within land acquisition boundary and approach to various buildings.	Field CBR test (California Bearing Ratio) at 750m c/c
5	Bank protection works	Two boreholes along the bank. Depth of borehole shall be 10m Disturbed samples shall be collected at atleast five locations along the bank, from the surface of the bank to the river bed at 3 metre depth interval.
6	Makeup water pipeline corridor	Boreholes of 10 m depth shall be carried out along the corridor @ 750m c/c and one ERT shall

		be conducted near to each borehole
7	Crossings along the pipeline corridor like road, river, nallah	2 no. of boreholes at each crossing (one on each side) and 2 nos (min) of boreholes inside the river/ nallah of width more than 10m Depth of borehole shall be 25m or 5 m into rock with RQD ≥ 50% continuously, whichever occurs earlier.

8.00.00	**GENERAL SPECIFICATION**
8.01.01	**Joints in Concrete Structures** **Construction Joints** All horizontal construction joints shall be provided with a groove (shear key) for transfer of shear force. **Expansions Joints** In case of expansion joints, preformed bitumen impregnated fibre board conforming to IS:1838 shall be used as joint filler. The joints shall be sealed with bitumen sealing compound conforming to IS: 1834, however in case of liquid retaining/carrying structures, two parts polysulphide sealant conforming to IS:12118 or silicon sealing compound shall be used. IS:3414 shall be followed for details of joints in buildings. 3 mm thick stainless steel strip in matt or buff finish shall be provided over building expansion joints.
8.01.02	All steel sections and fabricated structures, which are required to be transported on sea, shall be provided with anti corrosive paint before shipment to take care of sea worthiness.
8.01.03	A screed or concrete layer not less than 100 mm thick and of grade not weaker than M 10 conforming to IS: 456 shall be provided below all water retaining structures.
8.01.04	Minimum 75mm thick lean concrete M-7.5 shall be provided below all other underground structures, foundations, trenches, etc., to provide a base for construction.
8.01.05	Monorails, monorail girders and fixtures shall be provided, wherever required to facilitate erection / maintenance of equipment.
8.01.06	Wherever possible all floor openings shall be provided with 100 mm thick 150 mm high RCC kerb all around.
8.01.07	Angles 75 x 75 x 6 mm (minimum) with 8mm dia and 150mm long MS lugs @ 150 c/c shall be provided for edge protection all around cut outs/openings in floor slabs. Angles 50 x 50 x 6mm with effective anchor lugs shall be provided for edges of concrete drains supporting grating/covers, edges of RCC cable / pipe trenches supporting covers/chequered plates/ grating, edges of manholes supporting covers, supporting edges of precast RCC covers and any other place where breakage of corners of concrete is expected.
8.01.08	Floor of switchgear room shall be provided with embedded M.S. channel suitable for easy movement of breaker panels.
8.01.09	Anti termite chemical treatment shall be given to all vulnerable areas susceptible to termite including column pits, wall trenches, foundations of buildings, filling below the floors, etc., as per IS: 6313 and other relevant Indian Standards.
8.01.10	Trenches located outside the buildings shall project at least 200mm above the finished formation level unless noted otherwise elsewhere in this specification so that no storm water shall enter the trench. The bottom of the trench shall be provided with a longitudinal slope of 1:500.The downstream end of cable trenches shall be connected through pipe drains to the nearby RCC manholes (to convey water from trenches) of storm water drainage system, but avoiding back flow of storm water. The precast covers shall not be more than 300 mm in width and shall not weigh more than 65 kg. Lifting hooks shall be provided in the precast covers. The trenches shall be given a slope of 1 in 250 in the direction perpendicular to the

	run of the trenches. PVC water stops shall be provided at all expansion joints of all trenches. Trench covers near entry or at road crossings shall be designed for 10 T wheel load at centre. Pre - cast covers shall be designed for central point load of 75 Kgs. R. C. C. cable slits shall be filled with sand after erection of cables, up to top level and covered with pre - cast R. C. C. covers.
8.01.11	All steel platforms above grade shall be provided with 100 x 6 thick kick plates at edge of platform.
8.01.12	Duct banks consisting of PVC conduits conforming to IS:4998 for cables shall be provided with proper sealing arrangement consisting of fire retardant sealing compound.
8.01.13	Independent network of lines for sewerage and drainage shall be provided.
8.01.14	The sub-grade for the roads and embankment filling shall be compacted to minimum 95% of the Standard Proctor density at Optimum moisture content (OMC.)
8.01.15	Detailed scheme for dewatering shall be prepared, wherever required, before starting of deep excavation work. IS: 9758 shall be followed as general guidance for dewatering.
8.01.16	Structural steel column base plates and bolts, gussets, etc., shall not project above the floor level. These shall be encased by concrete cover upto floor level with concrete grade M 30.
8.01.17	Non-shrink flowable grout shall be used for under-pinning work below base plate of columns. Nominal thickness of grout shall be 50 mm. Non-shrink cum plasticizer admixture shall be added in the grout. Crushing strength of the grout shall generally be one grade higher than that of the base concrete. Minimum grade of grout shall be M-30. However, for equipment foundations, high strength (minimum characteristic compressive strength of 60 N/mm^2 at 28 days) ready mixed non-shrink, chloride free, cement based, free flowing, non-metallic grout as recommended by equipment manufacturer shall be used.
8.01.18	Fencing for fuel oil area, switchyard, and transformer yard area shall be of the same type as specified, elsewhere in this specification.
8.01.19	Plant effluent shall not be mixed with either storm water or sewage.
8.01.20	Rail-track in transformer yard area shall be provided with rigid type RCC foundation. Rail weighing 52 kg/m shall be used.
8.01.21	All building shall be design to take care of Rain Water harvesting & ground water recharging.
8.01.22	Ground Floor Slab & Area / Pathway Paving: For Ground floor / Area paving or path - way having earthen sub-grade, the paving work shall consist of following parts i.e. 150 mm thick RCC M - 25 Grade base slab, 75 mm thick PCC (1:4:8), 275 mm thick (compacted thickness) stone / rubble soling sub base with 63 mm down aggregate compacted to 85% of original volume and interstices filled with well graded selected sand on compacted and dressed sub - grade. Reinforcement of the RCC slab shall consists of minimum 8mm dia bars @ 200 mm c / c at top in both directions.
8.01.23	As required suitable steel frames shall be provided around openings in the roof and external walls for mounting exhaust fans.
8.01.24	All foundation embedments, inserts, blockouts required for mounting of equipments and supporting any other facility like pipes etc. shall be provided.

8.01.25	Grouting of all pockets, blockouts, sleeves and the openings around the embedment, inserts, bolts etc. and under pinning below the base / sole plate shall be with non - shrink flowable grout. Grade of grout shall be one grade higher than concrete. However minimum grade of grout shall be M - 30.
8.01.26	All cable trenches shall be provided with suitable insert plates for fixing support angles of cable trays.
8.01.27	All internal cable trenches shall have minimum 6mm thick (o / p) chequered plate covers while external cable trenches shall have pre - cast RCC covers. However, the portion of the cable trench behind and sides of control panel / MCC shall be provided with suitable chequered plate covers as directed by the Engineer.
8.01.28	All foundations and surfaces of substructures coming in contact with earth shall be applied with three coats of hot applied industrial bitumen conforming to IS : 702 (latest), of Grade 85 / 25, at the rate 1.7 Kg / Sq.m / coat.
8.01.29	All the liquid retaining structures shall be tested for water tightness with full water level in accordance with IS : 3370 (Part - I).
8.01.30	All structures receiving acid / alkali resistant lining shall be tested for water tightness and made leak proof before lining work.
8.01.31	Base slab of large tanks may be cast in number of panels viz. I, II, III etc. Starting with I, the slab panels shall be cast alternately in chess board fashion, with proper construction joints. Adjacent panels shall be cast with sufficient time interval, so that first cast concrete would have undergone most of its shrinking before the second cast concrete is poured against it. The construction joints shall be provided with chemical injection grouting treatment. The construction joints shall have continuity of reinforcement and shall be provided with suitably keys. The size of panels shall be as per IS : 3370 recommendations.
8.01.32	For construction joint in concrete wall, the maximum height of any lift should not exceed 2 meters. However, the time interval between the successive lifts should be as small possible and the wall should be built to its full height in the least possible time.
8.01.33	1000mm wide x 100 mm thick plinth protection in PCC (M-15) shall be provided around all buildings, pits / sumps, clarifiers, tanks, etc.
8.01.34	All masonry walls shall be provided with Damp Proof Course at plinth level.
8.01.35	Wherever required PVC coated chain - link fencing shall be provided as per specification.
8.01.36	Expansion joints for all underground structures shall be made water tight by using ribbed PVC water stops with central bulb or of kicker type. The thickness and width of PVC water stops shall be as per the requirement of design. However, the minimum thickness and width shall be 6mm and 225mm respectively. Two - part polysulphide sealant conforming to IS: 12118 shall be used for sealing of joints. Preformed bitumen impregnated fibre board conforming to IS: 1838 shall be used as joint filler.
8.01.37	All monorail openings in the walls shall be provided with double plate flush steel door shutters with suitable access platform and ladder as required.

8.01.38	a) All drains inside the building shall have minimum 40mm thick grating covers. In areas where heavy equipment loads would be coming, precast RCC covers shall be provided in place of steel grating. b) All drains outside building shall have perforated precast RCC covers of minimum 50mm thickness with provision of openable steel grating cover at about 4.0m interval. In areas where vehicular loads would be coming precast RCC covers of suitable thickness without perforations and designed for the vehicular loading shall be provided.
8.01.39	Hand rail height , size and material to be adopted shall be as per general architectural specification.
8.01.40	In all buildings, suitable arrangement for draining out water collected from equipment blowdowns, leakages, floor washings, fire fighting etc. shall be provided for each floor with suitable floor drains.
8.01.41	All cable & pipe routing in outlying area shall be clubbed and shall run over ground on steel trestles or other supporting structures at a height specified elsewhere in this specification except in some localised area (as approved by Employer) where the same can run in trenches. In case cable route is not envisaged in the area, pipe shall be routed on ground over RCC pedestals at a height of not less than 500 mm. All trenches shall be of RCC with removable RCC covers.
8.01.42	Water supply line & drainage of pump house shall be connected with the nearest Employer's water supply & drainage line.
8.01.43	Unless specified all sand filling shall be compacted to minimum 75% of the relative density and backfilled earth shall be compacted to minimum 90% of the Standard proctor density at OMC. However, sub - grade for the roads shall be compacted to minimum 95% of the Standard Proctor density at Optimum moisture content (OMC).
8.01.44	All liquid retaining structures shall be leak-proof. Water proofing of all liquid retaining structures shall be done by addition of plastciser cum water proofing admixture conforming to IS : 9103, in the concrete at the time of mixing and through external treatment by chemical injection grouting at all construction joints as described in the specification. Addition of admixture should not reduce the strength of the concrete below the specified strength in any case. In addition, limit on permeability as given in IS : 2645 shall also be met with. Further if required, chemical injection grouting treatment shall be applied to make the structure leak proof, if leakage is observed during hydro - test or otherwise, with no cost implication to the Employer.
8.01.45	Plywood formwork shall be used for all water retaining/ conveying structures (only on the face having contact with water) and for all overground concrete works. It shall also be used for the inner face of sump of pump (i.e. faces of piers back walls, breast walls and baffle walls having contact with water. For all other areas steel/ plywood formwork shall be used.
8.01.46	All buildings shall be provided with peripheral drains by the side of plinth protection for catering to the rain water from roofs and storm water from adjacent area.
8.01.47	Under drainage arrangement for under ground structures shall be provided as applicable in line with relevant codal provisions.

8.01.48 2.0m wide walkway with concrete paving shall be provided connecting all buildings and facilities. The top of walkway shall be minimum 200mm above FGL.

8.01.49 For all buildings, finished floor level (FFL) shall be minimum 500mm above finished ground level (FGL).

8.01.50 **Acid/ Alkali Resistant Lining**

The acid / alkali resistant lining shall be provided broadly in the areas identified. The Bidder shall give a guarantee for satisfactory functioning of the lining for a period of 36 months from the date of completion of the work or date of handing over the site to the Engineer, whichever is later. The Bidder shall replace / rectify defects is any, observed in the lining to the satisfaction of the Engineer without any extra cost during this period.

8.01.51 **Bituminous Coating**

Bituminous coating shall be applied on the inside faces of the water retaining structures and also on that portion of water retaining structure which are in contact with ground water. Surface to be treated shall be absolutely dry, clean and dust free. The surface shall be sand papered, before applying the coating.

The external surfaces of concrete which are in contact with ground water shall be applied with hot industrial bitumen conforming to IS : 702, of grade 85 / 25. The rate of application shall not be less than 1.70 Kg / sq.m / coat, in three coats and it should be heated to about 120^{o}C before application. Anti stripping compound shall be added wherever necessary. After application of third coat and before it is dried up, sand shall be spread on the surface to cover it completely. Sufficient time shall be allowed after spreading sand, before back filling is done in order to allow the final coat to dry up completely.

The internal surfaces of water retaining structure which are in contact with water shall be applied with two coats of bitumen paint conforming to IS : 9862, at the rate of 1.5 Kg / Sq. M. in first coat and 1.0 Kg / Sq. M. in second coat.

8.01.52 40mm Dia. MS rods as earthing mat, placed at a distance of 1.0M away and at depths between 0.60M and 1.00M shall be supplied and laid all around the periphery of buildings, structures, and out door equipment, as per approved drawings. Riser of 40mm Dia. MS rods and connecting to the above Earthing mat shall also be supplied and laid in position by the Contractor, as per the approved drawings. Raiser shall be laid up to a height of 300 mm above the local Ground level, at each of the columns

of the buildings on the outside of the buildings, and minimum 2 (two) numbers of structures and equipment. The contractor also supply and lay necessary number of 3.0 M deep 40 mm Dia. MS rods Earthing electrodes and connecting them to the Earthing mat, as per the approved drawings and supplying and laying of 40 mm Dia. MS rods for connecting the Contractor's earthing mat with the Employer's earthing mat separately of two locations.

8.02.00 **Concrete**

General

a) Concrete work shall be carried out as per IS:456. Mix design concrete shall be used for all areas other than lean concrete work and plain cement concrete where nominal/volume mix can be permitted. Design mix shall be carried out as per IS:10262. Specific approval of the Engineer shall be obtained regarding degree of quality control to be adopted for design mix.

b) Minimum grade of reinforced cement concrete for all foundations including piling shall be M25 unless noted otherwise. Minimum grade of concrete for other structures/areas (other that machine foundations) shall be M25 for all superstructure and substructure unless noted otherwise elsewhere in this specification.

c) The minimum grades of concrete for different machine foundations and some of other important structural members shall be as follows:

Sl. No.	Description	Minimum grade of concrete
i)	TG Top Deck	M-35
ii)	ID, FD and PA fan Deck	M-30
iii)	Coal Mill Deck	M-30
iv)	Sub structure supporting top decks of TG, ID/FD/PA Fans, Mills including raft/ footings	M-35
v)	BFP foundations including deck	M-35

d) Higher grade of concrete than specified above may be used at the discretion of the Bidder.

e) Unless otherwise specified, 20mm and down aggregates shall be used for all structural concrete works. However, 40mm and down aggregates may also be used under special conditions for mass concreting in foundation.

f) For thin concrete sections such as roof slab over profiled metal deck sheets, 12mm and down coarse aggregates shall be used for coarse aggregates.

g) All underground concrete structures like trenches, substructures of pump houses, all water retaining / carrying structures , etc., shall have super-plasticizer cum water proofing cement additive conforming to IS:9103. In addition, limit on permeability as given in IS:2645 shall also be met with.

h) Minimum grade of concrete for Plain Cement Concrete (PCC) has been specified in the preceeding section

Special requirements for concreting of major equipment foundations shall be as given below.

a) **Coarse Aggregates**

Sound and durable crushed stone aggregates shall be used. All aggregates shall be tested for alkali aggregate reaction. Materials, which contain high percentage of reactive silica, shall not be used. In exceptional cases, high percentage of reactive silica content, aggregate may be allowed where low alkali content cement shall be used. Lime stone aggregate shall not generally be used for foundations which are subjected to high temperature and repeated temperature cycles (like in the case of all machine foundations). However, in case other types of suitable aggregate is not available, the Engineer may allow the use of lime stone aggregate provided the Bidder gets the sample tested from a reputed testing laboratory for satisfactory performance under high temperature and repeated temperature cycle.

Unless otherwise specifically approved by the engineer, the tests shall be carried out

for a temperature range from 10 °C to 65 °C and for 60 (sixty) temperature cycles.

b) **Temperature Control of Concrete**

The temperature of fresh concrete shall not exceed 25 deg C when placed. For maintaining the temperature of 25 deg C in the top decks of machine foundations, crushed ice shall be used in mixing water.

c) **Admixture**

Plasticizer /super plasticizer admixture shall generally be added to the concrete for promoting workability. In addition, plasticizer/super plasticizer-cum-ratarder shall be added to retard the setting time for mass concreting work as required. In case of pumping, suitable pumping additive shall also be added to avoid segregation and increase flowability. The slump shall generally be in the range given below:

Top decks of TG,	-	150 mm to 200 mm
BFP, ID/PA/FD Fans,		
Mill deck	-	100 mm to 150 mm
Block foundation	-	100 mm to 150 mm
Column	-	100 mm to 150 mm

d) **Form work**

Plywood with film face form work shall be used for the top decks of all machine foundations and also for columns of TG foundation.

e) **Placing of Concrete**

Base Raft and top deck of machine foundations shall be cast in a single pour.

f) **Ultrasonic Testing**

Ultrasonic pulse velocity test shall be carried out for the top decks of all machine foundations and TG substructure to ascertain the homogeneity and integrity of concrete. In addition, additional cubes (at the rate of one cube per 150 cu.m. of concrete subject to a minimum of six cubes) shall be taken to carry out Ultrasonic Pulse velocity (UPV) testing on the cubes, to serve as reference UPV values. Testing shall be done as per IS:13311 (Part-1). In case of any defect, the Bidder shall rectify the defects suitably using cement/epoxy grout, etc.,

g) **Scheme for Concreting**

Weigh Batching Plants, transit mixer, concrete pump shall be mobilised. Arrangements for standby Plant and Equipment shall also be made.

h) **Reinforcement Steel**

Reinforcement Steel shall be of grade Fe500 TMT conforming to IS1786. However minimum elongation shall be 14.5%.

8.03.0 **Formwork**

Formwork for building RCC Slabs/ Beams & Columns shall be of 2 different types.

Type 1 Formwork: (For RCC slab of Structural Steel Framed Buildings Only)

Troughed colour coated metal deck sheets shall be used as permanent shuttering having minimum thickness of 0.80mm. These profiled metal deck sheets shall be fixed to the structural steel secondary beams/ Purlins using Headed shear anchor studs. The detailed material property requirement of metal deck sheet is specified elsewhere in this specification.

The shear anchor studs for fixing metal deck sheet to floor structural beams shall conform to Type-B studs specified in AWS D1.1/D1.1M or equivalent as shear connector of 19mm diameter and 100mm length manufactured from cold drawn round steel bars conforming to the requirement of ASTM A 29, of grade designation 1010 through 1020, of standard quality with either semi-killed or killed, welded by Drawn Arc Stud Welding through metal deck sheet.

The shear anchor studs for fixing metal deck sheet to roof structural purlins shall conform to Type-B studs specified in AWS D1.1/D1.1M or equivalent as shear connector of 16mm diameter and 65mm length manufactured from cold drawn round steel bars conforming to the requirement of ASTM A 29, of grade designation 1010 through 1020, of standard quality with either semi-killed or killed, welded by Drawn Arc Stud Welding through metal deck sheet.

Type 2 Formwork: (For RCC Buildings)

Plywood with film face formwork shall be used for floor & roof slabs, Columns & Beams of all RCC buildings

8.04.00 **Fencing and Gate**

Fencing

Fencing with gate shall be provided around transformer yard, switchyard area, fuel oil area and other areas wherever necessary due to security, safety, and statutory requirements as per following specifications.

The fencing, with gate (unless specified otherwise) shall comprise of PVC coated G.I. welded wire mesh fencing of minimum 4 mm diameter (including PVC coating) of mesh size 75mmX75mm of height 2.4m above the toe wall with a 600mm high galvanised concertina at the top, such that total fence height of 3.0m above the toe wall is achieved. The diameter of the steel wire for chain link fence (excluding PVC coating) shall not be less than 2.5 mm.

The PVC coated chain link will be stretched by the clips at 0.5m intervals to three strands of galvanised high tensile spring steel wire (HTSSW) of 2.5 mm diameter interwoven with chain link wire mesh and kept under tension which in turn are attached to the fence post with security nuts and bolts. On every fourth post a clamping strip will be threaded through the links of chain link and bolted to the fence post with the help of security nuts and bolts.

Above the chain link a 600mm high tensile serrated galvanised wire (HTSW) concertina made with wire diameter of 2.5mm will be stretched to 6m and attached to two strands of galvanised HTSSW of 2.5 mm diameter by means of clips at 1m intervals. These two HTSSW strands will be attached to the fence posts with 12 mm security fasteners.

All nuts, bolts, fasteners, clamping strips, clamps, clips, etc., shall be galvanised.

All fence posts shall be of 75 x 75 x 6 MS angles spaced at 2.5m c/c distance. All corner posts will have two stay posts and every tenth post will have transverse stay post. Suitable R.C.C. foundations for the post and stays shall be provided based on the prevailing soil conditions. All posts of fencing shall be painted with chlorinated rubber paint over a suitable primer.

Toe walls either of brick masonry with bricks of minimum 50 kg./sq.cm. crushing strength or of hollow concrete block masonry shall be provided between the fence posts all along the run of the fence with suitable foundation. Toe wall shall be minimum 200mm above the formation level with 50mm thick P.C.C. coping (1:2:4) and shall extend minimum 300mm below the formation level. Toe wall shall be plastered with cement sand mortar (1:6) on both sides and shall be painted with two coats of textured cement point (Sandtax Matt or equivalent) of approved colour and shade. Toe wall shall be provided with weep holes at appropriate spacings.

Gate along fencing

All gates shall be of structural steel of minimum 3.75 metres width for single lane access road and 8.00 m width for double lane access roads. The height of gate shall be same as that of the fence unless noted otherwise. Each gate shall have provision for wicket gate of size 1.0 m x 2.1 m.

The gate frame and post shall be fabricated from medium class MS pipe of nominal diameter not less than 75 mm. The panel plate shall be of minimum thickness 2.5 mm conforming to IS:513.

The gate shall be complete with fabricated hinges, MS aldrops with locking arrangement, tempered steel pivot, guide track of MS tee, bronze aluminium ball bearing arrangement, castor wheel, etc.

8.05.00 **Grating**

All gratings shall be electroforged types. Minimum thickness of the grating shall be 40 mm for indoor installation and 32 mm for outdoor installation. The opening size shall not be more than 30mmx100mm. The minimum thickness of the main bearing bar shall be 5 mm or as per design requirement whichever is higher. All gratings shall be hot dip galvanised at the rate of 610 g. per sq.m. after surface preparation by means of shot blasting.

8.06.00 **Fabrication**

The fabrication shall be done as per fabrication drawing which would clearly indicate various details of joints to be welded, type of weld, length and size of weld, whether shop or site weld.

Welding

a) Welding of Structural steel shall be done by an electric arc process and shall conform generally to relevant acceptable standards viz. IS:816, IS:9595, IS:814, IS:2014, IS:4354 and Indian Standard Hand Book for metal arc welding, and other standards, codes of practice internationally accepted. For welding of any particular type of joint, Bidder shall give appropriate tests as described in any of the Indian Standards - IS: 817, IS: 7307 and international standards as relevant.

b) Submerged arc-welding shall be used for welding longitudinal fillet welds (connecting

flange with web) and longitudinal / transverse butt joints for fabrication of columns, framing beams and crane girders and all other built-up members, unless manual arc welding is specifically approved by the Engineer. Necessary jigs and fixtures and rotation of structures shall be so arranged that vertically down-hand position of welding becomes possible. 'Open-Arc-Welding' process employing coated electrodes shall be employed for fabrication of other welded connections and field welding.

c) Wherever welding is done for assembling the components of structures, the job shall so positioned that downhand welding is possible.

d) Any structural joint shall be welded only by those welders who are qualified for all welding procedures and positions in such type of joint that is welded.

e) All records for entire welding operations such as welders identification marks, the joints welded by the each welder, the welding procedures adopted, welding machine employed, pre and post heating done and any non destructive test done and stress relieving /heat treatment performed on such joints shall be accessible to the Engineer for scrutiny.

f) In a fabrication of plated columns/beams and built up members all shop splices in each component part shall be done before such component part is welded to other parts of the member. Wherever weld reinforcement interferes with proper fitting between components to be assembled by welding, these welds shall be ground flush prior to assembly.

g) The members to be jointed by fillet welding shall be brought and held as close together as possible and in no event shall be separated locally by more than 3mm. If the local separation is 1.5mm or greater, the fillet weld size shall be increased by the amount of separation.

Edge preparation for welding as per weld joint detail shall be prepared either by machines or by automatic gas cutting. All edges cut by flame shall be ground before they are welded.

Electrodes

a) The electrodes used for welding shall be of suitable type and size depending upon specification of the parent materials, the method of welding, the position of welding and quality of welds desired e.g. normal penetration welds or deep penetration welds. However, only low Hydrogen electrodes shall be used for plate thickness above 20 mm.

b) All low hydrogen electrodes shall be baked and stored before use as per manufacturer recommendation. The electrodes shall be rebaked at 250^0C - 300^0 C for one hour and later on cooled in the same oven to 100^0C. It shall be transferred to an holding oven maintained at 60^0C - 70^0C. The electrodes shall be drawn from this oven for use.

c) Where coated electrodes are used they shall meet the requirements of IS:814 and relevant ASME-Sec. Covering shall be heavy to withstand normal conditions of handling and storage.

d) Only those electrodes which give radiographic quality welds shall be used for welds which are subjected to radiographic testing

e) Where bare electrodes are used, these shall correspond to specification of the

parent material. The type of flux-wire combination for submerged arc welding shall conform to the requirements of F-60 Class of AWSA-5-17-69 and IS:3613. The electrodes shall be stored properly and the flux shall be baked before use in an oven in accordance with the manufacturer's requirements as stipulated.

f) 308L and 309L electrodes / fillers shall be used for welding of stainless steel to stainless steel and stainless steel to mild steel respectively.

g) Specific approval of the Engineer shall be taken by Bidder for the various electrodes proposed to be used on the work before any welding is started.

Preheating inter-pass temperature and post weld heat treatment.

a) Mild steel plates conforming to IS:2062 and thicker than 20mm, may require preheating of the parent plate prior to welding as mentioned in Table-I.

However, higher preheat and interpass temperatures required due to joint restraint etc. and will be followed as per approved welding procedure. In welding materials of unequal thickness, the thicker part shall be taken for this purpose.

c) Base metal shall be preheated, not withstanding provisions of IS:9595, to the temperature given in Table-1 prior to welding or tack welding. Preheating shall bring the surface of the base metal to the specified preheat temperature and this temperature shall be maintained as minimum temperature while welding is in progress.

TABLE – 1
MINIMUM PREHEAT and INTER PASS TEMPERATURE FOR WELDING

Thickness of thicker part at point of Welding	**Welding using Low hydrogen electrodes or Submerged arc welding**
Upto and including 20mm	None
Over 20mm and upto and including 40m	20 ^{0}C
Over 40mm and upto and including 63mm	66 ^{0}C
Over 63mm	110 ^{0}C

c) Preheating may be applied by external flame which is non-carbonising like LPG, by electric resistance or electric induction process such that uniform heating of the surface extending upto a distance of four times the thickness of the plate on either side of the welding joint is obtained.

d) Thermo-chalk, thermo-couple or other approved methods, shall be used for measuring the plate temperature.

e) All butt welds with plates thicker than 50mm and all site butts weld of main framing beam shall require post weld heat treatment as per procedure given in AWS D-1.1. Post heating shall be done upto 600 deg.C and rate of application shall be 200 deg.C per hour. The post heat temperature shall be maintained for 60 minutes per 2.5cm. thickness. For maintaining slow and uniform cooling, asbestos pads shall be used

for covering the heated areas.

Sequence of Welding

a) The sequence of welding shall be carefully chosen to ensure that the components assembled by welding are free from distortion and large residual stresses are not developed. The distortion should be effectively controlled either by a counter effect or by a counter distortion. The direction of welding should be away from the point of restraint and towards the point of maximum freedom.

b) Each case shall be carefully studied before finally following a particular sequence of welding.

c) Butt weld in flange plates and/or web plates shall be completed before the flanges and webs are welded together.

d) The beam and column stiffeners shall preferably be welded to the webs before the web and flanges are assembled unless the web and flanges to the beam or column are assembled by automatic welding process.

e) All welds shall be finished full and made with correct number of runs, the weld being kept free from slag and other inclusions, all adhering slag being removed.

f) Current shall be appropriate for the type of electrode used. To ensure complete fusion, the weaving procedure should go proper and rate of arc advancement should not be so rapid as to leave the edges unmelted.

g) Pudding shall be sufficient to enable the gases to escape from the molten metal before it solidifies.

h) Non-uniform heating and cooling should be avoided to ensure that excessive stresses are not locked up resulting ultimately in cracks.

i) The ends of butt welds shall have full throat thickness. This shall be obtained on all main butt welds by the use of run off and run on pieces adequately secured on either side of main plates. The width of these pieces shall not be less than the thickness of the thicker part joined. Additional metal remaining after the removal of extension pieces shall be removed by grinding or by other approval means and the ends and surface of the welds shall be smoothly finished. Where the abutting parts are thinner than 20mm the extension pieces may be omitted but the end be welded to provide the ends with the required reinforcement.

j) The fusion faces shall be carefully aligned. Angle shrinkage shall be controlled by presetting. Correct gap and alignment shall be maintained during the welding operation.

k) All main butt welds shall have complete penetration and back surface of the weld being gouged out clean before first run of the weld is given from the back. However, partial penetration butt weld shall be permitted, when specifically shown in the design drawings.

l) Intermittent welds shall be permitted only when shown in the design drawings.

m) The welding shrinkage shall be minimised by adopting the correct welding procedure and method. In long and slender member extra length should be provided at the time of fabrication for shrinkage.

Testing of Welders

All the welders to be employed for the job shall have to qualify the appropriate tests laid down in IS: 817 and IS: 1181 and ASME IX/AWS D1.1. All the necessary arrangements required for the testing of welders are to be provided by the Bidder.

Inspection of Welds

a) **Visual Inspection**

100 percent of the welds shall be inspected visually for external defects. Dimensions of welds shall be checked. The lengths and size of weld shall be as per fabrication drawings. It may be slightly oversized but should not be undersized. The profile of weld is affected by the position of the joint but it should be uniform. The welds should have regular height and width of beads. The height and spacing of ripples shall be uniform. The joints in the welds run shall as far as possible be smooth and should not show any humps or craters in the weld surface. Welds shall be free from unfilled craters on the surface, under-cuts, stages on the surface and visible cracks.

Such inspection shall be done after cleaning the weld surface with steel wire brushes and chisel to remove the spatter metal, scales, slag, etc., If external defects mentioned above are noticed, there is every possibility of internal defects and further radiographic/ultrasonic examination shall be undertaken.

b) **Production Test Plate**

Test plates shall be incorporated on either side of at least one main butt welds of each flange plate and web plate of every main frame columns and crane girder. The weld shall be continuous over the test plate. The test plate extensions of the main plates and shall be fixed so that metal lies in the same direction as that of the main plate. Test plates shall be prepared and tested in accordance with the accepted Standards, in the presence of the Engineer or his authorised representative. Should any of these tests fail, further radiographic examination of the welds shall be done. These tests for test plates and radiographic examination are additional to those contemplated under inspection and testing.

c) **Non-destructive and special testing**

Radiographic / ultrasonic or other non-destructive examination shall be carried out. All tests of welds shall be carried out by the Bidder at his own cost. The cordoning of radiation zone, while Radiography testing is going on, shall be done.

In case of failure of any of the tests, re-testing of the joints shall also be carried out after rectification is done.

d) **Rectification of defective welding work**

Wherever defects like improper penetration, extensive presence of blow holes, undercuts, cracking, slag inclusion, etc., are noticed by visual inspection/other tests, the welds, in such location shall be removed by gouging process. The joints shall be prepared again by cleaning the burrs and residual matters with wire brushes and grinding, if necessary, and rewelded. The gouging shall as far as possible be done using gouging electrodes.

Inspection and Testing

a) **Fillet Welds**

i) All fillet welds shall be checked for size and visual defects.

ii) Macroetch examination on production test coupons for main fillet weld with minimum one joint per built up beam, column and crane girder, etc.

iii) 25% weld length of tension members of crane girder shall be subjected to dye-penetration test.

iv) On all other welds, dye-penetration test on 5% of weld length with minimum 300mm at each location shall be carried out.

b) **Butt Welds**

i) 100% visual examination.

ii) Dye penetration test on all butt welds after back gouging shall be carried out.

iii) Mechanical testing of production test coupons - minimum one joint/built up beam, column and crane girder. The engineer may reduce the frequency of the test, after getting consistently satisfactory results of initial 10 tests.

iv) 100% radiography test on butt welds of tension flange (bottom flange) of crane girder and bunker supporting girders. All other butt welds shall be subjected to radiography test on 10% of weld length of each welder.

c) **Dimensional Tolerance and Acceptance Criteria of Welds**

i) Every first and further every 10th set of identical structure shall be checked for control assembly at shop before erection.

ii) All structures, components/members shall be checked for dimensional tolerance during fabrication and erection as per IS:7215 and IS:12843 respectively.

iii) Dry film thickness after painting shall be checked by using elchometer.

iv) Acceptance criteria of NDTs on welds shall be as per AWS D-1.1 (Dynamically loaded structures - Tension welds).

Correction of Defective Welds

Correction of defective welds shall be carried out without damaging the parent metal. When a crack in the weld is removed magnetic particles inspection or any other equally positive means shall be used to ensure that the whole of the crack and material up to 25mm beyond each end of the crack has been removed.

Erection of Structures

All erection work shall be done with the help of cranes, use of derrick is not envisaged.

Erection Marks

a) Erection marks in accordance with fabrication drawing shall be clearly painted on the fabricated steelwork. Each piece shall be marked in at least on two places. Each piece shall also have its weight marked thereon.

d) The centre lines of all columns, elevations and girder bearings shall be marked on the sections to ensure proper alignment and assembly of the pieces at site.

Erection Scheme

a) The Erection Scheme for the erection of all major structures shall be furnished. The erectability of the structure shall be checked by the Bidder before commencement of fabrication work to avoid future modification. The erection scheme shall indicate the approximate weight of the structural members, position of lifting hook, crane boom length, crane capacity at different boom length and at different boom inclination, etc., Bidder shall take up the erection work only after he has obtained the approval of the erection scheme from the Engineer.

b) The erection scheme shall also give details of the method of handling, transport, hoisting, including false work/staging, temporary, bracing, guying, temporary strengthening, etc., It will also give the complete details of the number and capacity of the various erection equipment that will be used such as cranes, winches, etc., along with disposition at the time of erection of columns, trusses, etc.

c) The erection of columns, trusses, trestles, portals, etc., shall be carried out in one single piece as far as practicable. No column shall be fabricated and erected in more than 3 pieces. Galleries shall generally be erected as box i.e. the bottom chord and bracings, top chord and bracings, side vertical posts and bracings, end portals and roof-trusses shall be completely welded prior to erection and if required temporary strengthening during erection shall be made. The inside sheeting runners and roof sheeting purlins may be erected individually. When erection joints are provided in columns, their location shall generally be just above a floor level.

8.07.00 Steel Helical Springs And Viscous Damplers

8.07.01 **General Requirement**

This part of the specification covers the requirement for the manufacturing, testing, supply, transport to site, pre-stressing erection, supervision of erection by the vendor, release of pre-stress, alignment, commissioning, etc. of Steel helical springs and viscous dampers.

The Steel helical springs and viscous dampers supplied should be of proven make.

8.07.02 Codes and Standards

Some of the relevant applicable Indian standards and codes, etc, applicable to this section of the specification are listed below:

DIN : 4024 Machine foundations; Flexible supporting structures for machine with rotating masses.

DIN : 2089 Helical compression springs out of round wire and rod : calculation & design.

DIN : 2096 Helical compression springs out of round wire and rod; quality

requirements for hot formed compression springs.

VDI : 2056 Criteria for assessing mechanical vibrations of machine.

VDI : 2060 Criteria for assessing the state of balance of rotating rigid bodies.

8.07.03 Design & Supply of Material

i) Supply

Steel helical springs and viscous dampers and associated auxiliaries shall consist of:

(a) Steel helical spring units and viscous dampers along with viscous liquid including associated auxiliaries for installation of the spring units and dampers like steel shims, adhesive pads, etc.

(b) Frames for pre-stressing of spring elements.

(c) Suitable hydraulic jack system including electric pumps, high pressure tubes etc. required for the erection, alignment etc., of the spring units. One set of extra hydraulic jacks, and hand operated pumps shall also be provided.

(d) Any other items which may be required for the pre-stressing, erection, release of pre-stress, alignment, and commissioning of the Steel helical springs and viscous dampers.

ii) Design

The spring units should have stiffness in both vertical and horizontal directions with the horizontal stiffness not less than 50% of vertical stiffness. The stiffness should be such that the vertical natural frequency of any spring unit at its rated load carrying capacity is not more than 3 Hz. The damper units or spring-cum-damper units should be of viscous type offering velocity proportional damping. The damper units should be suitable for temperatures ranging from 0 to 50°C. The damping resistance of individual damper units should be such that the designed damping can be provided using reasonable number of Units.

The Steel helical springs and viscous dampers shall be designed for a minimum operating life of 30 years.

8.07.04 Manufacturing & Testing

Complete manufacturing and testing of the Steel helical springs and viscous dampers shall be done at the manufacturing shop of the approved sub vendor / supplier. For this purpose the contractor / sub vendor shall submit the detailed quality plan for approval of engineer and take up the manufacturing / testing after approval of such quality plan. The quality plan shall include

(a) Manufacturing schedule and quality check exercised during manufacturing.

(b) Detail of test to be carried out at the manufacturing shop with their schedule.

(c) Special requirements, if any, regarding concreting of top deck.

(d) Complete step-by-step procedure covering the installation and commissioning of the spring system.

(e) Manuals for erection, commissioning, testing and maintenance of the Steel helical springs and viscous dampers.

(f) A checklist for confirming the readiness of the civil fronts for erection of Steel helical springs and viscous dampers.

(g) Checklist for equipment required at each stage of erection.

(h) Bill of materials and data sheet of various elements such as spring units, viscous dampers, with their rating, stiffness etc. included in the supply.

(i) Bill of material and data sheet for frames for pre stressing, hydraulic jack including electric pump, high pressure tubes, hand operated pump etc., with their rating and umbers.

(j) Any other details which may be necessary to facilitate design and construction of the foundations / structures.

8.07.05 The Springs shall conform to codes DIN 2089 and DIN 2096. The quality assurance and inspection procedure shall be finalised on the basis of the above codes and the quality plans be drawn accordingly.

8.07.06 Transportation

Steel helical springs and viscous dampers shall be suitably protected, coated, covered, boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection.

8.07.07 Erection and Commissioning

Complete erection and commissioning of the Steel helical springs and viscous dampers including pre-stressing of elements, placing of elements in position, checking clearances on the shuttering of the RCC top deck, releasing of pre-stress in spring elements, making final adjustments and alignments etc. shall be carried out by a specialist supervisor of vendor.

The contractor shall guarantee the performance of the Steel helical springs and viscous dampers for 24 months from the date of commissioning of each machine which shall be termed as Guarantee Period".

8.07.07 Supervision

The supervision of installation of Steel helical springs and viscous dampers including pre-stressing, placing, releasing and alignment of spring units shall be done by a specialist supervisor of sub vendor / supplier, trained for this purpose.

8.07.08 Realignment of Spring System

If any realignment of the Steel helical springs and viscous dampers is required to be done for aligning the shaft or for any other reasons during the first one year of operation from the date of commissioning of the machine, the same shall be done by the contractor.

8.07.10 Acceptance Criteria

Stiffness values shall be checked. The permissible deviations shall be as per DIN 2096.

Following acceptance criteria shall be followed:

General workmanship is being good as recommended by the manufacturer and approved by the Engineer.

Tolerances are within the specified limit.

Material test certificate (MTC) is in compliance with the applicable codes / standards.

Bought out material is from the approved manufacturer / vendor.

Bought out material is matching with the approved sample.

9.00.00 **Architectural Concepts and Design**

9.01.00 For Architectural Concepts and Design refer to 5.00.01 in this specification.

9.02.00 **General Architectural Specifications**

9.02.01 **General**

a) Minimum 1000 mm high (from floor/ roof level) hand railing shall be provided around all floor/roof openings, projections/balconies, walkways, platforms, steel stairs, etc., wherever the height of the building is more than 12m, railing ht to be 1.2m. All handrails and ladder pipes (except at operating floors) shall be 32 mm nominal bore MS pipes (medium class) conforming to IS:1161 and shall be galvanised as per IS : 4736 and finished with suitable paint. All rungs and ladders shall also be galvanised. Minimum weight of galvanising shall be 610 g/sqm. The spacing of vertical posts shall be maximum 1500mm. Two number of horizontal rails shall be provided including the top member. In addition, toe guard/ kick plate of min size 100x6th shall be provided above the floor level.

In Service Building, Administrative Building, Plant Auditorium and Canteen Building RCC stairs and passages/ corridors hand railing with posts shall be made of stainless steel and be 1200mm high. For Atrium areas, same shall be provided with 10mm thick laminated Glass infill panels.

For RCC stairs, passages & Atriums in buildings, around all floor openings at operating floors, 1000 mm /1200mm high hand railing with 32 NB (polished) stainless steel pipe shall be provided. The spacing of vertical posts shall be 1500mm. Two number of horizontal rails shall be provided including the top member.Toe guard and kick plate shall be provided above the floor level.

b) All stairs shall have a maximum riser height of 180mm and a minimum tread width of 275 mm. Minimum clear width of stair shall be 1200 mm unless specified otherwise. For Administration Building& Service Building, stairs width shall be minimum 1500 mm, with Riser 150mm and Tread 300 mm.

c) All buildings having metal cladding shall be provided with a 150 mm high RCC toe kerb at the edge of the floor along the metal cladding. 1000 mm high hand railing shall be provided on this RCC kerb, wherever required from the safety point of view.

d) In all buildings, structures, suitable arrangement for draining out water collected from equipment blowdowns, leakages, floor washings, fire fighting, etc., shall be provided for each floor. All the drains shall be suitably covered with grating or precast RCC panels.

e) RCC staircase shall be provided for main entrance of Turbine building; control tower area and all other RCC construction buildings.

f) Parapet, Chajjas 450mm over window and 600mm door heads, 900mm over rolling shutters, architectural facias, projections, etc., shall be provided with drip course in cement sand mortar 1:3.

g) All fire exits shall be painted with fire resistant paint P.O red/signal red colour shade which shall not be used anywhere except to indicate emergency or safety measure. Fire safety norms shall be followed as per National Building Codes and fire safety requirements for providing fire exits, escape stairs and fire fighting equipment. In

detailing of all buildings, fire safety requirements conforming to IS: 1641 and IS:1642 shall be followed.

h) Ramps & Lifts for physically challenged persons shall be provided for barrier free access to the buildings.

9.03.00 **Water Supply and Sanitation**

9.03.01 Two numbers of roof water tanks (one for storing service water and another for potable water) of adequate capacities depending on the number of users and 8 hours requirement shall be provided for each building and pump house. Polyethylene water storage tanks conforming to IS:12701 shall be used. The tanks shall be complete with all fittings including lid, float valve, stop cock, vent pipe, etc.

Galvanised MS pipe of medium class conforming to IS: 1239 shall be used for internal piping works for service water and potable water supply. The pipes shall be concealed, and painted with anti-corrosive bituminous paint (as per IS: 158) wherever required.

Sand Cast Iron pipes with lead joints conforming to IS: 1729 shall be used for sanitary works above ground level. All Buildings shall be designed with Toilets as per NBC norms.

Minimum one number main toilet block for Gents & Ladies separately, with required facilities shall be provided on each floor of Service building, Administration building and Canteen building. Toilets for physically handicapped shall be provided as mentioned. Attached toilets shall be provided for all senior executive rooms and conference rooms. All other buildings shall have minimum one toilet block each. The facilities provided in the toilet block shall depend on the number of users. However, minimum facilities to be provided shall be as stipulated in subsequent clause. IS:1172 shall be followed for working out the basic requirements for water supply, drainage and sanitation. In addition, IS:2064 and IS:2065 shall also be followed.

9.03.02 Each Toilet block shall have the following minimum facilities. Unless specified all the fittings shall be of Chromium plated brass (fancy type). For GRIHA rated Buildings all fittings shall conform to GRIHA requirements, for water efficiency.

a) One number wall mounted coloured (excluding premium colours) glazed vitreous China European water closet and flushing valve system, water faucet, toilet paper holder as per IS:2556

b) One number white glazed vitreous China Orissa pan (580 x 440 mm) and flushing valve system, toilet paper holder as per IS:2256

c) One number colour (excluding premium colours) glazed ceramic oval shaped wash basin 450x 550 mm (approx.) mounted over 18mm thick granite beveled edge counter fitted with photo-voltaic control system for water controls, bottle trap as per IS:2556. For common toilets, number of washbasins shall be as per requirement. However for Pump Houses the same shall be provided without photo voltaic control system for water control.

d) For Male Toilets Urinal as per requirements, with all fittings with photovoltaic control flushing system as per IS:2556.

e) One number looking mirror 600 x 900 x 6 mm, edge mounted with teak beading and minimum 12 mm thick plywood backing, one number stainless towel rail 600 x 20 mm, one number liquid soap dispenser

f) One toilet with required facilities shall be provided for physically challenged persons as per National Building Code requirements

g) In addition to the facilities stipulated elsewhere Bathroom with rotating type chromium plated shower including all fitting and fixtures shall also be provided in toilet at ground and operating floor of main plant:

h) Janitor Space & space for drinking water cooler.

i) Electric operated hand dryer with photo voltaic control.

j) The pantry shall consist of one number stainless steel pantry sink, as per IS : 13983, of size 610 x 510 mm, bowl depth 200 mm with drain board of at least 450 mm length with trap, hot and cold water mixer, one number geyser of 25 liters capacity, with inlet and outlet connections, one number HDPE loft type / over head water storage tank, as per IS : 12701 and of 500 liters capacity, complete with float valve, overflow drainage pipe arrangement, GI concealed water supply pipe of minimum 12 mm dia of medium class, cast iron sanitary pipe (with lead joints) of minimum 75 mm diameter, floor trap with Stainless

Steel grating, inlet and outlet connections for supply and drainage, with all bends, tees, junctions, sockets, etc., as are necessary for the commissioning and efficient functioning of the pantry (all sanitary fittings shall be heavy duty chrome plated brass, unless noted otherwise)

k) Laboratory sink shall be of white vitreous china of size 600x400x200 mm conforming to IS:2556 (Part-5).

l) In addition, adequate number of portable toilet units with adequate plumbing and sanitary arrangement, shall be provided during construction stage.

9.04.00 **Flooring**

Floor finishes of approved shade and colour (non - premium colours), over under bed of cement mortar / concrete, at all levels and for all kind of works, elevations, on horizontal and vertical surfaces for all types of work (like flooring, skirting, dado, wall lining & facing, tread and risers etc., including topping, spreading white cement slurry at an average rate of 2.5 kg/Sq. M. (unless noted otherwise), jointing and joint filling with white cement (unless noted otherwise) slurry mixed with colour pigment, to match the shade of the finishing material, laying to plumb and water level in desired pattern, line and flush butt square jointing, curing, rubbing, grinding, polishing, edge moulding, finishing and cleaning, testing, providing opening of required size and shape, casting in panels wherever specified.

9.04.01 The nominal total thickness of floor finish shall be 50 mm i.e. underbed and topping. The floor shall be laid on an already laid and matured concrete base. The underbed for floors and similar horizontal surfaces shall consist of cement concrete M20 grade. Stone chips shall be 12.5 mm down well graded(& proper filling shall be done with brick bats/cinders). Flooring like Tiles/ Stones shall be laid with 1:4 cement sand mortar and Tile/ Stone Cladding on wall shall be laid with 1:3 cement sand mortar.

9.04.02 Sunken slabs shall be made water tight by suitable water proofing treatment.

9.04.03 Metallic hardener topping -with ordinary grey cement shall be- 12 mm thick (insitu) or finishing the concrete / mortar surfaces topping shall be furnished with neat cement slurry (with ordinary grey cement)

9.04.04 Heavy duty cement concrete tiles 300 mm x 300 mm shall be in using white cement with pigment, with hard and abrasion resistant carborundum / quartz chips for wearing course as per IS:1237. Laying of tiles shall be as per IS:1443.

9.04.05 Heavy duty (grade-5) dust pressed ceramic tiles (300mmx300mm shall be as per IS 15622. Designer ceramic wall tiles of size 300 mm x 200 mm / (300x600mm).

9.04.06 20mm / 38mm / 75 mm/ 115mm thick acid resistant tile on horizontal and vertical surfaces, at all levels for all type of works shall include one coat of bitumen primer followed by 12 mm thick bituminastic layer, 20mm / 38mm/ 75 mm / 115mm thick A.R. tiles, 6 mm thick under-bed by potassium silicate mortar, pointing of joints of tiles with acid/alkali resistant epoxy/furane mortar up to a depth of 20 mm and bituminastic end sealing.

9.04.07 Mirror polished/ Matt finish (80:20) Vitrified ceramic tiles (min 8.5mm thk) with 3mm groove joints as per approved pattern pointed neatly with 3X4mm stainless epoxy grout SP- 100 of Laticrete or approved equivalent in approved colour to match colour of tile. Sizes of the tiles shall be as under:

a) 600 mm x 600 mm

b) 800mm x 800mm

9.04.08 For pathway, chequered and designed concrete tiles minimum 22 mm thick, 200x200 mm size conforming to IS: 13801 of approved shade and colour shall be used. 1000 wide pathways shall be provided for maintenance on rooftops of all buildings.

9.04.09 PVC flooring, wherever used, shall be minimum 2 mm thick (virgin) as per IS: 3462. The laying of flooring shall be as per IS: 5318.

9.04.10 **Epoxy Flooring**

Epoxy Flooring shall be provided with surface preparation of concrete substrate with Captive Shot Blasting Machine OR Light Grinding to form the required anchor profile on the floor substrate followed by application of epoxy resin based moisture barrier underlay of 2 mm thickness including filling of saw cut joints with epoxy cementitious resin based moisture barrier underlay as per manufacturer specification. Application of self smoothing epoxy floor topping of epoxy based resin of 2 mm thickness over epoxy resin based moisture barrier underlay including application of solvent free epoxy resin based two component primer.

It shall include application of PU Sealant at Expansion and Isolation Joint respectively including surface preparation of the joint, fixing of backup strip and application of sealant.

9.04.11 Wherever required, carpet flooring shall be provided over cement concrete floor as in conference room of main control room complex. The carpet shall be of tile/roll form, machine/hand made tupled un-cut loop pile and lay with under lay of 10mm thick and shall be laid as per manufacturer's recommendations, in matching grains. It shall be treated with anti fungus and anti-termite before laying.

9.04.12 Mirror polished (6 layers of polish) Granite stone (slab) - 18 mm Thk (minimum) / Flame finish (making top surface rough by burning / shot blasting) granite stone (slab) - 18 mm Thk (minimum) shall be provided.

9.04.13 Mirror polished Marble stone (slab) - (Rajnagar) Plain white -18 mm thick shall be provided in main stairs & 18mm thick kota stone shall be provided in the fire escape stairs.

9.04.14 Decorative/designer prepolished, plain and pigmented, high wearing resistance concrete tiles of 20mm thickness (minimum) in various non-standard interlocking patterns.

9.04.15 Skirting in general shall be 150 mm high. Dado in toilets & pantries, shall be upto 2200 mm height from finished floor level. Skirting and Dado shall match with the floor finish.

9.04.16 Wherever required, removable metallic false flooring system shall be provided. Nominal height of the false flooring shall be 600 mm. The same shall comprise of special grade steel panels (of size 600x600mm). without any dimensional tolerance 1.2mm thick die cast to shape having 1mm thick top MS sheet spot welded together to form a composite steel panel, sitting on aluminum diecasted heads & mounted on steel pedestals of 25mm dia rod of adjustable height and supporting 1.2mm thick channel frame work at-top and 2mm thick 150x150mm base plate. The top finish shall be 2mm thick antistatic PVC sheet or High pressures laminate. Cavity area below the false flooring shall be made dust proof by using Polyurethane paint.

9.04.17 Interlocking concrete blocks shall be of various sizes and thickness having M 35 grade of concrete and pigmented to specified colours, in different pattern (in different textures chequered or other patterns in indentation for guiding band/s for visually impaired persons) including the preparation of sub base with 20mm thick sand and filling of joints with sand.

9.04.18 Matt finish (with grooves) Porselin tiles (for guiding band/s for visually impaired persons) shall be with 3mm groove joints as per approved pattern pointed neatly with 3X4mm stainless epoxy grout SP- 100 of Laticrete or approved equivalent in approved colour to match colour of tile.

24 mm x 24 mm x 3.8 mm thick (minimum) glass mosaic tiles in decorative murals and pattern.

Laminated wooden flooring shall be provided in VIP area, conference rooms & auditoriums.

9.04.19 **Paving**

a) Ground floor of all buildings shall be provided with normal duty paving with 50mm thick metallic hardener floor finish. For details of normal duty paving refer to description elsewhere in this specification.

b) PCC paving of nominal mix 1:2:4 (1 part cement: 2 parts sand: 4 parts aggregate), 100 mm thick laid over 75 mm thick bed of dry brick aggregate shall be provided for following areas:

i) 750 mm wide plinth protection around all buildings other than those covered under paved area.

ii) 2.0 m wide pathway all along pipe/ cable corridor and all around each cooling tower. 2.0 mm wide ways inter connecting all cooling towers with each other.

9.05.00 **Acid/ Alkali Resistant Lining**

9.05.01 The material shall conform to the following:

i) Bitumen primer shall conform to IS: 158.

ii) Bitumastic compound shall conform to IS: 9510. Where the height of bitumastic layer on vertical surface is more than 2.0 m, the bitumastic layer shall be reinforced with diamond pattern expanded metal steel sheets conforming to IS: 412.

iii) A.R. Bricks/ Tiles shall conform to class II of IS: 4860 & IS: 4457 respectively.

iv) Mortar: Potassium silicate & resin type mortars shall conform to IS: 4832 Part-I&II respectively.

9.05.02 Requirements for acid/ alkali resistant flooring and lining for different areas shall be as given Table-A enclosed at the end of this specification. Battery Room in all buildings shall be provided with acid/ alkali resistant tiles on flooring & dado 1200mm high.

9.06.00 **Roof**

9.06.01 Except for the roofs subjected to heavy loads, roof of all buildings having structural steel frame work shall consist of permanently colour coated (on exposed face) troughed metal sheet decking of approved profile having minimum base metal thickness of 0.8mm of galvanised (with minimum rate of galvanisation of 275 gm/sq.m.) M.S. sheet or minimum 0.8mm of high tensile steel (minimum yield strength 350 MPa) coated with zinc aluminium alloy (zincalume) (coating not less than 150 gm./sq.m.). Silicon modified polyester paint having DFT of minimum 20 microns shall be used for permanent coating. The sheeting shall be fixed by means of concealed fixing system or any other compatible method approved by the Engineer. RCC slab of minimum 40 mm clear thickness in excess of trough depth shall be provided over the metal decking. Water proofing cum plasticiser compound shall be added to concrete over the metal decking. Bidder shall demonstrate that the roof is leak proof by carrying out the water-retaining test by maintaining the minimum water depth of 50mm over the roof surface for a period of 48 hours. Water Proofing Treatment as given below for RCC roof slabs shall be provided to ensure that the roof is watertight.

9.06.02 Roof of all buildings having RCC framework shall have cast-in-situ RCC slab. Such roof shall be provided with roof water proofing treatment using high solid content liquid applied elastomeric water proofing membrane with separate wearing course as per ASTM - C-836 & 898. Thickness of the membrane shall be 1.5mm (min.). This treatment shall include application of polymerised mastic over the roof to achieve smooth surface and primer coat. Wearing course on the top of membrane shall consist of 25mm thick PCC (1:2:4) cast in panels of maximum 1.2m x 1.2m size and reinforced with 0.56mm dia galvanised chicken wire mesh and sealing of joints using sealing compound/elastomeric water proofing membrane. However, chequered concrete tile flooring 22 mm (min.) thick of approved colour and shade conforming to IS: 13801 shall be provided for path way of 1 m. width for access of personnel and handling of equipment and for the entire area of the roof where equipment like AC / Ventilation plant, cooling towers, etc. are provided in place of PCC wearing course. Equipment shall be installed on raised pedestal of minimum 30 cm height from the finished roof to facilitate maintenance of roof treatment in future.

9.06.03 For efficient disposal of rainwater, the run off gradient for the roof shall not be less than 1:100 and the roof shall be provided with RCC water gutter, wherever required. Gutter shall be made water tight using suitable watertight treatment. This gradient can be provided either in structure or subsequently by screed concrete 1:2:4 (using 12.5 mm coarse aggregate) and/or cement mortar (1:4). However, minimum 25 mm thick cement mortar (1:4) shall be provided on top to achieve smooth surface.

9.06.04 For Building where metal cladding is envisaged medium class galvanised mild steel pipes conforming to IS: 1239/IS:3589 with welded joints shall be provided to drain off rain water from the roof. For rest of the buildings cast-iron pipes with lead caulked joints conforming to IS:1230 shall be used. These shall be suitably concealed with masonry work, cement

concrete / or sheeting work to match with the exterior finish. The number and size of down comers shall be governed by IS:1742 and IS:2527. Roof drain level of all RCC framed buildings having cast-in-situ RCC roof shall be provided with Rain water gutter and/or 45 x 45 cm size Khurras having minimum thickness of 30 mm with 1:2:4 concrete over PVC sheet of 1 m x 1 m x 400 micron and finished with 12 mm thick cement sand plaster 1:3. All the pipes shall be provided with suitable fittings and fixtures. Gratings shall be of stainless steel.

9.06.05 Roof of the buildings that shall conform to minimum 4 star GRIHA Rating shall have over deck insulation with minimum 75 mm thick Extruded Polyurethane foam with minimum density 18 kg/Cu.m. above water proofing with mortar and Joints sealed with adhesive tape over roof and above it White glazed tile chips shall be provided for roofing over under bed of cement mortar/concrete including all workmanship, topping spreading white cement slurry at an average rate of 2.5 kg/sq m(unless noted otherwise)jointing and joint filling with white cement slurry (unless noted otherwise) ,laying to plumb and water level in desired pattern ,casting in panels .

9.06.06 **Roof Water Proofing**

Roof water proofing treatment shall be as follows:

a) For roofs having structural slope:

Top surface of sloped R.C.C. slab shall be finished with 15mm thick cement plaster (1:4). Over the finished surface elastomeric membrane shall be laid. The elastomeric shall comprise of high solid content liquid applied urethane laid over reinforcing layer of polyscrim cloth or non woven geo-textile. The top of the elastomeric membrane shall be finished with 20 mm thick cement: sand (1:4) mortar with chicken wire mesh and pressed precast concrete tiles of 20 mm thickness where applicable shall be laid over mortar at green stage. Provision for thermal expansion of roofing tiles shall be kept by providing an expansion gap in both directions filled up with polysulphide joint sealant. The expansion gap shall be provided in the cement sand mortar underbed layer also.

b) For roofs having no structural slope:

Screed concrete mix (1:2:4) grading having minimum 25mm thickness at the lowest point of the slope shall be laid over R.C.C. slab and shall be laid as per the slope specified elsewhere in the specification. Top surface of grading underbed shall be finished with 15mm thick cement plaster (1:4). Over the finished surface elastomeric membrane shall be laid and top of the elastomeric membrane shall be finished with 20 mm thick cement: sand (1:4) mortar with chicken wire mesh and pressed precast concrete tiles of 20 mm thickness where applicable shall be laid over mortar at green stage. Provision for thermal expansion of roofing tiles shall be kept by providing an expansion gap in both directions filled up with polysulphide joint sealant. The expansion gap shall be provided in the cement sand mortar underbed layer also

9.06.07 Roof of all buildings shall be provided with access/approach through staircase or ladder. Roof where equipment are mounted shall be provided with access through staircase.

9.06.08 RCC parapet wall of minimum 1000 mm height (above top of slab) for all accessible roofs and 600 mm height for all non-accessible roofs shall be provided. Alternatively parapet wall comprising structural steel post, runner and sheeting may be provided for buildings with metal sheet cladding.

9.06.09 Fillets at junction of roof and vertical walls shall be provided with cast-in-situ cement concrete (1:1.5:3) nominal mix followed by 12mm thick 1:4 cement sand plaster.

9.06.10	Pathways for handling of materials and movement of personnels shall be provided with 22mm thick chequered cement concrete tiles as per IS:13801 for a width of 1000mm .
9.07.00	**Walls**
9.07.01	All walls shall be non-load bearing infill panel walls.
9.07.02	For initial height up to 3 metres from ground floor one brick thick masonry wall shall be provided wherever metal cladding is specified.
9.07.03	All internal walls shall be with one brick thick in cement mortar (1:6). However, internal partition walls for toilets shall be with half brick masonry thick with cement mortar (1:4).
9.07.04	For Administration building, Service Building, Auditorium Building and Canteen Building Autoclaved Aerated Concrete blocks shall be used. Autoclaved Aerated Concrete (AAC) block masonry shall be with blocks having dimensions of 625 mm x 250 mm. thickness ranging from 100 mm to 300 mm conforming to I.S. :2185(part-III) .The jointing cement sand mortar in the composition of 1: 6 (Cement: sand) shall be used with suitable plasticizer(optional). Sand having modulus of fineness 1.1 shall be used. The horizontal and vertical joint thickness shall be approximately 10 mm. In case of partition walls (100 mm /125 mm thk.) the joint reinforcement i.e. 1 number of 6-8 mm diameter bars shall be placed at every alternate course to be anchored properly with the main structure. All other structural requirements like stiffening of masonry , joint reinforcement etc. in the AAC masonry work strictly be carried out as per instructions laid down in .I.S 6041 – 1985, I.S -1905.
9.07.05	For control room , control equipment room and ESP building wall shall be of factory made composite modular light weight aerated concrete panels,(minimum 4 hours of fire rating) consisting of 2 fiber reinforced cement sheets (minimum 4 mm thick) on either side of light weight concrete core, having minimum compressive strength of 35 Kg / Cm2 and the density in the range of 700-900 Kg. / cu.m. of the thickness and fire rating as specified below, to provide external wall and internal partition at all levels, capable of sustaining wind pressure of 4.50 M height (H) within limiting deflection of span/250, fixed in position in tongue and groove jointing system by screwing the panels to top and bottom U channels, (channels minimum 1.25 mm thick and galvanised to grade 180 (minimum) as per IS : 277), fixing U profiled top and bottom channels to concrete / primary steel members which are placed at the maximum vertical spacing of 4.5m with the help of galvanised steel expansion fasteners, filling the joints from both faces with silicon acrylic paste and making the same water tight by covering with fibre glass tape (minimum 50 mm wide and minimum 0.5 mm thick) or by any other suitable material, so as to ensure that the entire construction done with the light weight aerated concrete panels are weather proof and panel surfaces are flush for painting, creating opening for doors / windows /ventilators / ducts / pipes/fans/AC etc. and finishing the opening face with the same U profiled galvanized steel channel which is used at the top and bottom.
9.07.06	For Main plant building, Control tower and other buildings, the type, thickness and initial height of external cladding facing the transformer yard shall be according to the requirements. External face of Toilets, Air-conditioned and pressurised areas shall be provided with masonry wall as per functional / aesthetic requirements. (Inside the metal cladding wherever provided).
9.07.07	50 mm thick DPC in Cement concrete (1:1.5:3) with water proofing compound followed by two layers of bitumen coating 85/25 grade as per IS:702 @ 1.7 kg./sq.m. shall be provided at plinth level before starting the masonry work.

9.08.00

Colour coated and other sheeting work

Permanently colour coated sheet of approved shade and colour using galvanised mild steel sheet of minimum 0.6mm BMT(bare metal thickness i.e. metal thickness excluding thickness for coating and galvanizing) galvanised to grade 275 as per IS 277,of minimum yield strength of grade SS255 as per ASTM A653M / grade G250 as per AS 1397, coated with zinc of class designation Z275 or high tensile steel of minimum 0.5mm BMT(bare metal thickness i.e. metal thickness excluding thickness for zinc aluminium coating and colour coating) of grade SS340-Class 4 as per ASTM A792M / grade G350 as per AS 1397, coated with aluminium zinc alloy of class designation AZ150.

For profiled colour coated metal deck sheet, minimum 0.8 mm BMT (bare metal thickness i.e. metal thickness excluding thickness for coating and galvanizing) of grade SS255 as per ASTM A653M / grade G250 as per AS 1397, coated with zinc of class designation Z275, troughed profile having nominal trough depth 44 mm and pitching of 130 mm shall be used. However alternative profile meeting the strength, defection and other functional requirements such as sections modulus and moment of inertia shall be provided. To minimize the number of joints, the length of the sheet shall preferably be not less than 4.5m, cut pieces shall not be used, unless specifically approved by the Engineer. However, the actual length shall be such so as to suit the purling / runner spacing.

Steel shall be colour coated with total coating thickness of 35 microns (nominal) comprising of silicon modified polyester (SMP with silicon content of 30% to 50%) paint or Super Polyester paint, of minimum 20 microns (nominal) dry film thickness (DFT) on external face on 5 microns (nominal) primer coat and 5 microns (nominal) SMP or super polyester paint over 5 microns (nominal) primer coat on internal face. SMP and Super polyester paint systems shall be of industrial finish of product type 3 of AS2728. Coated surface shall be provided with a protected guard film (polyethylene) of about 40 microns to avoid any damage to the coating during handling.

No negative tolerance shall be allowed in bare metal thickness.

For wall cladding insulated / uninsulated and conveyor gallery sides and roof, permanently colour coated sheet of troughed profile shall be used. The nominal depth of trough shall be 30 mm.

Sheet shall be of approved profile, sectional properties, colour and shade.

For profiled metal decking sheets (to be used for RCC floor slab) the sectional modulus and moment of inertia of troughed profile per meter width shall be so as to limit the deflection of sheets to span/250 under total super imposed loading (DL +LL) comprising the self weight of metal deck sheet, dead weight of green concrete and an additional construction load 100kg per sqm for two span condition. The sectional modulus and moment of inertia of troughed profile shall be computed as per the provisions of IS:801 for satisfying the deflection and strength requirements.

For metal deck sheets used for RCC roofing and side cladding, the sectional modulus and moment of inertia of troughed profile per metre width shall be such that the deflection of sheets is limited to span/250 under design wind pressure for two span condition. The sectional modulus and moment of inertia of troughed profile shall be computed as per the provisions of IS:801 for satisfying the deflection and strength requirements. No increase in allowable stress is permissible under wind load condition.

The maximum spacing of the fasteners shall preferably be 390 mm c/c along the length of purlins/runners. However exact spacing shall be as per the design done by the bidder for the

fasteners considering the wind load, self load and other associated loads. Minimum diameter of the fastener shall be 5.5 mm and atleast 3 nos. of fasteners shall be used per sheet.

Z spacers if required shall be made of at least 2 mm thick galvanised steel sheet of grade 275 as per IS : 277

Sealant used for cladding shall be butyl based, two parts poly sulphide or equivalent approved, non stainless material and be flexible enough not to interface with fit of the sheets

.

Filler blocks as a trough filler shall be used to seal cavities formed between the profiled sheet and the support or flashing. The filler blocks shall be manufactured from black synthetic rubber or any other material approved by the Engineer.

For insulation of cladding and other areas, mineral wool conforming to IS : 8183 shall be used. The density shall be 32 or 48 kg. /Cu.M. for glass or rock wool respectively. The nominal thickness of insulation shall be 50mm.

The polycarbonate sheet to be used for cladding and glazing purpose in conveyor galleries shall have toughed profile to match with the metal cladding profile. Minimum 2.0mm thick fire retardant and UV resistant polycarbonate clean sheet of GE plastic or equivalent approved make shall be used. The polycarbonate sheet shall be installed along with the metal cladding so as to have a watertight lapping arrangement. Suitable detailing shall be made to cater for the thermal expansion. IS : 14434 to be referred for other details.

Polycarbonate sheet minimum 2mm thick fire retardant impact resistant and ultraviolet resistant sheet shall be provided (as glazing) in transfer houses, pump houses, etc.

All flashings, trim closures, caps etc. required for the metal cladding system shall be made out of plain sheets having same material and any weather/moisture sealnts with appropriate material and coating specification as mentioned above for the outer face of the sandwiched metal cladding. Overlap shall be min. 100 mm or as specified by manufacturer.

For buildings where insulated sandwiched double metal sheets shall be used for Roof. The sandwich sheet combination shall comprise top sheet as troughed permanently colour coated sheet & bottom sheet as plain permanently colour coated for covering of exposed metal/ concrete / brick surfaces with 50mm thick insulation sandwiched between the two sheets, each sheet shall be of steel with zinc coated to class 275 with minimum bare metal thickness (i.e. excluding the thickness of coating and painting) of 0.6mm of grade G250 as per AS1397 / grade SS255 as per ASTM A653M / grade S250GD as per EN 10326 or of steel with aluminium-zinc alloy coated to class AZ150 with minimum bare metal thickness (i.e. excluding the thickness of coating and painting) of 0.5mm of grade G350 as per AS1397 / grade SS340 class 4 as per ASTM A792M / grade S350GD as per EN 10326 or of steel with aluminium-zinc alloy coated to class AZ150 with minimum bare metal thickness (i.e. excluding the thickness of coating and painting) of 0.4mm of grade G550 as per AS1397 / grade SS550 as per ASTM A792M / grade S550GD as per EN 10326 or alternatively aluminium feed material of minimum bare metal thickness of 0.7 mm of aluminium alloy of Series 31000 and above as per IS:737 and IS:1254, steel / aluminium both colour coated with total coating thickness of 35 microns (nominal) dry film thickness (DFT) comprising of Silicon Modified Polyester (SMP with silicon content of 30% to 50%) paint or Polyester paint, of 20 microns (nominal) SMP or polyester paint on one side (exposed face), over 5 micron (nominal) primer coat and 5 micron (nominal) SMP or Polyester paint over 5 micron (nominal) primer coat on other side (SMP and Super Polyester paint shall conform to product type 4 of AS/NZS 2728), troughed sheet shall be of approved profile, sectional properties, (suitable for the specified loading / deflection and purlins / runner spacing), colour and shade, at all levels, including all labour, materials, equipment, handling, transportation, special coated fastener conforming to corrosion resistant Class 3 of AS3566 and tested for 1000 hours salt spray

	test, fixing insulated sandwiched metal sheeting assembly with the structural members below for supporting the sheeting system, scaffolding, equipment, end and side laps, cutting of openings, preparation of working drawings, testing, etc., all complete, as per specifications
9.09.00	**Plastering**
9.09.01	Outer face (i.e. rough side) of all brick walls shall have 18 mm thick and inner face (i.e. smooth side) of all walls shall have 12 mm thick cement sand plaster 1:6.
9.09.02	Plaster of paris (Gypsum Anhydrous) conforming to IS:2547 shall be used for plaster of paris punning over cement plastered surfaces. The finish surface shall be smooth and shall be of 2 mm nominal thickness.
9.09.03	All R.C.C. walls shall have minimum 12mm thick cement sand plaster 1:6.
9.09.04	All RCC ceilings (except areas provided with false ceiling, cable vault ceiling and metal decking) shall be provided with 6mm thick cement sand plaster 1:4.
9.09.05	Groove of uniform size 12 x 12 mm up to 20 x 15 mm in plastered surface as per approved pattern, shall be provided as per approved drawing.
9.09.06	All plastering work shall conform to IS:1661.
9.10.00	**Painting & Aluminium Composite Panel Cladding**
9.10.01	All painting on masonry or concrete surface shall preferably be applied by roller. If applied by brush then same shall be finished off with roller.
9.10.02	All paints shall be of approved make including chemical resistant paint.
9.10.03	Minimum 2 finishing coats of paint shall be applied over a coat of primer.
9.10.04	Solvent based (100% pure acrylic co-polymer resin based) paint shall not contain any water sensitive ingredients. Paint shall be applied in two or more coats as required on an under coat of suitable primer or one coat of cement paint on the new plastered surfaces inclusive of required tools, material and other painting accessories etc. The paint is to be applied as per the specifications, instructions and satisfaction of Engineer-in-charge.
9.10.05	Stone work for wall lining etc. (Veneer work) over 20 mm thick bed of cement mortar 1:3 (1 cement: 3 coarse sand) and jointed with grey cement slurry @3.3kg/sq.m, including rubbing and polishing in complete. (Black polished granite stone slab, 18 mm thk / polished Sadarhally grey granite slab 18 mm thk). The final, finished coating shall be fungus resistant, UV resistant, water repellant, alkali resistant, and extremely durable with colour fastness.
9.10.06	Acrylic emulsion paint shall be as per IS:15489. Acrylic distemper shall be as per IS:428. Cement paint shall conform to IS:5410, white wash/colour wash shall conform to IS:627.
9.10.07	Fire resistant transparent paint as per IS:162 shall be provided on all wood work over French polish or flat oil paint. French polish shall conform to IS:348. Flat oil paint shall conform to IS:137.
9.10.08	All fire exits shall be painted in post office red/signal red colour shade, which shall not be used anywhere else except to indicate emergency or safety measure.

9.10.09 For painting on concrete, masonry and plastered surface IS:2395 shall be followed. For painting on wood work IS:2338 shall be followed.

9.10.10 For painting on steel work and ferrous metals, BS: 5493 and IS:1477 shall be followed. The type of surface preparation, thickness and type of primer, intermediate and finishing paint shall be according to the painting system adopted.

9.10.11 Bitumen primer used in acid/alkali resistant treatment shall conform to IS:158.

9.10.12 All internal paints shall be of low VOC content conforming to GRIHA rating for reduction of VOC content.

9.10.13 Resin bonded granular textured finish, for external applications shall consist of crushed stone / quartz chips of 2.5 mm size and of approved colour/ shade and bonded with synthetic resins, Adhesives and additives, all together in a single pack mix. For internal finish 1.2mm of approved, colour & shade (pigmented granular or flake finish)

The final finish shall have UV-Resistant, fungus/bacterial resistant properties.

Grooves shall be provided as per drawing and the same shall be filled with polysulphide sealant of matching colour/shade.

9.10.14 **Aluminium Composite Panel**

Aluminum Composite Panels for external wall cladding at all heights and elevation shall be fixed on to the supporting steel members, masonry wall, fastening material and hardware complete with all labour, material, equipment, handling, transportation, workmanship, preparation of working drawings, staging, scaffolding, etc., all complete. The aluminum composite panel should consist of 3mm thick thermoplastic core of anti oxidant LDPE sandwiched between 2 skins of 0.5mm thick aluminum alloy sheet making a total panel thickness of 4mm. The surface shall be finished with PVDF based coating of minimum 30 micron on the topsides and service coating on the reverse side shall be with polymer paint. Coating shall conform to ECCA or AAMA.the surface shall be protected with self adhesive peel of masking foil. The system shall be designed to withstand a wind pressure of 200kg/Sqm and shall be fixed to he Masonry/RC walls with necessary clamps, brackets and anchor fasteners. All clamps and brackets shall be Hot dip galvanized minimum 80 microns thick and shall conform to IS: 4759-1996. The extruded aluminum section shall be anodized in approved colour with a anodic coating of minimum 20 microns. Extruded section shall be 6063 T5 or T6 alloy conforming to ASTM B221. Any other festering straps, nuts, bolts, rivets, washers, etc. shall be in stainless steel SS304 grade. EPDM gaskets, open cell polyethylene backer rods, weather sealant etc. shall be provided as per requirement.

Aluminium Composite Panel for internal encasement shall be with II B fire rated LDPE core mixed with mineral fibre.

9.10.15 **Solvent Based Exterior Paint**

The paint should be applied in minimum three coats as required on an undercoat of suitable primer or one coat of cement paint on new cement plastered surfaces inclusive of required tools, materials, scaffolding and other painting accessories etc. The paint shall be applied as per manufacturer's specifications and instructions and to the entire satisfaction of engineer-in-charge. The paint shall be solvent based (resin based). The coating shall be resistant to alkali, acids, & mould growth. The paint shall not contain any water sensitive ingredients. it shall have excellent water resistance property. All loose & flaking materials shall removed. All cracks and structural defects shall be made good. All surfaces must be dry and free from mould, algae & grease. If there is evidence of organic growth, vigorous cleaning shall be

done either manually or mechanically which is essential. the surface shall be sterilized with bleaching powder solution and rinsed with water after twenty four hours.

9.11.00 **Doors & Windows**

9.11.01 Doors, windows and ventilators of air-conditioned areas, entrance lobby of all buildings (where ever provided), and all windows and ventilators of all buildings (unless otherwise mentioned) shall have, electro colour dyed (anodised with 15 micron coating thickness) aluminium framework with glazing. All doors of toilet areas shall be of steel framed solid core flush shutter. For Mill Bunker Building, transfer points, crusher house, conveyor gallery, steel louvered windows shall be provided.

9.11.02 Main entrance of the common control room and control equipment room shall be provided with air-locked lobby with provision of double doors of aluminium framework with glazing. Doors shall be of double action floor springs mounted.

9.11.03 For common control building, double glazed wall panels with 24mm thick hermetically sealed toughened , fire resistant glass with aluminium frame shall be provided between air-conditioned and non air-conditioned areas and on the side of common control room and control equipment room(s) to have a clear view. One glass on external side of control room shall be tinted one. Internal partition in control room shall be with 10mm thick toughened fire resistant Glass.

9.11.04 Single glazed panels with aluminium framework shall be provided as partition between two air-conditioned areas wherever clear view is necessary.

9.11.05 a) The doors frames shall be fabricated from 1.6 mm thick MS sheets and shall meet the general requirements of IS:4351.

b) All steel doors shall consist of double plate flush door shutters. The door shutter shall be 35 mm (min.) thick with two outer sheets of 1.2 mm rigidly connected with continuous vertical 1.0 mm stiffeners at the rate of 150 mm centre to centre. Side, top and bottom edges of shutters shall be reinforced by continuous pressed steel channel with minimum 1.2 mm. The door shall be sound deadened by filling the inside void with mineral wool. Doors shall be complete with all hardware and fixtures like door closer, tower bolts, handles, stoppers, aldrops, locks etc.

9.11.06 Steel windows and ventilators shall be as per IS:1361 and IS:1038.

9.11.07 Wherever functionally required Rolling shutter (fully closed/partly grilled) with suitable operating arrangement (manual/Electric) shall be provided to facilitate smooth operations. Rolling shutters shall conform to IS:6248. M.S sliding doors with suitable mechanical and electrical operations fixtures as per requirement for bigger openings shall be used.

9.11.08 All windows and ventilators on ground floor of all buildings shall be provided with suitable Aluminium grill.

9.11.09 Fire-Proof doors with panic devices shall be provided at all fire exit points as per requirements. These doors shall generally be as per IS:3614 Part-II. Fire rating of the doors shall be of minimum 2 hours. These doors shall be double cover plated type with mineral wool/wood insulation.

9.11.10 Hollow extruded section of minimum 2 mm wall thickness as per IS:1285 shall be used for all aluminium doors, windows and ventilators.

9.11.11	Minimum size of door provided shall be 2.1 m high and 1.2 m wide. However for toilets minimum width shall be 0.75 m and office areas minimum width shall be 1.20m.
9.11.12	Electrically operated, self operable/closing, aluminium framed with tinted glass . sliding doors shall be provided at the entrance of all common control rooms, entrance lobby of facility building.
9.12.00	**Glazing**
9.12.01	All accessible ventilators and windows of all buildings shall be provided with min. 4mm thick float glass, plain or tinted for preventing solar radiations, unless otherwise specified.
9.12.02	All inaccessible (where regular maintenance is not feasible) ventilators and windows of all buildings shall be provided with 6mm thick clear toughened glass. 2 mm thick polycarbonate sheet with profile matching with metal sheeting shall be provided in TPs, conveyor galleries and Mill Bunker Building. The Polycarbonate sheets shall be fire and u/v resistant, and suitable for continuous use up to a temperature of 100^0C. Suitable aluminium beading shall be used. The open ends of the sheet shall be sealed as per manufacturer's recommendations.
9.12.03	The sky light/ dome / north light shall have minimum 10mm thick Multiwall Polycarbonate sheet fixed with anodised aluminium frame of approved colour & the same shall be made leak proof.
9.12.04	All windows and ventilators located in fire prone areas shall be provided with minimum 6 mm thick toughened glass conforming to IS:5437.
9.12.05	For single glazed aluminium partitions and doors, 8mm or 10 mm thick clear toughened glass shall be used.
9.12.06	Ground glass of minimum 4 mm thickness shall be used for all windows/ventilators in toilets.
9.12.07	All glazing work shall conform to IS:1083 and IS:3548.
9.12.08	For main plant glazings, 6mm thk clear reflective toughened glass shall be provided. The glass to be used should be from the manufacturers of glass like Saint Gobain (India) or Asahi (India) or equivalent. The glass should be free from distortion and thermal stress.
9.12.09	For glazings of Air Conditioned Buildings Composite double glazing shall be 24mm thick consisting of 6mm thick clear float glass on inner side and 6mm thick reflective toughened glass on outer side. The two glasses shall be separated by 12mm air-gap and hermetically sealed by beading of anodized aluminium with outer edge sealed with silicon sealant. Outer glass of 6mm thickness shall have following technical characteristics: Solar factor 25% or less, U-value less than 2.268 W/ SQMK,VLT min 30%: The glass to be used should be from the manufacturers of glass like Glavebel (Belgium), Saint Gobain (France) or Fort (USA) Or equivalent. The glass should be free from distortion and thermal stress. For CER & Control room, 24 mm thick hermitically sealed double glazing with toughened, fire resistant plane glass & tinted glass shall be provided. For glazing in non A/C areas of A/C Building single 6mm thick reflective glass shall be provided.
9.12.10	Glass block masonry work with glass blocks of size 190 x 190 x 90 (min), jointed with suitable adhesive complete as per the best construction practices.
9.12.11	For internal glazed partition, 8mm thick & 10mm thick clear toughened glass shall be provided.

9.13.00	**False ceiling**
9.13.01	False ceiling of 12.5 mm thick tapered/square edge glass fibre reinforced gypsum board conforming to IS : 2095 having fine texture finish, including providing and fixing of frame work at all levels, for all kind of work, consisting of light weight galvanised steel member (minimum 0.8 mm thick and galvanised as per IS : 277) having maximum grid size of 1200 mm x 600 mm for supporting panels of specified size, suspended from RCC structural steel or catwalkway grid above, with 4 mm (minimum) galvanised wires (rods), with special height adjustment clips, providing angle section of minimum 25 mm width along the perimeter of ceiling, supporting grid system (minimum 0.8 mm thick and galvanised as per IS : 277), expansion fasteners for suspension arrangement from RCC, providing openings for AC ducts, return air grills, light fixtures, etc., all complete. (concealed grid and finished flat seamless and curve shape (dome etc.), finished smooth(seamless) along with the galvanised light gauge steel supporting system laid in profile to suit the profile of dome)
9.13.02	False ceiling of 15 mm thick mineral fibre board, in tile form of size 600mm x 600mm, along with galvanised light gauge rolled form supporting system in double web construction pre painted with steel capping, of approved shade and colour, to give grid of maximum size of 1200x600. as per manufacturers details including supporting grid system, expansion fasteners for suspension arrangement from RCC, providing openings for AC ducts, return air grills, light fixtures, etc., all complete.
9.13.03	False ceiling of 12 mm thk calcium silicate board of 'HILUX' or equivalent with suspension system as per manufacturers details including supporting grid system, expansion fasteners for suspension arrangement from RCC, providing openings for AC ducts, return air grills, light fixtures, etc., all complete. (With concealed grid and finished flat seamless).
9.13.04	Aluminium false ceiling shall be in 600 mm x 600 mm tile of 0.6 mm thk. alluminum with perforation patterns in combination with built in nonwoven tissue, for providing good acoustic properties and installed with T-Grid (of profile 24 mm) in same or contrasting colours or with 6 mm recess joints. The whole system shall be level adjusting arrangement and shall be suspended as per manufacturer guidelines of Luxalon, Armstrong or equivalent.
9.13.05	Pre-Painted Coil coated Steel false ceiling system, at all level, for all kind of works, consisting of 0.5 mm thick galvanised as per IS : 277, along with galvanised supporting steel members exposed faces of galvanised member to be prepainted with regular modified polyester coating / super polyester coating minimum 20 DFT, to form panels of specified size for tile type panels and roll formed stove enamelled 0.6 mm thick steel carrier, for fixing of lineal type panels by clip on arrangement, suspended from RCC slab / structural steel or catwalk way steel channel grid above with 4 mm (minimum) galvanised wires (rods), with special height adjustment clips, providing angle section of minimum 25 mm leg width along the perimeter of ceiling, including all labour, material, supporting grid system (members minimum 0.8 mm thick and galvanised as per IS : 277) anchor fasteners for making suspension arrangement from RCC, providing openings for AC ducts, return air grills, insulation light fixtures, etc., all complete.
9.13.06	Tile type steel false ceiling system in square pattern panels of 600 mm x 600 mm size along with galvanised light gauge rolled form. supporting system in double web 'T' construction with pre-painted steel, with Tee support.
9.13.07	Lineal pattern (closed type) of 100 mm nominal width, with carrier support. Metal ceiling as above in lineal/tile shape in stainless steel, bright finish instead of pre-painted coil coated finish.
9.13.08	Mineral wool insulation shall be laid on top of false ceiling panels. Additional hangers and height adjustment clips shall be provided for return air grills, light fixtures, A.C. ducts etc.

9.13.09 Suitable M.S. channel (Minimum MC75 with maximum spacing of 1.2 m C/C both ways) grid shall be provided above the false ceiling level for movement of personnel and to facilitate maintenance of lighting fixtures, AC ducts etc.

9.12.10 Underdeck insulation shall be provided on the ceiling (underside of roof slab) and underside of floor slab of air-conditioned area depending upon the functional requirements. This underdeck insulation shall consist of 50mm thk. mineral wool insulation with 0.05 mm thick aluminium foil & 0.6 mm x 25mm mesh wire netting and shall be fixed to the ceiling with 2 mm wire ties.

9.13.11 Suitable cut-outs shall be provided in false ceiling to facilitate fixing of lighting fixtures, AC grills, smoke detectors, etc.

9.14.00 **Interior Design**

A comprehensive interior design scheme shall be conceived with the intention of projecting a definite theme and aesthetic appearance to inside working environment. It shall take into account the mutlidisciplinary engineering activities involving power plant technology, and architectural & civil engineering for a smooth control hierarchy and man machine interface. All the design aspects such as flooring, false ceiling, furniture, colour scheme equipment design & layout, illumination, fire fighting, acoustics and ergonomics requirements shall be detailed out so as to present an overall unified aesthetic spatial appearance.

The areas to be undertaken for this interior design process shall be control room complex including common control room, computer room, conference rooms and office areas in the main plant building and the following aspects shall be reviewed and evaluated for design. Furniture to be supplied by Bidder for the control room complex shall be as specified under C&I specification.

a) Layout, keeping in view the man-machine interface and suitable ergonomic practices.

b) Integration of civil engineering with architecture and interior design.

c) Illumination levels, noise levels, electromagnetic interference levels, taking into account the equipment and furniture.

d) Comfort and safety requirements such as air conditioning, fire fighting, fire escapes, etc.

e) Microprocessors based control system to control the functional requirements.

The above design philosophy put into practice shall be detailed out through presentation drawings, perspective views, scale models, detail drawings, etc.

9.15.00 **Finishing Schedule**

Interior and Exterior Finishes shall be as given in Tables-B & C respectively attached at the end of these specification.

TABLE – A
PROPOSED ACID /ALKALI RESISTANT TREATMENT

S.NO.	AREA	PRIMER (ONE COAT)	TYPE OF LINING AND THICKNESS				EPOXY COATING (TWO COATS)
	EFFLUENT TREATMENT PLANT		A.R. BRICKS	A.R. TILES	EPOXY MORTAR	BITUMASTIC	
1	**CPU:** a) Neutralisation Pit i) Floors	Bitumen	75 mm thick			18 mm thick	
	ii) Walls	Bitumen	115 mm thick			18 mm thick	
	iii) Ceiling	Epoxy					150 micron
	iv) Pillasters		115 mm thick				
	b) Effluent Drains	Bitumen		38 mm thick		12 mm thick	
	c) Floor & ground equipment & dado	Bitumen		38 mm thick		12 mm thick	
	d) Regeneration area floor & dado	Bitumen		38 mm thick		12 mm thick	

	e) Acid / Alkali storage area	Bitumen		75 mm thick		12 mm thick	
	f) Degasser area floor	Bitumen		38 mm thick		12 mm thick	
	g) Pedestals for supporting equipment	Bitumen		38 mm thick		12 mm thick	
	h) M.S. Grating / Chequered plate	Epoxy					150 micron

Note : -

1. The above table is for general guidance only, however, actual areas/ facilities to be covered shall be as per Scope of work.
2. Suitable end sealing shall be provided.
3. Structures shall be tested for waterproofing before application of Acid / Alkali Resistant Treatment.
4. This treatment shall be applied on dry surface.
5. For laying of AR bricks / tiles, the bedding mortar shall be of potassium silicate 6 mm thickness and the pointing mortar shall be of epoxy / furane 20 mm deep and 6 mm thickness.

TABLE –B

INTERIOR FINISHING SCHEDULE

S.NO.	DESCRIPTION OF AREA	FLOORING	WALLING	CEILING
1.	Main power house Building.			
	a)Unloading Bay	Cement concrete with Metallic hardener topping	Acrylic distemper	Acrylic distemper
	b)Cable vault	Cement concrete with Metallic hardener topping	Acrylic distemper	Acrylic distemper
	c)Balance area including passage	- do –	- do –	-do-
	d)SWAS Room	Vitrified ceramic tiles	Acrylic emulsion paint.	Mineral fiber board false ceiling.
	e)Equipment Area, ESP SWGR/ ACP Room/ UAF Room	Cement concrete with Metallic hardener topping	Acrylic distemper.	Acrylic distemper
	f) UPS Battery charger room	Vitrified ceramic tiles.	Acrylic emulsion paint.	Metal panel false ceiling in approved pattern.
	g) Deaerator floor	Cement concrete with Metallic hardener topping.		Metal deck roofing (bottom of sheeting with RAL 9002 finish)
	h) Operating Floor	18 mm thick Granite stone (polished & shot blasted in ratio of 80:20).	Colour coated Metal cladding on A-Row& Gable end, up to crane girder level.	- do –

TABLE –B

INTERIOR FINISHING SCHEDULE

S.NO.	DESCRIPTION OF AREA	FLOORING	WALLING	CEILING
	i) General circulation and movement areas	18mm thk. Polished granite stone / marble stone/ Vitrified Ceramic tiles.		Acrylic distemper (except metal deck area).
	j) Switchgear room	Cement concrete with Metallic hardener topping	Acrylic distemper	Acrylic distemper
	k) MCC Room	- do -	- do -	- do -
	l) Control room area including control room, computer room,	Vitrified ceramic tiles	Partition in glass with anodized Aluminium frame& Aluminium composite panel cladding for columns	Mineral fibre board false ceiling / Aluminium false ceiling
	m) control equipment room,	Vitrified ceramic tiles	vitrified ceramic tiles for wall cladding& Aluminium composite panel cladding for columns	Metal panel false ceiling in approved pattern.
	n) Conference room, senior executive room.	Laminated wooden flooring	Glazed partition with anodized Aluminium frame/ Acrylic emulsion paint.	Mineral fiber board false ceiling.
	o) Record room	Heavy duty dust pressed ceramic tiles	Acrylic distemper.	- do –

TABLE –B

INTERIOR FINISHING SCHEDULE

S.NO.	DESCRIPTION OF AREA	FLOORING	WALLING	CEILING
	p) Locker room	Heavy duty dust pressed Ceramic Tiles	Acrylic distemper	Acrylic distemper
	q) Toilet area	Heavy Duty Dust pressed ceramic tiles and 18mm thick. Polished granite in one piece for wash basin platform.	Designer ceramic wall tiles upto 2.1m ht. and Acrylic distemper for balance height.	Acrylic distemper / Calcium Silicate false ceiling.
	r) Office Room, Staff Room/Library	Vitrified ceramic tiles	Acrylic emulsion paint.	Mineral fiber board false ceiling..
	s) Laboratory area	Heavy duty dust pressed ceramic tiles	Designer ceramic wall tiles up to 1.2m ht.& rest Acrylic distemper/chemical resistant paint.	Gypsum board false ceiling as/profile or chemical resistant paint.
	t) RCC Stair case	18mm thick Marble stone	Vitrified Ceramic Tiles upto 1.2m. ht. & Resin bonded granular texture finish for balance height.	Acrylic Distemper
	u)Lift areas.	18mm thick polished marble stone/ granite stone as/ pattern.	Acrylic emulsion paint or 18mm thick polished marble/ granite cladding.	Metal panel false ceiling
	v)Passages and general circulation areas.	18mm thick polished Marble Stone/ granite stone.	Acrylic Distemper / acrylic emulsion paint.	- do- & Acrylic emulsion paint.

TABLE –B

INTERIOR FINISHING SCHEDULE

S.NO.	DESCRIPTION OF AREA	FLOORING	WALLING	CEILING
	w) Battery Room	Acid and alkali resistant tile.	Acid and alkali resistant tile up to 1.2m height and chemical resistant paint for balance height	Chemical Resistant paint.
	x)Oil canal, oil room, oil purification Tank and other areas where oil spillage is likely to occur.	Oil resistant paint (epoxy based) 150 micron over primer.	As above except oil canal Oil resistant Paint	As above except oil canal.
	y) Pathways including roof area.	22mm thick concrete chequered tiles.	-	-
2.	Service Building/ Admin Building/Auditorium Building			
	a) Entrance Lobbies and Lift areas/Foyer/Exhibition space/Canteen.	18mm thick polished marble stone/ granite stone as/ pattern	Textured paint/ acrylic emulsion paint or 18mm thick polished marble/ granite cladding.	Gypsum Board False Ceiling as/profile/ Aluminum tile false ceiling.
	b) Conference room, senior executive room.	Laminated wooden fooring	Glazed partition with Aluminium frame/ Acrylic emulsion paint.	Mineral fiber board false ceiling.
	c) Office Room, Staff Room/Library.	Vitrified ceramic tiles.	Acrylic emulsion paint.	Gypsum Board False Ceiling as/profile or Metal Panel False ceiling in approved pattern.
	d) Passage	Vitrified ceramic tiles.	Textured paint/ acrylic emulsion paint.	Metal Panel False ceiling/ Mineral fiber board false ceiling.

TABLE –B

INTERIOR FINISHING SCHEDULE

S.NO.	DESCRIPTION OF AREA	FLOORING	WALLING	CEILING
	e) RCC Stair case	Marble stone / granite stone.	Marble stone/ granite stone up to 1.2m.ht. & Textured paint above	Acrylic Distemper.
	f) Toilet/ Pantry/ Kitchen	Heavy Duty Dust pressed ceramic tiles and Granite stone in one piece for wash basin platform..	Designer ceramic wall tiles cladding upto 2.1 m. height and Acrylic distemper for balance area height. .	Acrylic distemper / Calcium Silicate false ceiling.
	g) AHU/ A.C. Plant room/MCC Room/Store	Cement concrete with Metallic hardener topping.	Acrylic distemper	Acrylic distemper
	h) Covered parking area	Pavers interlocking cement concrete blocks.	External finish	Acrylic Distemper
	i) Pathways including roof area.	22mm thick concrete chequered tiles.		
	j) Green Room	Vitrified ceramic tiles.	Acrylic emulsion paint .	Gypsum Board False Ceiling
	k) Seating Area	Cement concrete with Metallic hardener topping covered with carpet tiles/ wooden flooring	Wall paneling.	Gypsum Board False Ceiling /Mineral fiber board false ceiling as per acoustic requirement.
	l) Stage	Cement concrete with Wooden flooring	Wooden paneling per acoustic requirement.	-do-

TABLE –B

INTERIOR FINISHING SCHEDULE

S.NO.	DESCRIPTION OF AREA	FLOORING	WALLING	CEILING
	m) Projector room	Dust pressed ceramic tile	Acrylic distemper	Acrylic Distemper
3	ESP control building/Air compressor house/ARCW. building			
	a) Operating/Maintenance areas	Cement concrete with Metallic hardener topping	Pre color coated metal panel cladding.	Acrylic distemper (except metal deck area)
	b) Office Room, Staff Room	Vitrified ceramic tiles	Acrylic emulsion paint	Acrylic emulsion paint
	c) Control Room	Vitrified ceramic tiles.	Vitrified tile cladding on walls up to false ceiling& column encased with ACP.	False ceiling in lineal Metal panel
	d) MCC Room	Cement concrete with Metallic hardener topping	Acrylic distemper	Acrylic distemper (except metal deck area)
	e) RCC Stair case	Marble stone / granite stone.	Vitrified tile up to 1.2m.ht. & Acrylic Distemper	Acrylic Distemper
	f) Battery Room	Acid, Alkali resistant tile	Acid, Alkali resistant tile	Acrylic Distemper
	g) AHU/ AC Plant room/ Cable vault	Cement concrete with Metallic hardener topping	Acrylic Distemper	Acrylic Distemper

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TABLE –B

INTERIOR FINISHING SCHEDULE

S.NO.	DESCRIPTION OF AREA	FLOORING	WALLING	CEILING
	h) Toilets	Heavy Duty Dust pressed ceramic tiles and Granite stone in one piece for wash basin platform.	Designer ceramic wall tiles up to 2.1 m / ceiling ht. and Acrylic distemper for balance height.	Acrylic distemper/ Calcium silicate false ceiling.
4.	Canteen/ Gate Complex/Fire station/ Consruction Office			
	a) Reception/Waiting	Marble stone / Granite stone	Textured paint/ acrylic emulsion paint	Acrylic Distemper
	b) Office/Guard Room/Conference/Viewing Gallery/ Staff room	Vitrified ceramic tiles.	Acrylic distemper/ acrylic emulsion paint	Acrylic Distemper/Mineral fiber board false ceiling./ Aluminium False Ceiling
	c) Detention Room/ Ammunition store	Cement concrete with Metallic hardener topping	Acrylic distemper	Acrylic Distemper
	d) Sitting and General Area	Granite stone/Vitrified ceramic tiles.	Designer ceramic wall tiles up to 1.2 m, and Textured Paint for balance height. Glass mosaic tiles for murals & Glass blocks for interior purpose.	Acrylic distemper/ Gypsum board false ceiling./ Aluminium False ceiling
	e) Kitchen, Pantry and preparation area	Heavy duty dust pressed ceramic tiles and Granite stone for platform	Designer ceramic wall tiles dado upto 2.1 m. height and Acrylic distemper for balance area height. .	Acrylic distemper

TABLE –B

INTERIOR FINISHING SCHEDULE

S.NO.	DESCRIPTION OF AREA	FLOORING	WALLING	CEILING
	f) Toilets	Heavy Duty Dust pressed ceramic tiles and Granite stone in one piece for wash basin platform.	Designer ceramic wall tiles.	Acrylic distemper / Calcium Silicate false ceiling.
	g) Fire Tender area	Cement concrete with Metallic hardener topping.	Acrylic distemper.	Acrylic distemper.
	h) Stores	Cement concrete with Metallic hardener topping.	Acrylic distemper.	Acrylic distemper.
5.	CHP Maintenance Building /O&m store/O&M workshop building Dozer shed.			
	a) Workshop/stores/dozer shed	Cement concrete with Metallic hardener topping.	Acrylic distemper/ color coated Metal panel cladding	Acrylic distemper (except metal deck area)
	b) Office Room, Staff Room	Vitrified ceramic tiles.	Acrylic emulsion paint.	Mineral fiber board false ceiling/ Acrylic distemper
	c) Passages	Vitrified Ceramic Tiles	Acrylic distemper	Mineral fiber board false ceiling/ Acrylic distemper
	d) RCC Stair case	18mm thick polished Marble stone / granite stone.	Vitrified Ceramic Tiles 1.2m.ht. & Distemper above.	Acrylic Distemper

TABLE –B

INTERIOR FINISHING SCHEDULE

S.NO.	DESCRIPTION OF AREA	FLOORING	WALLING	CEILING
	e) Toilets	Heavy Duty Dust pressed ceramic tiles and Granite stone in one piece for wash basin platform.	Designer ceramic wall tiles dado upto 2.1 m. height and Acrylic distemper for balance area height. .	Acrylic distemper
6.	Mill& Bunker building/Track Hooper/T.P./Conveyer's gallery/Crusher			
	a) Mill& Bunker area/Track Hooper area/ T.P. area/Conveyer's gallery area/Crusher area	Cement concrete with Metallic hardener topping	Acrylic distemper on masonry walls/ color coated Metal panel cladding	color coated Metal panel cladding
	a) Toilets	Heavy Duty Dust pressed ceramic tiles and Granite stone in one piece for wash basin platform.	Designer ceramic wall tiles up to 2.1m / ceiling ht. and Acrylic distemper for balance height.	Acrylic distemper
7.	Fire water pump house			
	a) Maintenance /Pump floor/PLC	Cement concrete with Metallic hardener topping	Acrylic distemper	Acrylic distemper (except metal deck area)
	b) Control room /PLC.	Epoxy flooring	Acrylic emulsion paint .	Mineral fiber board false ceiling.
	c) Toilet area	Heavy Duty Dust pressed ceramic tiles and Granite stone in one piece for wash basin platform.	Designer ceramic wall tiles up to 2.1m / ceiling ht. and Acrylic distemper for balance height.	Acrylic distemper

TABLE –B

INTERIOR FINISHING SCHEDULE

S.NO.	DESCRIPTION OF AREA	FLOORING	WALLING	CEILING
8.	Fire water booster water pump house /Foam pump house.			
	a) Maintenance /Pump floor/PLC	Cement concrete with Metallic hardener topping	Acrylic distemper	Acrylic distemper (except metal deck area)
	b) Control room /PLC.	Vitrified Ceramic Tiles	Acrylic emulsion paint .	Mineral fiber board false ceiling.
	c) Toilet area	Heavy Duty Dust pressed ceramic tiles and Granite stone in one piece for wash basin platform	Designer ceramic wall tiles up to 2.1m / ceiling ht. and Acrylic distemper for balance height.	Acrylic distemper
9.	Ash slurry pump house/ Ash water pump house / Silo Area Utility Building / Ash Water recirculation Pump House/ Transport air compressor house/ HCSD pump house/ Ash Dyke Maintenance building.			
	a) Operating/Maintenance areas/ MCC room	Cement concrete with Metallic hardener topping	Acrylic distemper	Acrylic distemper (except metal deck area)
	b) Office Room, Staff Room	Vitrified ceramic tiles.	Acrylic emulsion paint	Acrylic distemper.
	c) Control room	Vitrified Ceramic Tiles	Acrylic emulsion paint	Mineral fiber board false ceiling.

TABLE –B

INTERIOR FINISHING SCHEDULE

S.NO.	DESCRIPTION OF AREA	FLOORING	WALLING	CEILING
	d) RCC Stair case	Marble stone / Granite stone.	Marble stone / Granite stone upto 1.2 mt.ht. & Acrylic emulsion paint	Acrylic Distemper.
	e) Toilet area	Heavy Duty Dust pressed ceramic tiles and Granite stone in one piece for wash basin platform.	Designer ceramic wall tiles upto 2.1 m / ceiling ht. and Acrylic distemper over plaster of Paris for balance height.	Acrylic distemper.
10.	CWPH / DMPT buildings / & Other auxiliary building.			
	a) Workshop/ Operating/Maintenance areas/MCC areas	Cement concrete with Metallic hardener topping	Acrylic distemper	Acrylic distemper (except metal deck area)
	b) Office Room, Staff Room	Vitrified ceramic tiles.	Acrylic emulsion paint	Acrylic emulsion paint
	c) Control room	Vitrified Ceramic Tiles	Acrylic emulsion paint	Mineral fiber board false ceiling/ Acrylic distemper
	d) Acid/Alkali storage area/ CW treatment area/ DM plant area/ Regeneration area/ Neutralization pit etc.	Acid, Alkali resistant tile as per requirement.	Acid/Alkali resistant tile as per requirement.	Acrylic Distemper

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TABLE –B

INTERIOR FINISHING SCHEDULE

S.NO.	DESCRIPTION OF AREA	FLOORING	WALLING	CEILING
	e) RCC Stair case	Marble stone / granite stone.	Marble stone up to1.2 m.ht. & Acrylic Distemper paint	Acrylic Distemper
	f) Toilet area	Heavy Duty Dust pressed ceramic tiles and Granite stone in one piece for wash basin platform.	Designer ceramic wall tiles upto 2.1m / ceiling ht. and Acrylic distemper for balance height.	Acrylic distemper

Note :

1. All wall and roof areas above false ceiling shall be plastered and white washed.
2. The colour and pattern of finish shall be as per approved details.
3. All materials shall be of reputed and established brand approved by Engineer-in-charge.
4. Wherever alternative materials are specified, the final selection rests with Engineer-in-charge.
5. This finishing schedule shall also be applicable for similar functional areas for all other buildings and facilities.
6. All the finishing materials shall be applied/provided as per manufacturer specification and guidelines under the supervision & guidelines of manufacturer.
7. Requirement given above are suggestive and minimum. Bidder is welcome to suggest alternative scheme conforming to design functional requirement subject to approval of the Engineer-in-charge.

TABLE –C

EXTERIOR FINISHES SCHEDULE

Sl.No.	DESCRIPTION OF AREA	WALL AND PROJECTIONS	SOFFIT OF PROJECTIONS
1.	Main plant building & Fire walls in Transformer yard; Other Auxilliary building in steel framed structure.	Resin bonded granular texture finish of approved colour/colour combination over plastered surface on masonry/concrete. Approved colour/ colour combination of colour coated metal cladding	Solvent based (resin based) over plastered surface. Approved colour/ colour combination of colour coated metal cladding.
2.	Building with concrete frame work, etc.	solvent based resin based paint of approved colour/colour combination. For Service building/ Admin. Bldg. / canteen & Auditorium. Aluminium composite Panel Cladding in combination with Resin bonded Granular texture finish (50:50)	Solvent based (100% pure acrylic co-polymer resin based) over plastered surface.
3.	Steel Structure, trestles, etc.	High performance Paint of approved specification and shade.	

NOTE : 1. The colour and pattern of finish shall be as finalized by Engineer.

2. All materials shall be of reputed and established brand approved by Engineer.

10.00.00 MATERIAL SPECIFICATION

10.01.00 **Cement**

Fly ash based portland pozzolana cement conforming to IS:1489 (Part-1) shall be used for all areas other than for the critical structures identified below. Other properties shall be as per IS code.

Ordinary Portland Cement (OPC) shall necessarily be used for the following structures.

a) TG foundation top deck

b) Spring supported decks of all machine foundations such as PA/FD/ID Fans and TDBFP/MDBFP

c) RCC for Chimney shell.

d) NDCT shell and racker columns of NDCT.

The grade of cement shall be Grade 43 for OPC conforming to IS:8112.

In place of fly ash based portland pozzolana cement, OPC mixed with Fly Ash can be used. Batching plant shall have facility for mixing fly ash. Fly ash shall conform to IS:3812(Part I & Part II). Percentage of fly ash to be mixed in concrete shall be based on trial mix. Mix design shall be done with varying percentage of fly ash mix with cement

10.02.00 **Aggregates**

a) **Coarse aggregate**

Coarse aggregate for concrete shall be crushed stones chemically inert, hard, strong, durable against weathering of limited porosity and free from deleterious materials. It shall be properly graded. It shall meet the requirements of IS: 383.

b) **Fine aggregate**

Sand shall be hard, durable, clean and free from adherent coatings of organic matter and clay balls or pellets. Sand, when used as fine aggregate in concrete shall conform to IS : 383. For plaster, it shall conform to IS : 1542 and for masonry work to IS : 2116.

10.03.00 **Reinforcement Steel**

Reinforcement steel shall be of high strength deformed TMT steel bars of grade Fe-500 and shall conform to IS:1786. However, minimum elongation shall be 14.5%.

Mild steel & medium tensile steel bars and hard drawn steel wire shall conform to grade-1 of IS:432 (Part-1) or grade A of IS:2062. Welded wire fabric shall conform to IS:1566.

10.04.00 **Structural Steel**

Structural Steel (including embedded Steel) shall be straight, sound, free from twists, cracks, flaw, laminations and all other defects. Structural steel shall comprise of mild steel, medium strength steel and high tensile steel as specified below.

10.04.01 Mild Steel

a) Rolled sections shall be of grade designation E250, Quality A/BR, Semi-killed/ killed conforming to IS 2062. All steel plates shall be of Grade designation E250, Quality BR (fully killed), conforming to IS 2062 and shall pass the impact test value at room temperature. Plates beyond 12mm thickness and up to 40mm thickness shall be normalized rolled. Plates beyond 40mm thickness shall be vacuum degassed & furnace normalised and shall also be 100% ultrasonically tested as per ASTM –A578 level B-S2.

b) Pipes shall conform to IS: 1161.

c) Hollow (square and rectangular) steel sections shall be hot formed conforming to IS: 4923 and shall be of minimum Grade Yst 240.

d) Chequered plate shall conform to IS 3502 and shall be minimum 6 mm thick excluding projection. Steel for chequered plate shall conform to grade E250A semi killed of IS: 2062 or equivalent grade conforming to ASTM & BS standards only.

10.04.02 **Medium and High Tensile Steel**

Rolled Sections and plates shall be of grade designation E350, **Quality B0(killed),** conforming to **IS 2062**. Plates beyond 20mm thickness and upto 40mm thickness shall be controlled rolling. Plates beyond 40mm thickness shall be normalizing rolling and shall also be ultrasonically tested as per ASTM –A578 level B.

10.05.00 **Bricks**

Bricks shall be table mounted/ machine made of uniform size, shape and sharp edges and shall have minimum compressive strength of 50kg/cm^2. Burnt clay fly ash bricks and fly ash lime bricks shall conform to IS:13757 and IS:12894 respectively. Minimum fly ash content in fly ash based bricks shall be minimum 25%. Common burnt clay bricks shall conform to IS:1077.

10.06.00 **Foundation Bolts**

Material and details of foundation bolts shall conform to IS:5624. Mild steel bars used for the fabrication of bolt assembly shall conform to grade 1of IS432 and/ or grade A of IS:2062. Hexagonal nuts and lock nuts shall conform to IS 1363 & IS1364 upto M36 diameter and IS 5624 for M42 to M150 diameter.

10.07.00 **Stainless steel**

The material specification for stainless steel plates are mentioned in the design concept area of Mill Bunker building.

10.08.00 **Water**

Water used for cement concrete, mortar, plaster, grout, curing, washing of coarse aggregate, soaking of bricks, etc. shall be clean and free from oil, acids, alkalis, organic matters or other harmful substances in such amounts that may impair the strength or durability of the structure. Potable water shall generally be considered satisfactory for all masonry and concrete works, including curing. When water from the proposed source is used for making the concrete, the maximum permissible impurities, development of strength and initial setting

time of concrete shall meet the requirements of IS:456.

All materials brought for incorporation in works shall be of best quality as per IS unless specified otherwise.

10.08.00 **Statutory Requirements**

Bidder shall comply with all the applicable statutory rules pertaining to Factories Act, Fire Safety Rules at Tariff Advisory Committee. Water Act for pollution control, Explosives Act, etc.

Provisions of safety, health and welfare according to Factories Act shall be complied with. These shall include provision of continuous walkways along the crane - girder level on both sides of building, comfortable approach to EOT crane cabin, railing, fire escape, locker room for workmen, pantry, toilets, rest room etc.

Provisions for fire proof doors, number of staircases, fire separation wall, lath plastering/encasing the structural members (in fire prone areas), type of glazing etc. shall be made according to the recommendations of Tarrif Advisory Committee.

Statutory clearances and norms of State Pollution Control Board shall be followed.

Bidder shall obtain approval of Civil/Architectural drawings from concerned authorities before taking up the construction work.

11.00.00 Inspection, Testing And Quality Control

11.01.00 Sampling and testing of major items of civil works viz. earthwork, concreting, structural steel work (including welding), piling, sheeting, etc. shall be carried out in accordance with the requirements of this specification. Wherever nothing is specified relevant Indian Standards shall be followed. In absence of Indian Standard equivalent International Standards may be used.

The Bidder shall submit and finalise a detailed field Quality Assurance Programme before starting of the construction work according to the requirement of this specification. This shall include frequency of sampling and testing, nature/type of test, method of test, setting of a testing laboratory, arrangement of testing apparatus/equipment, deployment of qualified/experienced manpower, preparation of format for record, Field Quality Plan, etc. Tests shall be done in the field and/or at a laboratory approved by the Engineer. The Bidder shall furnish the test certificate from the manufacturer's of various materials to be used in the construction.

11.02.00 Workmanship and dimensional shall be checked as stipulated below.

12.00.00 ANNEXURES

(a) List Of Codes And Standards

All applicable standards, references, specifications, codes of practice, etc., shall be the latest edition including all applicable official amendments and revisions. A complete set of all these documents shall be available at site with Bidder. List of some of the applicable Standards, in original Codes and references is as given in Annexure-a of this specification.

Annexure-(a)

LIST OF CODES AND STANDARDS

Excavation and Filling

IS :2720	Methods of test for soils(relevant parts)
IS:4701	Code of practice for earth work on canals.
IS:9759	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	33 grade for ordinary Portland cement.
IS:383	Coarse and fine aggregates from natural sources for concrete.
IS:432	Specification for mild steel and medium tensile steel bars and
(Part 1&2)	hard drawn steel wires for concrete reinforcement.
IS:455	Portland slag cement.
IS:702	Industrial bitumen.
IS:712	Specification for building limes.
IS:1077	Common burnt clay buidling bricks.
IS:1161	Steel tubes for structural purposes.
IS:1239	Mild steel tubes, tubulars and other wronght steel fillting - MS tubes.
IS:1363	Hexagon head bolts, screws and nuts of productions
(Part 1-3)	grade - C.
IS:1364	Hexagon head bolts, screws and nuts of productions
(Part 1-5)	grade-A & B.
IS:1367 (Part 1-18)	Technical supply condition for threaded fasteners.
IS:1489 (Part-I)	Portland-pozzolana cement. Fly ash based
IS:1542	Sand for Plaster.

	IS:1566	Hard drawn steel wire fabric for concrete reinforcement.
	IS:1786	High strength deformed steel bars & wires for concrete reinforcement.
	IS:2062	Hot Rolled Low, Medium and High Tensile Structural Steel
	IS:2116	Sand for masonry mortars.
	IS : 2185 (Part 1) (Part 2)	Hollow & solid concrete blocks. Hollow & solid light weight concrete blocks.
	IS:2386 (Part I-VIII)	Testing of aggregates for concrete.
	IS:3812	Specification for fly ash for use as pozzolona and admixture.
	IS:4082	Recommendation on stacking and storage of construction materiel and components at site
	IS:8112	43 grade ordinary portland cement.
	IS:8500	Structural steel-Microalloyed (Medium and high strength qualities).
	IS:12269	53 grade ordinary portland cement.
	IS:12894	Specification for fly ash lime bricks.
	IS:13757	Burnt clay fly ash building bricks.
	Cast in-situ Concrete and Allied Works	
	IS:280	Mild steel wire for general engineering purpose.
	IS:456	Code of practice for plain and reinforcement concrete.
	IS:457	Code of practice for general construction of plain and reinforced concrete for dams and other massive structures.
	IS:516 IS:1199	Method of test for strength of concrete. Methods of sampling and analysis of concrete.
	IS:1791	General requirement for batch type concrete mixers.
	IS:1834	Hot applied sealing compound for joints in concrete.
	IS:1838	Preformed fillers for expansion joints in concrete pavement and structures.
	IS:2438	Specification for roller pan mixers.
	IS:2502	Code of practice for bending and fixing of bars for concrete reinforcement.
	IS:2505	Concrete vibrators - immersion type.
	IS:2506	General requirements for screed board concrete vibrators.

	IS:2722	Specification for Portable Swing weigh batchers for concrete (single and double bucket type).
	IS:2750	Steel scaffoldings
	IS:2751	Recommended practice for welding of mild steel plain and deformed bars for reinforced construction.
	IS:3150	Hexagonal wire netting for general purposes.
	IS:3366	Specification for pan vibrators.
	IS:3370 (Part 1-4)	Code of practice for concrete structures for the storage of liquids.
	IS:3558	Code of practice for use of immersion vibrators for consolidating concrete.
	IS:4014 (Part-1&2)	Code of practice for steel tubular scaffolding.
	IS:4326	Code of practice for earth quake resistant design and construction of buildings.
	IS:4656	Form vibrators for concrete.
	IS:4925	Concrete batching and mixing plant.
	IS:4990	Plywood for concrete shuttering work.
	IS:5256	Code of practice for sealing expansion joints in concrete lining on canals.
	IS:5525	Recommendations for detailing of reinforcement in reinforced concrete works.
	IS:6461	Glossary of terms relating to cement concrete.
	IS:6494	Code of practice for water proofing of underground reservoir and swimming pools.
	IS:6509	Code of practice for installation of joints in concrete pavements.
	IS:7861 (Part -1&2)	Code of practice for extreme weather concreting.
	IS:9012	Recommended practice for shotcreting.
	IS:9103	Admixtures for concrete.
	IS:9417	Recommendations for welding cold worked 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:12118	Two parts polysulphide based sealants.

	IS:12200	Code of practice for provision of water stops at transverse construction joints in masonry and concrete dams.
	IS:13311	Non destructive testing of concrete - methods of test.
	(Part 1)	Ultrasonic pulse velocity.
	(Part 2)	Rebound hammer.
	SP-16	Design codes for reinforced concrete to IS:456-1978.
	SP-23	Hand book of concrete mixes.
	SP-24	Explanatory handbook on Indian standards code for plain and reinforced concrete. (IS : 456)
	SP-34	Hand book on concrete reinforcement and detailing.
	ACI-318	American Concrete Institute code for structural concrete.
	Precast Concrete Works	
	SP:7 (Part 6/Sec.7)	National Building Code - Structural Design Prefabrication and system building and mixed / composite construction.
	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 waffle units.
	IS:15658	Pre-cast concrete block for paving.
	Masonry & Allied Works	
	IS:1905	Code of practice for structural use of unreinforced masonry.
	IS: 2185	Part-1 Concrete Masonry Units - Specification Part 1 Hollow and Solid Concrete Blocks Part-3 Specification for concrete masonry units: Part 2 Hollow and solid light weight concrete blocks
	IS:2212	Code of practice for brick work.
	IS:2250	Code of practice for preparation and use of masonry mortars.
	IS:2572	Code of practice for construction of hollow concrete block masonry.
	SP:20	Hand book on masonry design and construction.
	Sheeting Works	
	IS:277	Galvanised steel sheets (Plan & corrugated).
	IS:513	Cold-rolled low carbon steel sheets & strips.
	IS:730	Hook bolts for corrugated sheet roofing.

IS:801	Code of practice for use of cold formed light gauge steel structural members in general building construction.
IS:2527	Code of practice for fixing rain water gutters and down pipe for roof drainage.
IS:7178	Technical supply condition 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:12436	Preformed rigid Polyurethane (PUR) and isocyanurate (PIR) foams for thermal insulation.
IS:12866	Plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced).
IS:14246	Continuously pre-painted galvanised steel sheets and coils.
BS:5950	Code of practice for design of light gauge profiled
(Part-6)	steel sheeting

Fabrication and Erection of Structural Steel Works

IS:800	Code of practice for General Construction of steel.
IS:813	Scheme for symbols for welding.
IS:814	Covered electrodes for manual metal arc welding of carbon & carbon manganese steel.
IS:816	Code of practice for use of metal arc welding for general construction in mild steel.
IS:817	Code of practice for training and testing of metal arc welders.
IS:1024	Welding in bridges and substructured subject to dynamic.
IS:1181	Qualifying tests for Metal Arc welders (engaged in welding structures other than pipes).
IS:1182	Recommended practice for Radiographic examination of fusion welded butt joints in steel plates
IS:1608	Mechanical testing of metals - tensile testing
IS:1852	Rolling and Cutting Tolerances for Hot rolled steel products.
IS:2016	Specification for Plain washers.
IS:2595	Code of practice for Radiographic testing

IS:2629	Hot dip galvanising of iron and steel
IS:3502	Steel chequred plate.
IS:3613	Acceptance tests for wire flux combination for submerged arc welding.
IS:3658	Code of practice for liquid penetrant flaw detection.
IS:3664	Code of practice for ultra sonic pulse echo testing contact and immersion method
IS:3757	High strength structural bolts.
IS:4000	High strength bolts in steel structure - code of practice.
IS:4353	Sub merged arc welding of mild steel and low alloy steel Recommendation
IS:4759	Hot dip zinc coating on structural steel and other allied products.
IS:5334	Code of practice for magnetic particle flaw detection of welds.
IS:5369	General requirements for plain washers and lock washer
IS : 6623	High strength structural nuts.
IS:6649	Hardened and tampered washers for high strength structural bolts & nuts.
IS:6911	Stainless steel plate, sheet and strip.
IS:7205	Safety code for erection of structural steel.
IS:7215	Tolerances for fabrication of structural steel.
IS:7307	Approved test for welding procedures
(Part - I)	Fusion welding of steel.
IS:7310 (Part-I)	Approval test for welders working to approval welding procedure. Fusion welding of steel
IS:9178 (Part-1to 3)	Criteria for design of steel bins for storage of bulk material.
IS:9595	Recommendations for metal arc welding of carbon & carbon manganese steel.
IS:12843	Tolerances for erection of steel structures.
SP:6 (Part 1 to 7)	ISI Hand book for structural Engineers.

Plastering and Allied Works

IS:1661	Code of practice for application of cement and cement lime plaster finishes.
IS:2402	Code of practice for external rendered finishes.

IS:2547 (Parts 1&2)	Gypsum building plaster.
Acid and Alkali Resistant Lining	
IS:158	Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali & heat resisting.
IS:412	Expanded metal steel sheets for general purpose.
IS:4441	Code of practice for use of silica type chemical resistant mortars.
IS:4443	Code of practice for use of resin type chemical resistant mortars.
IS:4456 (Part I & II)	Method of Test for chemical resistant tiles.
IS:4457	Ceramic unglazed vitreous acid resisting tiles.
IS:4832	Specification for chemical resistant mortars.
(Part - 1)	Silicate type
(Part - 2)	Resin type
(Part - 3)	Sulfur type
IS:4860	Acid resistant bricks.
IS:9510	Bitumastic acid resisting grade.
Water Supply, Drainage and Sanitation	
IS:458	Precast concrete pipes (with & without reinforcement).
IS:554	Pipe threads where pressure tight joints are made on the threads – dimensions, tolerances and designation.
IS:651	Salt glazed stoneware pipes and fittings.
IS:774	Flushing cisterns for water closets and urinals.
IS:775	Cast iron brackets and supports for wash basins and sinks.
IS:778	Copper alloy gate, globe and check valves for water works purposes.
IS:781	Cast copper alloy screw down bib taps & stop valves for water services.
IS:782	Caulking lead.
IS:783	Code of practice for laying of concrete pipes.
IS:1172	Code of basic requirements of water supply, drainage and sanitation.
IS:1230	Cast iron rain water pipes and fittings.

	IS:1239 (Part 1&2)	Mild Steel tubes, tubulars and other wrought steel fittings
	IS:1536	Centrifugally cast (Spun) iron pressure pipes for water.
	IS:1537	Vertically cast iron pressure pipes for water, gas and sewage.
	IS:1538	Cast iron fittings for pressure pipe for water, gas and sewage.
	IS:1703	Copper alloy float valve for water supply fitting.
	IS:1726	Cast iron manhole covers and frames.
	IS:1729	Cast iron / Ductile iron drainage pipes and pipe/fittings for over ground non pressure pipeline socket and spigot series.
	IS:1742	Code of practice for building drainage.
	IS:2064	Selection, installation and maintenance of sanitary appliances.
	IS:2065	Code of practice for water supply in buildings.
	IS:2326	Automatic flushing cisterns for urinals.
	IS:2548	Plastic seats and covers for water closets.
	IS:2556	Vitreous sanitary appliances (vitreous china).
	IS:3114	Code of practice for laying of cast iron pipes.
	IS:3311	Waste plug and its accessories for sinks and wash basins.
	IS:3438	Silvered glass mirrors for general purposes.
	IS:3486	Cast iron spigot and socket drain pipes.
	IS:3589	steel pipe for water and sewage (168.3 to 2540mm outside diameter)
	IS:3989	Centrifugally cast (Spun) iron spigot and socket soil, waste and ventilating pipes, fittings and accessories.
	IS:4111 (Part 1 to 5)	Code of practice for ancillary structure in sewerage system.
	IS:4127	Code of practice for laying of glazed stone ware pipes.
	IS : 4733	Methods of sampling and testing sewage effluents.
	IS:4764	Tolerance limits for sewage effluents discharged into inland surface waters.
	IS:1068	Electroplated coating of nickel plus chromium and copper plus nickel plus chromium.
	IS:5329	Code of practice for sanitary pipe work above ground for buildings.
	IS:5382	Rubber sealing rings for gas mains, water mains and sewers.

	IS:5822	Code of practice for laying of electrically welded steel pipes for water supply.
	IS:5961	Specification for cast iron grating for drainage purpose.
	IS:7740	Code of practice for construction and maintenance of road gullies.
	IS:8931	Copper alloy fancy single taps combination tap assembly and stop valves for water services.
	IS:9762	Polyethylene floats for float valves.
	IS:10592	Industrial emergency showers, eye and face fountains and combination units.
	IS:12592	Specification for precast concrete manhole covers and frames.
	IS:12701	Rotational moulded polyethylene water storage tanks.
	IS:13983	Stainless steel sinks for domestic purposes.
	SP:35	Hand book on water supply and drainage with special emphasis on plumbing.
	CPH&EEO	Manual on sewage and sewage treatment
	Publication	- as updated.
	Doors Windows and Allied Works	
	IS:204	Tower Bolts.
	(Part 1)	Ferrous metals
	(Part 2)	Non - ferrous metals
	IS:208	Door Handles.
	IS:281	Mild steel sliding door bolts for use with padlocks.
	IS:362	Parliament Hinges.
	IS:419	Putty, for use on window frames.
	IS:451	Technical supply conditions for wood screws
	IS:733	Wrought aluminium and aluminium alloy bars, rods and sections for general engineering purposes.
	IS:1003 (Part I)	Timber panelled and glazed shutters (doors shutters).
	IS:1003	Timber panelled and glazed shutters
	(Part-1)	door shutters.
	IS:1038	Steel doors, windows and ventilators.

	IS:1081	Code of practice for fixing and glazing of metal (steel and aluminium) doors, windows and ventilators.
	IS:1285	Wrought aluminium and aluminium alloy extruded round tube & hollow section (for general engineering purposes).
	IS:1341	Steel butt hinges.
	IS:1361	Steel windows for Industrial buildings.
	IS:1823	Floor door stoppers.
	IS:1868	Anodic coatings on Aluminium and its alloys.
	IS:2202	Wooden flush door shutters (solid core type) particle
	(Part-2)	board face panels and hard board face panels.
	IS:2209	Mortice locks (vertical type)
	IS:2553	Safety glass.
	(Part-1)	General purposes
	IS:2835	Flat transparent sheet glass.
	IS:3548	Code of practice for glazing in buildings.
	IS:3564	Door closers (Hydraulically regulated)
	IS:3614	Specification for fire check doors :
	(Part-1)	plate, metal covered and rolling type.
	(Part-2)	Resistance test and performance criteria.
	IS:4351	Specification for steel door frames.
	IS:5187	Flush bolts.
	IS:5437	Figured, rolled and wired glass.
	IS:6248	Specification for metal rolling shutters and rolling grills.
	IS:6315	Specification for floor springs (Hydraulically regulated) for heavy doors.
	IS:7196	Hold fast.
	IS:7452	Hot rolled steel sections for doors, windows and ventilators.
	IS:10019	Mild steel stays and fasteners.
	IS:10451	Steel sliding shutters (top hung type)
	IS:12823	Prelaminated particle boards.

Roof Water Proofing and Allied Works

IS:3067	code of practice for general design details and preparatory work for damp proofing and water proofing of buildings.
ASTM	Standard specification for high solid content cold
C836-89a	liquid applied elastomeric water proofing membrane for use with separate wearing course.
ASTM	Standard guide for high solid content cold
C898-89	liquid applied elastomeric water proofing membrane for use with separate wearing course.

Floor Finishes and Allied Works

IS:5318	Code of practice for laying of flexible PVC sheet and tile flooring.
IS:8042	White portland cement.
IS:13755	Dust pressed ceramic tiles with water absorption of 3%, E 6% (Group B11a).
IS:13801	Chequered cement concrete tiles.

Painting and Allied Works

IS:162	Ready mixed paint, brushing fire resisting, silicate type for use on wood, colour as required.
IS:428	Distemper, oil, emulsion, colour as required.
IS:1477	Code of practice for painting of terrous metals in buildings.
(Part -1)	Pretreatment.
(Part -2)	Painting.
IS:1650	Specification for colours for building and decorative materials.
IS:2074	Ready mixed paint, air drying, red oxide-zinc chrome, priming.
IS:2338	Code of practice for finishing of wood and wood based materials.
(Part -1)	Operations and Workmanship.
(Part -2)	Schedule.
IS:2395	Code of pratice for painting concrete, masonry and plaster surfaces.
(Part-1)	Operations and Workmanship.
(Part -2)	Schedule.
IS:2524	Code of practice for painting of nonferrous metals in buildings.

	(Part -1)	Pretreatment
	(Part -2)	Painting.
	IS:2932	Enamel, synthetic, exterior, (a) under coating and (b) finishing.
	IS:2933	Enamel exterior, (a) under coating, (b) finishing.
	IS:4759	Hot dip zinc coatings on structural steel and other allied products.
	IS:5410	Specification for cement paint.
	IS:15489	Plastic emulsion paint.
	IS:6278	Code of practice for white washing and Colour washing.
	IS:10403	Glossary of term related to building finish.
	IS:12027	Silicone based water repellent
	IS:13238	Epoxy based zinc phosphate primer (2 pack)
	IS:13239	Epoxy surfacer (2 pack)
	IS:13467	Chlorinated rubber for paints
	IS:14209	Epoxy enamel, two component glossy.
	BS:5493	Code of practice for protective coating of iron and steel structures against corrosion.
	Piling and Foundation	
	IS:1080	Code of practice for design and construction of shallow foundations on soils.
	IS:1904	Code of practice for design and construction of foundation in Soils : General Requirements.
	IS:2314	Steel sheet piling sections.
	IS:2911	Code of practice for design and construction of pile foundations. (Relevant Parts)
	IS:2950	Code of practice for designs and construction of Raft foundation.
	(Part-1)	Design
	IS:2974 (Part-1 to 5)	Code of practice for design and construction of machine foundation.
	IS:4091	Code of practice for design and construction foundations for transmission line towers and poles.
	IS:6403	Code of practice for determination of Bearing capacity of Shallow foundations.
	IS:8009	Code of practice for calculation of settlement of foundation.

(Part -1)	Shallow foundations.
(Part -2)	Deep foundations.
IS:12070	Code of practice for design and construction of shallow foundations on rocks.
VIN:2056	Criteria for assessing mechanical vibrations of machines.
VDI:2060	Criteria for assessing the st of balance of rotating rigid bodies.
DIN:2089	Helical compression spring made of round wire and rod : calculation and design of compression .
DIN:2096	Helical compression spring out of round wire and rod : Quality requirements for hot formed compression spring.
DIN:4024	Flexible supporting structures for machine with rotating machines.
Roads	
IRC:5 (Section-1)	Standard specifications and Code of practice for road bridges, General Features of Design.
IRC:14	Recommended practice for 2cm thick bitumen and tar carpets.
IRC:15	Standard specifications and code of practice for construction of concrete roads.
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 (Section-III)	Standard specifications and Code of practice for road bridges. Cement concrete (plain and reinforced).
IRC:34	Recommendations for road construction in water logged 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:58	Guidelines for the design of rigid pavements for highways.
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 -	Ministry of Surface Transport (Road wing),

Publication	specifications for road and bridge works.
IS:73	Paving bitumen.
Loading	
IS:875	Code of practice for design loads (other than earthquake) for (Relevant parts) 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 and poles.
IRC:6 (Section-II)	Standard specifications & Code of practice for road bridges. loads and stresses
Safety	
IS:1641	Code of practice for fire safety of buildings - General principles of fire grading and classification.
IS:1642	Code of practice for fire safety of buildings - Details of construction.
IS:3696 (Part-1&2)	Safety code for scaffolds and ladders.
IS:3764	Excavation work - code of safety.
IS:4081	Safety code for blasting and related drilling operations.
IS:4130	Demolition of buildings - code of safety.
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 of structural steel work.
IS:7293	Safety code for working with construction machinery.
IS:7969	Safety code for handling and storage of building materials.
Indian Explosives Act 1940)	(As updated)
Architectural Design of Buildings	
SP:7	National Building Code of India
SP:41	Hand book on functional requirements of buildings (other than industrial buildings)
ECBC	Energy Conservation Building Code
GRIHA	Green Rating For Integrated Habitat Assessment.

Chimney

IS:4998	Criteria for design of reinforced chimneys
IS:6533	Code of practice for design and construction of steel chimneys
ICAO	International Civil Aviation Organisation (ICAO)
DGCA	Instruction of Director General of Civil Aviation , India
ACI:307	Specification for the design and construction of reinforced concrete chimneys
BS:4076	Specification for steel chimneys
CICIND	Model Code for concrete chimneys Model code for steel chimneys
ASCE Code	Design and construction of steel chimney liners prepared by Task committee on steel chimney liners. Fossil power committee, Power division published by ASCE - 1975.
IS:1554	PVC insulated (heavy duty) electric cables
IS:2606	Alloy lead anodes for chromium plating
IS:3043	Code of Practice for Earthing
IS:9537	Conduits for electrical installations. The Indian Electricity Rules The Indian Electricity Act The Indian Electricity (Supply) Act The Indian Factories Act
IS:2309	Practice for protection of buildings and allied structures against lightning

Miscellaneous

IS:802 (Relevant parts)	Code of practice for use of structural steel in overhead trans-mission line towers.
IS:803	Code of practice for design, fabrication and erection of vertical mild steel cylindrically welded in storage tanks.
IS:10430	Criteria for design of lined canals and guidance for selection of type of lining.
IS:11592	Code of practice for selection and design of belt conveyors.
IS:12867	PVC handrails covers.
IS 11504	Criteria for structural design of reinforced concrete natural draught cooling towers
BS:4485 (IV)	British Standard : Code of design for water cooling towers
CIRIA Publication	Design and construction of buried thin-wall pipes.
IS 4671	Expanded polystyrene for thermal insulation purposes.

ANNEXURE (b)

CONSTRUCTION METHODOLOGY

Construction and erection activities shall be fully mechanised from the start of the work.

All excavation and backfilling work shall be done using excavators, loaders, dumpers, dozers, poclains, excavator mounted rock breakers, rollers, sprinklers, water tankers, etc. Manual excavation can be done only on isolated places with specific approval of engineer.

For controlled rock blasting specialized agency, equipped with sensors to assess the impact of the blast on the adjoining existing structures, shall be employed.

Dewatering shall be done using the combination of electrical and standby diesel pumps.

Pile installation equipment suitable for flushing with air lift technique shall be used for construction of bored piles.

For concreting, weigh batching plants, transit mixers, concrete pumps, hoists, etc. shall be used.

All fabrication and erection activities of structural steel shall be carried out using automatic submerged arc welding machines, cutting machines, gantry cranes, crawler mounted heavy cranes and other equipment like heavy plate bending machines, shearing machines, lathe, milling machines, etc. Use of derricks shall not be permitted. Special enclosures, for blast cleaning of steel structure surface preparation, shall be used.

All handling of materials shall be with cranes. Heavy trailers shall be used for transportation.

Mechanized modular units of scaffolding and shuttering shall be used.

Grouting shall be carried out using hydaulically controlled grouting equipment.

Roadwork shall be done using pavers, rollers and premix plant.

All finishing items shall be installed using appropriate modern mechanical tools. Manual punching etc. shall not be permitted.

Heavy duty hoists for lifting of construction materials shall be deployed. Compressors for cleaning of foundations and other surfaces shall be used.

Field laboratory shall be provided with all modern equipment for survey, testing of soil, aggregates, concrete, welding, etc. For testing of steel works, ultrasonic testing machines, radiographic testing machines, dye penetration test equipment, destruction testing equipment, etc. shall be deployed.

All persons working at site shall be provided with necessary safety equipment and all safety aspects shall be duly considered for each construction/ erection activity. Moreover, only the persons who are trained in the respective trade shall be employed for executing that particular work.

ANNEXURE (c)

BORE HOLE DATA

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 1 OF 2	DATE	: 20/04/2011 To 24/04/2011
BORE HOLE NO.	: BH-13	METHOD	: ROTARY DRILLING
LOCATION	: --	CASING	: Up to 2.50m BGL
CO-ORDINATES	: E-587900, N-2440400	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG /SQCM)
1.00	100 mm		Brown silty Sand	1.00						
2.00	NX		Grey Fractured basalt	2.50	CORE			15	NIL	
3.00										
4.00				4.00	CORE			22	NIL	
5.00				5.50	CORE			30	NIL	
6.00										
7.00				7.00	CORE			35	NIL	
8.00				8.50	CORE			40	10	
9.00										
10.00				10.00	CORE			41	08	

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO. : 2 OF 2	DATE : 20/04/2011 To 24/04/2011
BORE HOLE NO.: BH-13	METHOD : ROTARY DRILLING
LOCATION : --	CASING : Up to 2.50m BGL
CO-ORDINATES: E-587900, N-2440400	DIAMETER : 100m m & NX
REDUCED LEVEL : --	GROUND W. T. : NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
11.00	NX		Grey Basalt	11.50	CORE			40	NIL	
12.00										
13.00				13.00	CORE			45	15	
14.00				14.50	CORE			60	50	
15.00										
16.00				16.00	CORE			65	53	
17.00				17.00	CORE			60	55	
18.00				18.00	CORE			67	60	
19.00			BORE HOLE IS TERMINATED AT 18.00 M. BGL.							
30.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE

CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 1 OF 2	DATE	: 24/04/2011 To 28/04/2011
BORE HOLE NO.:	BH-14	METHOD	: ROTARY DRILLING
LOCATION	: -	CASING	: Up to 3.0m BGL
CO-ORDINATES:	E-588100, N-2440400	DIAMETER	: 100m m & NX
REDUCED LEVEL :	--	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
1.00	100 mm		Brown silty sand										
2.00				1.50/ 2.10	SPT1	05	09	13	9	22			
3.00				3.00									
				3.00/ 3.10	SPT2	55	--	--	--	R			
4.00											18	NIL	
				4.50							CORE		
5.00													
6.00				6.00							13	NIL	
											CORE		
7.00	NX		Grey fractured Basalt										
				7.50							14	NIL	
8.0											CORE		
				8.50							10	NIL	
9.00											CORE		
				10.00							30	NIL	
10.00													

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO. : 2 OF 2	DATE : 24/04/2011 To 28/04/2011
BORE HOLE NO.: BH-14	METHOD : ROTARY DRILLING
LOCATION : -	CASING : Up to 3.0m BGL
CO-ORDINATES: E-588100, N-2440400	DIAMETER : 100m m & NX
REDUCED LEVEL : --	GROUND W. T. : NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
11.00	NX		Grey Basalt	11.50	CORE			27	07	
12.00				12.00	CORE			50	39	909
13.00				13.00	CORE			90	58	
14.00				14.20	CORE			83	62	619
15.00				15.50	CORE			70	50	487
16.00				17.00	CORE			83	60	
17.00										
19.00										
30.00										

BORE HOLE IS TERMINATED AT 17.00 M. BGL.

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 17.00 M BELOW EXISTING GROUND LEVELS

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

SCALE : 1: 50
JOB NO. : 0300

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 1 OF 2	DATE	: 24/04/2011 To 28/04/2011
BORE HOLE NO.	: BH-15	METHOD	: ROTARY DRILLING
LOCATION	: --	CASING	: Up to 2.50m BGL
CO-ORDINATES	: E-588300, N-2440400	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
1.00	100 mm			1.00						
2.00			Silty Sand mixed with boulders	2.50	CORE			15	NIL	
3.00					CORE			20	NIL	
4.00				4.00						
5.00	NX			5.50	CORE			25	NIL	
6.00			Grey weathered Basalt		CORE			28	NIL	
7.00				7.00						
8.00				8.50	CORE			35	NIL	
9.00			Grey fractured Basalt	10.00	CORE			40	10	945
10.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

SCALE : 1: 50
JOB NO. : 0300

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CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 2 OF 2	DATE	: 24/04/2011 To 28/04/2011
BORE HOLE NO.	: BH-15	METHOD	: ROTARY DRILLING
LOCATION	: --	CASING	: Up to 2.50m BGL
CO-ORDINATES	: E-588300, N-2440400	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG /SQCM)
11.00	NX		Grey Basalt	11.50	CORE			50	12	
12.00				13.00	CORE			52	15	626
13.00										
14.00					CORE			65	55	
15.00				15.50	CORE			63	62	
16.00										
17.00				17.00	CORE			60	55	939
18.00				18.00	CORE			65	60	
19.00			BORE HOLE IS TERMINATED AT 18.00 M. BGL.							
30.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

SCALE : 1: 50
JOB NO. : 0300

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 1 OF 2	DATE	: 29/04/2011 To 02/05/2011
BORE HOLE NO.:	BH-16	METHOD	: ROTARY DRILLING
LOCATION	: --	CASING	: Up to 3.00m BGL
CO-ORDINATES:	E-587700, N-2440200	DIAMETER	: 100m m & NX
REDUCED LEVEL :	--	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG /SQCM)
1.00	100 mm			1.00						
2.00			Silty Sand mixed with boulders	2.00		CORE		1[illegible]	NIL	
3.00			3.00			CORE		15	NIL	
4.00	NX					CORE		22	NIL	
5.00			Grey weathered Basalt	4.5[illegible]						
6.00				6.00		CORE		30	NIL	
7.00				7.50		CORE		35	NIL	
8.00			Grey Fractured Basalt							
9.00				9.00		CORE		40	10	839
10.00				10.00		CORE		43	NIL	

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE

CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

SCALE : 1: 50
JOB NO. : 0300

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 2 OF 2	DATE	: 29/04/2011 To 02/05/2011
BORE HOLE NO.	: BH-16	METHOD	: ROTARY DRILLING
LOCATION	: --	CASING	: Up to 3.00m BGL
CO-ORDINATES	: E-587700, N-2440200	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
11.00	NX		Grey Basalt	11.50	CORE			45	NIL	
12.00				13.00	CORE			50	15	623
13.00										
14.00				14.50	CORE			60	51	
15.00										
16.00				16.00	CORE			63	55	764
17.00				17.00	CORE			63	55	
18.00				18.00	CORE			70	65	
			BORE HOLE IS TERMINATED AT 18.00 M. BGL.							
19.00										
30.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 1 OF 2	DATE	: 04/07/2011 To 15/07/2011
BORE HOLE NO.:	BH-17	METHOD	: ROTARY DRILLING
LOCATION	: --	CASING	: Up to 3.00m BGL
CO-ORDINATES:	E-587900, N-2440200	DIAMETER	: 100m m & NX
REDUCED LEVEL :	--	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG /SQCM)
1.00	100 mm		Silty sand mixed with Boulders	1.00				05	NIL	
2.00				2.00				08	NIL	
3.00				3.00				CORE	24	NIL
4.00	NX			4.50				CORE	23	09	668
5.00			Grey fractured Basalt							
6.00				6.00				CORE	30	17	
7.00				7.50				CORE	32	17	
9.00				9.00				CORE	33	18	463
10.00								CORE	33	17	

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 2 OF 2	DATE	: 04/07/2011 To 15/07/2011
BORE HOLE NO.	: BH-17	METHOD	: ROTARY DRILLING
LOCATION	: --	CASING	: Up to 3.00m BGL
CO-ORDINATES	: E-587900, N-2440200	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
11.00	NX		Grey Basalt	10.50	CORE			33	17	
12.00				12.00	CORE			37	20	
13.00				13.50	CORE			40	27	981
14.00				15.00	CORE			55	55	
15.00				16.50	CORE			57	57	
16.00				18.00	CORE			59	59	
17.00										
18.00										
			BORE HOLE IS TERMINATED AT 18.00 M. BGL.							
19.00										
30.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

SCALE : 1: 50
JOB NO. : 0300

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CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed

SHEET NO.	: 1 OF 2	DATE	: 07/07/2011 To 20/07/2011
BORE HOLE NO.	: BH-18	METHOD	: ROTARY DRILLING
LOCATION	: --	CASING	: Up to 3.00m BGL
CO-ORDINATES	: E-588100, N-2440200	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG /SQCM)
1.00	100 mm		Silty sand mixed with boulders	1.00				08	NIL	
2.00								10	NIL	
3.00	NX				CORE			25	NIL	
4.00			Grey Fractured Basalt	4.50	CORE			25	NIL	
5.00										
6.00				6.00	CORE			28	NIL	
7.00				7.50	CORE			27	13	1224
9.00			Grey Basalt	9.00	CORE			32	17	551
10.00					CORE			30	24	

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

SCALE : 1: 50
JOB NO. : 0300

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed

SHEET NO.	: 2 OF 2	DATE	: 07/07/2011 To 20/07/2011
BORE HOLE NO.	: BH-18	METHOD	: ROTARY DRILLING
LOCATION	: --	CASING	: Up to 3.00m BGL
CO-ORDINATES	: E-588100, N-2440200	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
11.00	NX		Grey Basalt	10.50	CORE			30	24	
12.00				12.00	CORE			37	28	1202
13.00				13.50	CORE			39	29	
14.00				15.00	CORE			55	55	
15.00				16.50	CORE			55	55	
16.00				18.00	CORE			60	60	
17.00										
18.00										
19.00			BORE HOLE IS TERMINATED AT 18.00 M. BGL.							
30.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 1 OF 2	DATE	: 02/05/2011 To 07/05/2011
BORE HOLE NO.	: BH-19	METHOD	: ROTARY DRILLING
LOCATION	: -	CASING	: Up to 3.50m BGL
CO-ORDINATES	: E-588300, N-2440200	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
1.00	100 mm		Black cotton soil							
2.00				1.50/ 2.10	SPT1	04 05 06 [illegible]	11			
				2.50						
3.00	NX				CORE			10	NIL	
				2.50						
4.00					CORE			15	NIL	
				4.50						
5.00			Grey [illegible] Basalt		CORE			40	NIL	
				5.50						
6.00					CORE			30	07	
7.00				7.00						
8.0					CORE			33	13	1106
			Grey Basalt	8.50						
9.00					CORE			43	20	
10.00				10.00						

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

SCALE : 1: 50
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CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 2 OF 2	DATE	: 02/05/2011 To 07/05/2011
BORE HOLE NO.	: BH-19	METHOD	: ROTARY DRILLING
LOCATION	: -	CASING	: Up to 3.5 m BGL
CO-ORDINATES	: E-588300, N-2440200	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
11.00	NX		Grey Basalt	11.50	CORE			45	17	1008
12.00				13.00	CORE			46	23	
13.00										
14.00				14.50	CORE			57	53	1258
15.00				16.00	CORE			63	53	
16.00				17.00	CORE			65	65	
17.00				18.00	CORE			65	52	
18.00										
			BORE HOLE IS TERMINATED AT 18.00 M. BGL.							
19.00										
30.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

SCALE : 1: 50
JOB NO. : 0300

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CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 1 OF 2	DATE	: 06/05/2011 To 10/05/2011
BORE HOLE NO.	: BH-20	METHOD	: ROTARY DRILLING
LOCATION	: -	CASING	: Up to 3.00m BGL
CO-ORDINATES	: E-588500, N-2440200	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
1.00	100 mm		Black cotton soil										
2.00				1.50/ 2.00	SPT1	05	08	15	5[illegible]	23			
3.00				3.00							CORE	30	NIL
4.00				[illegible].50							CORE	37	NIL
5.00											CORE	40	08
6.00	NX		Grey Basalt	6.00									
7.00				7.50							CORE	45	28
[illegible].00											CORE	41	19
9.00				9.00									
10.00											47	23	

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

SCALE : 1: 50
JOB NO. : 0300

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CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 2 OF 2	DATE	: 06/05/2011 To 10/05/2011
BORE HOLE NO.	: BH-20	METHOD	: ROTARY DRILLING
LOCATION	: -	CASING	: Up to 3.0m BGL
CO-ORDINATES	: E-588500, N-2440200	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
10.50					CORE			47	23	
11.00										
					CORE			48	30	
12.00				12.00						
13.00					CORE			56	50	
				13.50						
14.00	NX		Grey Basalt		CORE			57	57	
15.00				15.00						
16.00					CORE			60	55	
				16.50						
17.00					CORE			68	61	
18.00				18.00						
			BORE HOLE IS TERMINATED AT 18.00 M. BGL.							
19.00										
30.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

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CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 1 OF 2	DATE	: 08/05/2011 To 12/05/2011
BORE HOLE NO.:	BH-21	METHOD	: ROTARY DRILLING
LOCATION	: --	CASING	: Up to 2.50m BGL
CO-ORDINATES:	E-588700, N-2440200	DIAMETER	: 100m m & NX
REDUCED LEVEL :	--	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG /SQCM)
1.00	100 mm		Silty sand mixed with boulders	1.00						
2.00				2.50				05	NIL	
3.00	NX		Grey fractured Basalt	4.00	CORE			17	NIL	
4.00				5.50	CORE			23	NIL	
5.00				7.00	CORE			27	NIL	
6.00				8.50	CORE			37	NIL	
7.00				10.00	CORE			34	NIL	
8.00										
9.00										
10.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

SCALE : 1: 50
JOB NO. : 0300

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 2 OF 2	DATE	: 08/05/2011 To 12/05/2011
BORE HOLE NO.:	BH-21	METHOD	: ROTARY DRILLING
LOCATION	: --	CASING	: Up to 2.50m BGL
CO-ORDINATES:	E-588700, N-2440200	DIAMETER	: 100m m & NX
REDUCED LEVEL :	--	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG /SQCM)
11.00	NX		Grey Basalt	11.50	CORE			42	16	1167
12.00										
13.00				13.00	CORE			47	08	
14.00				14.50	CORE			53	53	1392
15.00										
16.00				16.00	CORE			60	53	
17.00				17.00	CORE			65	65	1205
18.00				18.00	CORE			69	69	
19.00			BORE HOLE IS TERMINATED AT 18.00 M. BGL.							
30.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 1 OF 2	DATE	: 24/05/2011 To 29/05/2011
BORE HOLE NO.	: BH-22	METHOD	: ROTARY DRILLING
LOCATION	: --	CASING	: Up to 2.50m BGL
CO-ORDINATES	: E-588900, N-2440200	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
1.00	100 mm		Silty sand mixed with boulders	1.00									
2.00											25	NIL	
2.50													
3.00			Grey Fractured Basalt		CORE						25	NIL	
4.00				4.00									
5.00					CORE						30	NIL	
5.50													
6.00	NX				CORE						40	NIL	
7.00				7.00									
8.00					CORE						45	10	616
8.50													
9.00					CORE						43	NIL	
10.00				10.00									

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO. : 2 OF 2	DATE : 24/05/2011 To 29/05/2011
BORE HOLE NO.: BH-22	METHOD : ROTARY DRILLING
LOCATION : --	CASING : Up to 2.50m BGL
CO-ORDINATES: E-588900, N-2440200	DIAMETER : 100m m & NX
REDUCED LEVEL : --	GROUND W. T. : NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG /SQCM)
11.00	NX		Grey Basalt	11.50	CORE			40	NIL	
12.00										
13.00				13.00	CORE			45	10	
14.00				14.50	CORE			55	51	743
15.00				15.50	CORE			60	55	
16.00										
17.00				17.00	CORE			65	60	
18.00				18.00	CORE			75	70	
19.00			BORE HOLE IS TERMINATED AT 18.00 M. BGL.							
30.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO. : 1 OF 2	DATE : 23/05/2011 To 29/05/2011
BORE HOLE NO.: BH-23	METHOD : ROTARY DRILLING
LOCATION : --	CASING : Up to 2.50m BGL
CO-ORDINATES: E-589100, N-2440200	DIAMETER : 100m m & NX
REDUCED LEVEL : --	GROUND W. T. : NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG /SQCM)
1.00	100 mm			1.00									
2.00			Silty sand mixed with boulders								27	NIL	
			2.50										
3.00													
4.00				4.00	CORE						30	NIL	
5.00	NX			5.50	CORE						33	NIL	
6.00			Grey fractured Basalt										
7.00				7.00	CORE						40	08	
8.00				8.50	CORE						43	16	1239
9.00													
10.00				10.00	CORE						40	NIL	

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

SCALE : 1: 50
JOB NO. : 0300

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 2 OF 2	DATE	: 23/05/2011 To 29/05/2011
BORE HOLE NO.:	BH-23	METHOD	: ROTARY DRILLING
LOCATION	: --	CASING	: Up to 2.50m BGL
CO-ORDINATES:	E-589100, N-2440200	DIAMETER	: 100m m & NX
REDUCED LEVEL :	--	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
11.00	NX		Grey Basalt	11.50	CORE			35	07	
12.00										
13.00				13.00	CORE			31	08	
14.00				14.50	CORE			53	51	2083
15.00										
16.00				16.00	CORE			55	55	
17.00				17.50	CORE			70	70	1037
18.00			BORE HOLE IS TERMINATED AT 17.50 M. BGL.							
19.00										
30.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 17.50 M BELOW EXISTING GROUND LEVELS

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 1 OF 2	DATE	: 08/07/2011 To 15/07/2011
BORE HOLE NO.	: BH-24	METHOD	: ROTARY DRILLING
LOCATION	: -	CASING	: Up to 2.50m BGL
CO-ORDINATES	: E-587700, N-2440000	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
1.00	100 mm										05	NIL	
2.00				1.50/ 1.70	SPT1	25	50	--	--	R			
3.00			Completely Weathered ROCK								07	NIL	
4.00				3.50/ 3.95	SPT2	55	--	--	--	R	07	NIL	
5.00	NX			4.50/ 4.57	SPT3	51	--	--	--	R	08	NIL	
6.00				6.00/ 6.05	SPT4	55	--	--	--	R			
7.00				7.50		CORE					30	NIL	
9.00			Brown Basalt	9.00		CORE					29	16	461
10.00						CORE					36	17	

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 2 OF 2	DATE	: 08/07/2011 To 15/07/2011
BORE HOLE NO.	: BH-24	METHOD	: ROTARY DRILLING
LOCATION	: -	CASING	: Up to 2.50m BGL
CO-ORDINATES	: E-587700, N-2440000	DIAMETER	: 100m m & NX
REDUCED LEVEL	--	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
				10.50	CORE			36	17	
11.00										
				12.00	CORE			39	25	727
12.00										
				13.00	CORE			45	36	
13.00										
14.00	NX		Brown Basalt		CORE			56	56	418
				14.50						
15.00				16.00	CORE			63	63	
16.00										
				17.00	CORE			56	56	
17.00										
18.00				18.00	CORE			65	65	
			BORE HOLE IS TERMINATED AT 18.00 M. BGL.							
19.00										
30.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

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PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 1 OF 2	DATE	: 02/07/2011 To 09/07/2011
BORE HOLE NO.	: BH-25	METHOD	: ROTARY DRILLING
LOCATION	: -	CASING	: Up to 2.00m BGL
CO-ORDINATES	: E-587900, N-2440000	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
1.00	100 mm										08	NIL	
2.00				1.50/ 1.75	SPT1	25	51	--	--	R			
3.00											07	NIL	
			Completely weathered rock	3.00/ 3.10	SPT2	55	--	--	--	R			
4.00											10	NIL	
				4.50/ 5.55	SPT3	51	--	--	--	R			
5.00													
6.00	NX										12	NIL	
				6.00/ 6.05	SPT4	50	--	--	--	R			
7.00				7.50		CORE					23	08	589
8.00			Grey fractured Basalt										
9.00				9.00		CORE					25	17	
10.00						CORE					35	16	

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE

CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 2 OF 2	DATE	: 02/07/2011 To 09/07/2011
BORE HOLE NO.	: BH-25	METHOD	: ROTARY DRILLING
LOCATION	: -	CASING	: Up to 2.00m BGL
CO-ORDINATES	: E-587900, N-2440000	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
11.00	NX		Grey Basalt	10.50	CORE			35	16	
12.00				12.00	CORE			43	25	856
13.00					CORE			45	30	
14.00										
15.00				15.00	CORE			60	60	972
16.00				16.00	CORE			54	54	
17.00				18.00	CORE			59	59	
19.00			BORE HOLE IS TERMINATED AT 18.00 M. BGL.							
30.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

SCALE : 1: 50
JOB NO. : 0300

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PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO. : 1 OF 2	DATE : 12/05/2011 To 17/05/2011
BORE HOLE NO.: BH-26	METHOD : ROTARY DRILLING
LOCATION : --	CASING : Up to 3.00m BGL
CO-ORDINATES: E-588100, N-2440000	DIAMETER : 100m m & NX
REDUCED LEVEL : --	GROUND W. T. : NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG /SQCM)
	100 mm		Black cotton soil 0.50							
1.00				1.50				30	NIL	
2.00			Silty sand mixed with boulders		CORE			24	NIL	
3.00			3.00							
4.00				4.50	CORE			30	NIL	
5.00	NX									
6.00				6.00	CORE			35	NIL	
7.00			Grey Fractured Basalt	7.50	CORE			33	12	
8.00										
9.00				9.00	CORE			35	NIL	778
10.00					CORE			30	NIL	

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

SCALE : 1: 50
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PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 2 OF 2	DATE	: 12/05/2011 To 17/05/2011
BORE HOLE NO.	: BH-26	METHOD	: ROTARY DRILLING
LOCATION	: --	CASING	: Up to 3.00m BGL
CO-ORDINATES	: E-588100, N-2440000	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
11.00	NX		Grey Basalt	10.50	CORE			30	NIL	
12.00				12.00	CORE			40	10	
13.00				13.50	CORE			50	15	
14.00										
15.00				15.00	CORE			61	52	655
16.00				16.50	CORE			60	55	
17.00										
18.00				18.00	CORE			65	60	
19.00			BORE HOLE IS TERMINATED AT 18.00 M. BGL.							
30.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

SCALE : 1: 50
JOB NO. : 0300

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PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 1 OF 2	DATE	: 08/05/2011 To 14/05/2011
BORE HOLE NO.	: BH-27	METHOD	: ROTARY DRILLING
LOCATION	: -	CASING	: Up to 3.0m BGL
CO-ORDINATES	: E-588300, N-2440000	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
1.00	100 mm		Black cotton soil										
2.00				1.50/ 2.10	SPT1	04	05	06	08	11			
3.00				3.00									
				3.00/ 3.45	SPT2	15	20	55	--	R			
4.00			Completely weathered rock										
				4.50/ 4.75	SPT3	16	51	--	--	R			
5.00				5.00									
6.00	NX			6.50		CORE					20	NIL	
7.00			Brown weathered Basalt										
				8.00		CORE					37	16	262
9.00				9.50		CORE					37	NIL	
10.00			Grey Basalt			CORE					33	10	

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

SCALE : 1: 50
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PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 2 OF 2	DATE	: 08/05/2011 To 14/05/2011
BORE HOLE NO.	: BH-27	METHOD	: ROTARY DRILLING
LOCATION	: -	CASING	: Up to 3.0m BGL
CO-ORDINATES	: E-588300, N-2440000	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
11.00	NX		Grey Basalt	11.00	CORE			33	10	
12.00				12.50	CORE			43	15	
13.00				14.00	CORE			50	40	1148
14.00				15.50	CORE			51	51	
15.00				16.50	CORE			60	54	1225
16.00				18.00	CORE			57	57	
17.00										
18.00										
19.00			BORE HOLE IS TERMINATED AT 18.00 M. BGL.							
30.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

SCALE : 1: 50
JOB NO. : 0300

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CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 1 OF 2	DATE	: 23/05/2011 To 26/05/2011
BORE HOLE NO.	: BH-28	METHOD	: ROTARY DRILLING
LOCATION	: --	CASING	: Up to 3.00m BGL
CO-ORDINATES	: E-588700, N-2440000	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
1.00	100 mm		Black cotton soil 1.00										
2.00			Silty sand mixed with Boulders 2.00	2.00	CORE						15	NIL	
3.00			3.00		CORE						14	NIL	
4.00	NX		Grey Fractured Basalt	4.50	CORE						30	NIL	1119
5.00				6.00	CORE						33	NIL	
6.00				7.50	CORE						40	NIL	
7.00				9.00	CORE						39	NIL	1268
8.00				10.00	CORE						40	NIL	
9.00													
10.00													

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

SCALE : 1: 50
JOB NO. : 0300

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO. : 2 OF 2	DATE : 23/05/2011 To 26/05/2011
BORE HOLE NO.: BH-28	METHOD : ROTARY DRILLING
LOCATION : --	CASING : Up to 3.00m BGL
CO-ORDINATES: E-588700, N-2440000	DIAMETER : 100m m & NX
REDUCED LEVEL : --	GROUND W. T. : NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
11.00	NX		Grey Basalt	11.50	CORE			45	NIL	
12.00										
				13.00	CORE			47	15	464
13.00										
14.00				14.50	CORE			61	55	
15.00				16.00	CORE			65	57	
16.00										
17.00				17.00	CORE			67	60	
18.00				18.00	CORE			70	65	
19.00			BORE HOLE IS TERMINATED AT 18.00 M. BGL.							
30.00										

SPT N =STANDARD PENETRATION TEST VALUE — CR = CORE RECOVERY

UDS = UNDISTURBED SOIL SAMPLE — RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

SCALE : 1: 50

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

JOB NO. : 0300

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 1 OF 2	DATE	: 30/05/2011 To 03/06/2011
BORE HOLE NO.	: BH-29	METHOD	: ROTARY DRILLING
LOCATION	: --	CASING	: Up to 2.50m BGL
CO-ORDINATES	: E-589100, N-2440000	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG /SQCM)
1.00	100 mm		Silty Sand 1.00							
2.00	NX		Grey Fractured Basalt	2.50	CORE			20	NIL	
3.00										
4.00				4.00	CORE			30	NIL	
5.00				5.50	CORE			33	NIL	
6.00										
7.00				7.00	CORE			40	NIL	
8.00				8.50	CORE			42	12	1055
9.00										
10.00				10.00	CORE			45	10	

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO. : 2 OF 2	DATE : 30/05/2011 To 03/06/2011
BORE HOLE NO.: BH-29	METHOD : ROTARY DRILLING
LOCATION : --	CASING : Up to 2.50m BGL
CO-ORDINATES: E-589100, N-2440000	DIAMETER : 100m m & NX
REDUCED LEVEL : --	GROUND W. T. : NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG /SQCM)
11.00	NX		Grey Basalt	11.50	CORE			40	13	1061
12.00				13.00	CORE			45	20	
13.00										
14.00				14.50	CORE			63	55	1280
15.00				16.00	CORE			60	53	
16.00				17.00	CORE			65	60	
17.00				18.00	CORE			68	65	
18.00										
19.00			BORE HOLE IS TERMINATED AT 18.00 M. BGL.							
30.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 1 OF 2	DATE	: 02/07/2011 To 09/07/2011
BORE HOLE NO.	: BH-30	METHOD	: ROTARY DRILLING
LOCATION	: --	CASING	: Up to 3.00m BGL
CO-ORDINATES	: E-587700, N-2439800	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
1.00	100 mm		Silty sand	1.50/ 2.10	SPT1	09	15	15	20	23			
2.00													
3.00				3.00									
				3.00/ 3.45	SPT2	55	--	--	--	R			
4.00											CORE	05	NIL
				4.50									
5.00											CORE	07	NIL
6.00	NX		Completely weathered rock	6.00									
				6.00/ 6.05	SPT3	50	--	--	--	R			
7.00											CORE	08	NIL
				7.50									
8.00											CORE	10	NIL
9.00				9.00									
10.00			Grey Basalt								CORE	47	39

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE

CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

SCALE : 1: 50
JOB NO. : 0300

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO. : 2 OF 2	DATE : 02/07/2011 To 09/07/2011
BORE HOLE NO.: BH-30	METHOD : ROTARY DRILLING
LOCATION : --	CASING : Up to 3.00m BGL
CO-ORDINATES: E-587700, N-2439800	DIAMETER : 100m m & NX
REDUCED LEVEL : --	GROUND W. T. : NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
11.00	NX		Grey basal	10.50	CORE			47	39	
12.00				12.00	CORE			42	37	
13.00				13.00	CORE			50	30	
14.00				14.50	CORE			60	57	
15.00				16.00	CORE			65	60	
16.00				17.00	CORE			57	57	
17.00				18.00	CORE			63	63	
19.00			BORE HOLE IS TERMINATED AT 18.00 M. BGL.							
30.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

SCALE : 1: 50
JOB NO. : 0300

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CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 1 OF 2	DATE	: 27/06/2011 To 04/07/2011
BORE HOLE NO.	: BH-31	METHOD	: ROTARY DRILLING
LOCATION	: --	CASING	: Up to 3.00m BGL
CO-ORDINATES	: E-587900, N-2439800	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG /SQCM)
1.00	100 mm												
2.00			Silty sand	1.50/ 1.80	SPT1	15	25	55		R			
3.00			3.00	3.00/ 3.45	SPT2	51	--	--	--	R			
4.00				4.50							CORE	08	NIL
5.00													
6.00			Completely weathered rock	6.00							CORE	07	NIL
7.00	NX			6.00/ 6.07	SPT3	50	--	--	--	R			
				7.50							CORE	10	NIL
8.00				8.50							CORE	09	NIL
9.00													
10.00				10.00							CORE	12	NIL

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

SCALE : 1: 50
JOB NO. : 0300

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CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 2 OF 2	DATE	: 27/06/2011 To 04/07/2011
BORE HOLE NO.	: BH-31	METHOD	: ROTARY DRILLING
LOCATION	: --	CASING	: Up to 3.00m BGL
CO-ORDINATES	: E-587900, N-2439800	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG /SQCM)
11.00	NX		Grey Basalt	11.50	CORE			43	25	779
12.00										
13.00				13.00	CORE			50	40	
14.00				14.50	CORE			57	53	418
15.00				15.50	CORE			58	58	
16.00				16.50	CORE			61	61	
17.00				18.00	CORE			63	58	863
19.00			BORE HOLE IS TERMINATED AT 18.00 M. BGL.							
30.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 1 OF 2	DATE	: 18/05/2011 To 22/05/2011
BORE HOLE NO.	: BH-32	METHOD	: ROTARY DRILLING
LOCATION	: -	CASING	: Up to 5.50m BGL
CO-ORDINATES	: E-588100, N-2439800	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
1.00	100 mm		Black cotton soil	1.50/ 2.10	SPT1	04	04	04	05	09			
3.00				3.00/ 3.60	SPT2	03	07	09	12	16			
4.00			Silty Sand										
5.00				4.50/ 5.10	SPT3	05	09	10	12	19			
6.00				6.00									
7.00			Completely weathered rock	6.00/ 6.10	SPT4	51	--	--	--	R			
				7.50/ 7.60	SPT5	55	--	--	--	R			
9.00			Grey fractured Basalt	8.00									
				9.50		CORE					33	NIL	
10.00						CORE					43	NIL	

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE

CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO. : 2 OF 2	DATE : 18/05/2011 To 22/05/2011
BORE HOLE NO.: BH-32	METHOD : ROTARY DRILLING
LOCATION : -	CASING : Up to 5.5m BGL
CO-ORDINATES: E-588100, N-2439800	DIAMETER : 100m m & NX
REDUCED LEVEL : --	GROUND W. T. : NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
11.00	NX		Grey fractured basalt	11.00	CORE			43	NIL	
12.00				12.50	CORE			47	08	839
13.00				13.50	CORE			42	10	
14.00										
15.00				15.00	CORE			57	57	939
16.00				16.50	CORE			56	56	789
17.00										
18.00				18.00	CORE			60	60	979
19.00			BORE HOLE IS TERMINATED AT 18.00 M. BGL.							
30.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE

CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

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CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 1 OF 2	DATE	: 10/05/2011 To 16/05/2011
BORE HOLE NO.	: BH-33	METHOD	: ROTARY DRILLING
LOCATION	: -	CASING	: Up to 3.00 m BGL
CO-ORDINATES	: E-588300, N-2439800	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
1.00	100 mm		Black cotton soil							
2.00				1.50/ 2.10	SPT1	01 03 05 08 08				
2.50										
3.00					CORE			13	NIL	
4.00				4.00						
5.00			Grey weathered Basalt		CORE			20	NIL	
5.50				5.50						
6.00					CORE			27	NIL	
7.00	NX			7.00						
8.00					CORE			26	NIL	
8.50										
9.00			Grey Fractured Basalt		CORE			30	NIL	
10.00				10.00						

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

SCALE : 1: 50
JOB NO. : 0300

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CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO. : 2 OF 2	DATE : 10/05/2011 To 16/05/2011
BORE HOLE NO.: BH-33	METHOD : ROTARY DRILLING
LOCATION :	CASING : Up to 3.00 m BGL
CO-ORDINATES: E-588300, N-2439800	DIAMETER : 100m m & NX
REDUCED LEVEL : --	GROUND W. T. : NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG /SQCM)
11.00	NX		Grey Basal	11.50	CORE			36	12	
12.00				13.00	CORE			40	27	1439
14.00				14.50	CORE			53	53	
15.00				16.00	CORE			60	60	686
16.00				17.00	CORE			65	65	
17.00				18.00	CORE			75	75	687
19.00			BORE HOLE IS TERMINATED AT 18.00 M. BGL.							
30.00										

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SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 1 OF 2	DATE	: 30/05/2011 To 03/06/2011
BORE HOLE NO.	: BH-34	METHOD	: ROTARY DRILLING
LOCATION	: -	CASING	: Up to 3.00m BGL
CO-ORDINATES	: E-588900, N-2439800	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm				SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
1.00	100 mm		Brown silty Sand										
2.00				1.50/ 2.00	SPT1	08	17	51	--	R			
3.00	NX		Grey Fractured Basalt	3.50	CORE						27	NIL	
4.00													
5.00				5.00	CORE						31	NIL	
6.00				6.50	CORE						33	NIL	
7.00													
8.00				8.00	CORE						37	NIL	
9.00				9.50	CORE						36	NIL	
10.00											32	08	1559

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO. : 2 OF 2	DATE : 30/05/2011 To 03/06/2011
BORE HOLE NO.: BH-34	METHOD : ROTARY DRILLING
LOCATION : -	CASING : Up to 3.0m BGL
CO-ORDINATES: E-588900, N-2439800	DIAMETER : 100m m & NX
REDUCED LEVEL : --	GROUND W. T. : NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
11.00	NX		Grey Basalt	11.00	CORE			32	08	
12.00				12.50	CORE			40	15	
13.00				13.50	CORE			52	22	
14.00										
15.00				15.00	CORE			53	53	1555
16.00				16.50	CORE			65	59	
17.00										
18.00				18.00	CORE			70	61	735
19.00	BORE HOLE IS TERMINATED AT 18.00 M. BGL.									
30.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 1 OF 2	DATE	: 31/05/2011 To 08/06/2011
BORE HOLE NO.	: BH-35	METHOD	: ROTARY DRILLING
LOCATION	: -	CASING	: Up to 2.50m BGL
CO-ORDINATES	: E-589300, N-2439800	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
	100 mm		Brown silty Sand 0.50										
1.00	NX										07	NIL	
2.00				1.50/ 1.75	SPT1	30	51	--	--	R			
3.00											10	NIL	
4.00			Completely weathered rock	3.00/ 3.10	SPT2	51	--	--	--	R	08	NIL	
5.00				4.50 4.65	SPT3	51	--	--	--	R			
6.00											07	NIL	
7.00				6.00 6.05	SPT4	51	--	--	--	R	05	NIL	
8.00				7.50 7.55	SPT5	55	--	--	--	R			
9.00			9.00		CORE						25	NIL	
10.00			Grey fractured basalt		CORE						31	09	735

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

SCALE : 1: 50
JOB NO. : 0300

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO. : 2 OF 2	DATE : 31/05/2011 To 08/06/2011
BORE HOLE NO.: BH-35	METHOD : ROTARY DRILLING
LOCATION : -	CASING : Up to 2.50m BGL
CO-ORDINATES: E-589300, N-2439800	DIAMETER : 100m m & NX
REDUCED LEVEL : --	GROUND W. T. : NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG /SQCM)
11.00	NX		Grey Basalt	10.50	CORE			31	09	
12.00				12.00	CORE			37	21	
13.00				13.50	CORE			40	25	861
14.00				15.00	CORE			57	53	
15.00				16.50	CORE			67	58	1103
16.00				18.00	CORE			70	53	
17.00										
18.00										
19.00			BORE HOLE IS TERMINATED AT 18.00 M. BGL.							
30.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 1 OF 2	DATE	: 25/06/2011 to 02/07/2011
BORE HOLE NO.:	BH-36	METHOD	: ROTARY DRILLING
LOCATION	: -	CASING	: Up to 3.00m BGL
CO-ORDINATES:	E-587700, N-2439600	DIAMETER	: 100m m & NX
REDUCED LEVEL :	--	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG /SQCM)
1.00	100 mm		Silty Sand										
2.00			2.00	1.50/ 1.55	SPT1	05 55	-- --	-- --	-- --	N			
3.00				3.00							CORE	30	NIL
4.00				4.50							CORE	25	NIL
5.00													
6.00	NX		Grey Fractured Basalt	6.00							CORE	30	15
7.00				7.50							CORE	33	17	1028
9.00				9.00							CORE	37	20
10.00											CORE	38	28	689

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO. : 2 OF 2	DATE : 25/06/2011 to 02/07/2011
BORE HOLE NO.: BH-36	METHOD : ROTARY DRILLING
LOCATION : -	CASING : Up to 3.00m BGL
CO-ORDINATES: E-587700, N-2439600	DIAMETER : 100m m & NX
REDUCED LEVEL :	GROUND W. T. : NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
11.00	NX		Grey Basalt	10.50	CORE			38	28	
12.00				12.00	CORE			40	24	
13.00				13.50	CORE			43	23	603
14.00										
15.00				15.00	CORE			56	50	
16.00				16.50	CORE			57	57	
17.00				18.00	CORE			61	61	
19.00			BORE HOLE IS TERMINATED AT 18.00 M. BGL.							
30.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 1 OF 2	DATE	: 23/06/2011 to 02/07/2011
BORE HOLE NO.	: BH-37	METHOD	: ROTARY DRILLING
LOCATION	: -	CASING	: Up to 3.00m BGL
CO-ORDINATES	: E-587900, N-2439600	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
1.00	100 mm		Brown Silty Sand							
2.00				1.50/ 1.70	SPT1	35 51 --	R			
				2.50						
3.00										
4.00				4.00				CORE	23	NIL
5.00				5.50				CORE	25	09
6.00	NX									
7.00			Grey Fractured Basalt	7.00				CORE	29	15
8.00				8.50				CORE	30	17
9.00										
10.00				10.00				CORE	35	23

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

SCALE : 1: 50
JOB NO. : 0300

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CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 2 OF 2	DATE	: 23/06/2011 to 02/07/2011
BORE HOLE NO.:	BH-37	METHOD	: ROTARY DRILLING
LOCATION	: -	CASING	: Up to 3.00m BGL
CO-ORDINATES:	E-587900, N-2439600	DIAMETER	: 100m m & NX
REDUCED LEVEL :	--	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG /SQCM)
11.00	NX		Grey Basalt	11.50	CORE			37	22	
12.00										
13.00				13.00	CORE			41	21	1015
14.00				14.50	CORE			55	55	
15.00										
16.00				16.00	CORE			60	55	1313
17.00				17.00	CORE			62	62	
18.00				18.00	CORE			66	66	
19.00			BORE HOLE IS TERMINATED AT 18.00 M. BGL.							
30.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

SCALE : 1: 50
JOB NO. : 0300

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CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 1 OF 2	DATE	: 17/05/2011 To 22/05/2011
BORE HOLE NO.	: BH-38	METHOD	: ROTARY DRILLING
LOCATION	: -	CASING	: Up to 6.00m BGL
CO-ORDINATES	: E-588100, N-2439600	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
1.00													
2.00				1.50/ 2.10	SPT1	07	08	07	10	15			
3.00													
4.00	100 mm		Brown silty Sand	3.50/ 4.60	SPT2	05	06	08	09	14			
5.00				4.50/ 5.10	SPT3	08	10	15	25	25			
6.00				6.00/ 6.25	SPT4	20	51	--	--	R			
				6.50									
7.00													
				8.00		CORE					25	NIL	
9.00	NX		Grey Fractured Basalt										
				9.50		CORE					31	NIL	
10.00											33	NIL	

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO. : 2 OF 2	DATE : 17/05/2011 To 22/05/2011
BORE HOLE NO.: BH-38	METHOD : ROTARY DRILLING
LOCATION : -	CASING : Up to 6.0m BGL
CO-ORDINATES: E-588100, N-2439600	DIAMETER : 100m m & NX
REDUCED LEVEL : --	GROUND W. T. : NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
11.00				11.00	CORE			33	NIL	
12.00				12.50	CORE			40	10	
13.00					CORE			57	53	
14.00	NX		Grey Basalt	14.00						
15.00				15.50	CORE			60	55	1062
16.00										
17.00				17.00	CORE			65	58	1194
18.00				18.00	CORE			70	60	626
19.00			BORE HOLE IS TERMINATED AT 18.00 M. BGL.							
30.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE

CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 1 OF 2	DATE	: 23/05/2011 To 30/05/2011
BORE HOLE NO.	: BH-39	METHOD	: ROTARY DRILLING
LOCATION	: -	CASING	: Up to 4.50m BGL
CO-ORDINATES	: E-588300, N-2439600	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
1.00													
2.00				1.50/ 2.10	SPT1	06	08	08	10	16			
3.00	100 mm		Brown silty Sand	3.00/ 3.45	SPT2	08	09	10	15	19			
4.00													
5.00				4.50/ 4.80	SPT3	30	51	--	--	R			
				5.00									
6.00				6.50		CORE					20	NIL	
7.00													
8.00	NX		Grey Basalt	8.00		CORE					25	NIL	
9.00				9.00		CORE					30	NIL	
10.00				10.00		CORE					40	NIL	

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE

CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

SCALE : 1: 50
JOB NO. : 0300

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO. : 2 OF 2	DATE : 23/05/2011 To 30/05/2011
BORE HOLE NO.: BH-39	METHOD : ROTARY DRILLING
LOCATION : -	CASING : Up to 4.50m BGL
CO-ORDINATES: E-588300, N-2439600	DIAMETER : 100m m & NX
REDUCED LEVEL : --	GROUND W. T. : NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG /SQCM)
11.00	NX		Grey Basal	11.50	CORE			45	NIL	
12.00				13.00	CORE			50	15	723
14.00				14.50	CORE			55	55	1261
15.00				16.00	CORE			60	57	1064
16.00				17.00	CORE			63	53	
17.00				18.00	CORE			70	65	
19.00			BORE HOLE IS TERMINATED AT 18.00 M. BGL.							
30.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

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CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 1 OF 2	DATE	: 31/05/2011 To 08/06/2011
BORE HOLE NO.	: BH-40	METHOD	: ROTARY DRILLING
LOCATION	: -	CASING	: Up to 3.00m BGL
CO-ORDINATES	: E-588700, N-2439600	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
1.00	100 mm		Completely weathered rock										
2.00				1.50/ 1.55	SPT1	51	--	--	--	R			
3.00			3.00										
				3.00/ 3.07	SPT2	55	--	--	--	R			
4.00				4.50	CORE						13	NIL	
5.00													
6.00				6.00	CORE						23	NIL	
7.00	NX		Grey Fractured Basalt	7.50	CORE						24	10	1135
8.00													
9.00				9.00	CORE						27	17	
10.00			Grey Basalt		CORE						33	23	1145

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE

CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO. : 2 OF 2	DATE : 31/05/2011 To 08/06/2011
BORE HOLE NO.: BH-40	METHOD : ROTARY DRILLING
LOCATION : -	CASING : Up to 3.00m BGL
CO-ORDINATES: E-588700, N-2439600	DIAMETER : 100m m & NX
REDUCED LEVEL : --	GROUND W. T. : NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
	NX		Grey Basalt	10.50	CORE			33	23	
11.00										
					CORE			37	21	
12.00				12.00						
				13.00	CORE			40	25	793
13.00										
				14.50	CORE			54	50	
14.00										
				16.00	CORE			53	53	1327
15.00										
				17.00	CORE			60	60	
16.00										
				18.00	CORE			67	67	
17.00										
18.00										
19.00			BORE HOLE IS TERMINATED AT 18.00 M. BGL.							
30.00										

SPT N =STANDARD PENETRATION TEST VALUE — CR = CORE RECOVERY

UDS = UNDISTURBED SOIL SAMPLE — RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

SCALE : 1: 50

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

JOB NO. : 0300

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO. : 1 OF 2	DATE : 28/05/2011 to 06/06/2011
BORE HOLE NO.: BH-41	METHOD : ROTARY DRILLING
LOCATION : -	CASING : Up to 2.50m BGL
CO-ORDINATES: E-589100, N-2439600	DIAMETER : 100m m & NX
REDUCED LEVEL : --	GROUND W. T. : NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG /SQCM)
1.00	100 mm		Silty sand										
				1.50									
2.00				1.50/ 1.55	SPT1	55	--	--	--	R			
					CORE						17	NIL	
3.00				3.00									
4.00					CORE						20	NIL	
				4.50									
5.00					CORE						27	19	
6.00				6.00									
	NX		Grey Fractured Basalt		CORE						33	11	911
7.00				7.50									
8.00					CORE						33	18	
9.00				9.00									
					CORE						37	20	706
10.00													

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

SCALE : 1: 50

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

JOB NO. : 0300

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO. : 2 OF 2	DATE : 28/05/2011 to 06/06/2011
BORE HOLE NO.: BH-41	METHOD : ROTARY DRILLING
LOCATION : -	CASING : Up to 2.50m BGL
CO-ORDINATES: E-589100, N-2439600	DIAMETER : 100m m & NX
REDUCED LEVEL : --	GROUND W. T. : NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
11.00	NX		Grey Basalt	10.50	CORE			37	20	
12.00				12.00	CORE			42	20	
13.00				13.50	CORE			43	30	1383
14.00				15.00	CORE			58	53	
15.00				16.50	CORE			57	57	
16.00				18.00	CORE			61	61	
17.00										
18.00										
19.00	BORE HOLE IS TERMINATED AT 18.00 M. BGL.									
30.00										

SPT N =STANDARD PENETRATION TEST VALUE — CR = CORE RECOVERY

UDS = UNDISTURBED SOIL SAMPLE — RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

SCALE : 1: 50

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

JOB NO. : 0300

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 1 OF 2	DATE	: 04/06/2011 To 10/06/2011
BORE HOLE NO.:	BH-42	METHOD	: ROTARY DRILLING
LOCATION	: --	CASING	: Up to 2.50m BGL
CO-ORDINATES:	E-589500, N-2439600	DIAMETER	: 100m m & NX
REDUCED LEVEL :	--	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG /SQCM)
1.00	100 mm		Silty Sand 1.00										
2.00			Grey completely weathered rock	1.50/ 1.55	SPT1	50	--	--	--	R	09	NIL	
3.00													
4.00				3.00/ 3.60	SPT2	50	--	--	--	R	05	NIL	
5.00	NX			4.00	CORE						11	NIL	
6.00				5.00	CORE						28	NIL	
7.00			Grey Fractured Basalt	6.00	CORE						30	NIL	
8.00				7.50	CORE						35	20	890
9.00				9.00	CORE						43	22	
10.00													

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO. : 2 OF 2	DATE : 04/06/2011 To 10/06/2011
BORE HOLE NO.: BH-42	METHOD : ROTARY DRILLING
LOCATION : --	CASING : Up to 2.50m BGL
CO-ORDINATES: E-589500, N-2439600	DIAMETER : 100m m & NX
REDUCED LEVEL : --	GROUND W. T. : NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG /SQCM)
				10.50	CORE			43	22	
11.00										
				12.00	CORE			43	17	
12.00										
					CORE			46	33	267
13.00				13.50						
	NX		Grey fractured Basalt							
14.00					CORE			60	53	662
15.00				15.00						
					CORE			61	57	757
16.00				16.50						
17.00					CORE			67	58	
18.00				18.00						
			BORE HOLE IS TERMINATED AT 18.00 M. BGL.							
19.00										
30.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 1 OF 2	DATE	: 20/06/2011 To 26/06/2011
BORE HOLE NO.	: BH-43	METHOD	: ROTARY DRILLING
LOCATION	: --	CASING	: Up to 3.00m BGL
CO-ORDINATES	: E-585900, N-2441200	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
1.00	100 mm		Silty sand mixed with boulders	1.50				10	NIL	
2.00								10	NIL	
3.00			3.00							
4.00	NX		Grey fractured Basalt	4.50	CORE			27	NIL	
5.00										
6.00				6.00	CORE			30	NIL	
7.00				7.50	CORE			40	22	959
8.00										
9.00				9.00	CORE			43	27	
10.00					CORE			39	29	1202

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 2 OF 2	DATE	: 20/06/2011 To 26/06/2011
BORE HOLE NO.	: BH-43	METHOD	: ROTARY DRILLING
LOCATION	: --	CASING	: Up to 3.00m BGL
CO-ORDINATES	: E-585900, N-2441200	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG /SQCM)
11.00	NX		Grey Basalt	10.50	CORE			39	29	
12.00				12.00	CORE			45	30	
13.00				13.50	CORE			45	33	
14.00										
15.00				15.00	CORE			60	55	830
16.00				16.50	CORE			57	57	
17.00										
18.00				18.00	CORE			60	56	
19.00			BORE HOLE IS TERMINATED AT 18.00 M. BGL.							
30.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 1 OF 2	DATE	: 09/07/2011 To 16/07/2011
BORE HOLE NO.	: BH-44	METHOD	: ROTARY DRILLING
LOCATION	: --	CASING	: Up to 3.00m BGL
CO-ORDINATES	: E-585900, N-2440800	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
1.00	100 mm		Silty sand mixed with boulders	1.50				10	NIL	
2.00										
3.00				3.00		CORE		30	NIL	
4.00			Grey fractured Basalt	4.50		CORE		32	10	
5.00	NX									
6.00				6.00		CORE		33	10	
7.00				7.50		CORE		40	25	
8.00			Grey Basalt							
9.00				9.00		CORE		42	24	
10.00						CORE		37	27	1108

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 2 OF 2	DATE	: 09/07/2011 To 16/07/2011
BORE HOLE NO.	: BH-44	METHOD	: ROTARY DRILLING
LOCATION	: --	CASING	: Up to 3.00m BGL
CO-ORDINATES	: E-585900, N-2440800	DIAMETER	: 100m m & NX
REDUCED LEVEL	: --	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
11.00	NX		Grey, BASALT	10.50	CORE			37	27	
12.00				12.00	CORE			40	23	
13.00				13.50	CORE			45	33	
14.00										
15.00				15.00	CORE			68	57	865
16.00				16.50	CORE			56	56	
17.00										
18.00				18.00	CORE			61	56	
19.00			BORE HOLE IS TERMINATED AT 18.00 M. BGL.							
30.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

SCALE : 1: 50
JOB NO. : 0300

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO.	: 1 OF 2	DATE	: 15/06/2011 To 22/06/2011
BORE HOLE NO.:	BH-45	METHOD	: ROTARY DRILLING
LOCATION	: -	CASING	: Up to 3.50m BGL
CO-ORDINATES:	E-586700, N-2440800	DIAMETER	: 100m m & NX
REDUCED LEVEL :	--	GROUND W. T.	: NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG /SQCM)
1.00											05	NIL	
2.00				1.50/ 1.75	SPT1	35	51	--	--	R			
3.00			Completely Weathered Rock								10	NIL	
4.00				3.00/ 3.10	SPT2	55	--	--	--	R			
			4.50								08	NIL	
5.00	NX			4.50 4.55	SPT3	51	--	--	--	R			
6.00				6.50	CORE						17	NIL	
7.00			Reddish brown weathered Basalt rock	7.50	CORE						30	NIL	
8.00					CORE						30	NIL	
9.00				9.00									
10.00					CORE						37	17	208

SPT N =STANDARD PENETRATION TEST VALUE — CR = CORE RECOVERY

UDS = UNDISTURBED SOIL SAMPLE — RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

SCALE : 1: 50

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

JOB NO. : 0300

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO. : 2 OF 2	DATE : 15/06/2011 To 22/06/2011
BORE HOLE NO.: BH-45	METHOD : ROTARY DRILLING
LOCATION : -	CASING : Up to 3.50m BGL
CO-ORDINATES: E-586700, N-2440800	DIAMETER : 100m m & NX
REDUCED LEVEL : --	GROUND W. T. : NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG /SQCM)
10.50	NX		Grey Basalt	10.50	CORE			37	17	
11.00										
				12.00	CORE			40	24	
12.00										
13.00				13.50	CORE			43	31	355
14.00										
				15.00	CORE			57	50	
15.00										
16.00				16.50	CORE			64	64	576
17.00										
				18.00	CORE			57	53	
18.00										
19.00	BORE HOLE IS TERMINATED AT 18.00 M. BGL.									
30.00										

SPT N =STANDARD PENETRATION TEST VALUE — CR = CORE RECOVERY

UDS = UNDISTURBED SOIL SAMPLE — RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

SCALE : 1: 50

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

JOB NO. : 0300

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO. : 1 OF 2	DATE : 01/07/2011 To 14/07/2011
BORE HOLE NO.: BH-46	METHOD : ROTARY DRILLING
LOCATION : -	CASING : Up to 3.50m BGL
CO-ORDINATES: E-586700, N-2441400	DIAMETER : 100m m & NX
REDUCED LEVEL : --	GROUND W. T. : NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
1.00	100 mm		Black cotton soil 0.50										
2.00				1.50/ 1.60	SPT1	51	--	--	--	R			
3.00			Completely weathered rock										
				3.00/ 3.05	SPT2	55	--	--	--	R			
4.00													
5.00			5.00	4.50/ 4.60	SPT3	55	--	--	--	R			
6.00	NX		Brown Basalt	6.50	CORE						30	13	
7.00				8.00	CORE						35	18	
8.00													
9.00				9.50	CORE						35	18	
10.00					CORE						33	17	

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO. : 2 OF 2	DATE : 01/07/2011 To 14/07/2011
BORE HOLE NO.: BH-46	METHOD : ROTARY DRILLING
LOCATION : -	CASING : Up to 3.50m BGL
CO-ORDINATES: E-586700, N-2441400	DIAMETER : 100m m & NX
REDUCED LEVEL : --	GROUND W. T. : NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG /SQCM)
11.00	NX		Grey Basalt	11.00	CORE			33	17	
12.00				12.00	CORE			45	35	
13.00				13.00	CORE			48	28	
14.00				14.50	CORE			56	50	
15.00										
16.00				16.00	CORE			60	60	
17.00				17.50	CORE			61	61	
18.00	BORE HOLE IS TERMINATED AT 17.50 M. BGL.									
19.00										
30.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 17.50 M BELOW EXISTING GROUND LEVELS

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO. : 1 OF 2	DATE : 03/07/2011 to 12/07/2011
BORE HOLE NO.: BH-47	METHOD : ROTARY DRILLING
LOCATION : -	CASING : Up to 3.00m BGL
CO-ORDINATES: E-587100, N-2441200	DIAMETER : 100m m & NX
REDUCED LEVEL : --	GROUND W. T. : NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
1.00	100 mm		Silty sand mixed with boulders	0.50						
				1.50				05	NIL	
2.00					CORE			08	NIL	
3.00				3.00						
4.00	NX		Grey fractured Basalt		CORE			25	NIL	
				4.50						
5.00					CORE			27	10	532
6.00				6.00						
7.00					CORE			33	17	
				7.50						
8.00					CORE			33	15	1258
9.00				9.00						
					CORE			37	17	
10.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUED ON NEXT PAGE

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC LIMITED

PROJECT : Preliminary Geotechnical Investigation for main plant, and allied areas, for proposed Super Thermal Power Project (2 x 660 MW) near village Selda, Town Sanawad in Distt. Khargone, M.P.

SHEET NO. : 2 OF 2	DATE : 03/07/2011 to 12/07/2011
BORE HOLE NO.: BH-47	METHOD : ROTARY DRILLING
LOCATION : -	CASING : Up to 3.00m BGL
CO-ORDINATES: E-587100, N-2441200	DIAMETER : 100m m & NX
REDUCED LEVEL : --	GROUND W. T. : NMW

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
11.00	NX		Grey Basalt	10.50	CORE			37	17	
12.00				12.00	CORE			39	25	
13.00				13.50	CORE			41	20	
14.00				15.00	CORE			55	50	1050
15.00				16.50	CORE			61	53	
16.00				18.00	CORE			63	63	
17.00										
18.00										
19.00			BORE HOLE IS TERMINATED AT 18.00 M. BGL.							
30.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 18.00 M BELOW EXISTING GROUND LEVELS

SCALE : 1: 50
JOB NO. : 0300

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT ; NTPC

PROJECT : SOIL INVESTIGATION FOR PROPOSE CONSTRUCTION OF INTAKE WELL FOR STPP KHARGONE AT THE SITE OF RESERVOIR OF OMKARESHWAR DAM

SHEET NO. : 1 OF 1	DATE : 19/04/2012 TO 01/05/2012
BORE HOLE NO: BHW-1	METHOD : ROTARY DRILLING
GROUND R.L. : —	CASING : NX 5.50 M BBL
GROUND W. T. : 10.50 M ABOVE BED LEVEL	DIAMETER : 100 MM AND NX
LOCATION: INTAKE WELL	

DEPTH (m.)	DIA OF BORE HOLE	LOG	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
	100 MM		Sandy Silty Clay 0.50										
1.00													
2.00				2.00	CORE						6	NIL	
3.00				3.00	CORE						12	NIL	
4.00				4.00	CORE						12	NIL	
5.00	NX		Brownish coloured Highly to moderately strong fractured Basalt	4.00 / 4.10	SPT 1	50	–	–	–	R			
				5.00	CORE						14	NIL	
6.00				6.00	CORE						21	NIL	
7.00				7.00	CORE						19	NIL	
8.00				8.00	CORE						23	NIL	
9.00				9.00	CORE						42	20	
10.00	BORE HOLE IS TERMINATED AT 9.0 M DEPTH BELOW BED LEVEL.												

SPT N =STANDARD PENETRATION TEST VALUE K = INSITU PERMEABILITY CR = CORE RECOVERY
UDS = UNDISTURBED SOIL SAMPLE DS = DISTURBED SOIL SAMPLE RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE IS TERMINATED AT 9.0 M DEPTH BELOW BED LEVEL.

SCALE : 1: 50
JOB NO. : 0400

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC

PROJECT : SOIL INVESTIGATION FOR PROPOSE CONSTRUCTION OF INTAKE WELL FOR STPP KHARGONE AT THE SITE OF RESERVOIR OF OMKARESHWAR DAM

SHEET NO. : 1 OF 2	DATE : 07/05/2012 TO 30/05/2012
BORE HOLE NO: BHW-2	METHOD : ROTARY DRILLING
GROUND R.L. : —	CASING : 100 MM 3.0 M AND NX 5.50 M BBL
GROUND W. T. : 6.0 M ABOVE BED LEVEL	DIAMETER : 100 MM AND NX
LOCATION: INTAKE WELL	

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
	100 MM		Sandy Silty Clay 0,50										
1,00				1.50	CORE						13	NIL	
2,00				1,50 / 1,53	SPT 1	50	–	–	–	R			
				2.50	CORE						13	NIL	
3,00				3.50	CORE						12	NIL	
4,00				3,50 / 3,55	SPT 2	50	–	–	–	R			
				4,50	CORE						18	NIL	
5,00			Brownish coloured Highly weathered Moderately fractured jointed highly strong Basalt	5.50	CORE						21	NIL	
6,00	NX			5,50 / 5,57	SPT 3	50	–	–	–	R			
				6,50	CORE						19	NIL	
7,00				7,50	CORE						25	NIL	
8,00				7,50 / 7,55	SPT 4	50	–	–	–	R			
				8,50	CORE						33	NIL	
9,00				9,50	CORE						23	NIL	
10,00				9,50 / 9,55	SPT 5	50	–	–	–	R	39	NIL	

SPT N = STANDARD PENETRATION TEST VALUE K = INSITU PERMEABILITY CR = CORE RECOVERY
UDS = UNDISTURBED SOIL SAMPLE DS = DISTURBED SOIL SAMPLE RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUES...

SCALE : 1: 50
JOB NO. : 0400

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT ; NTPC

PROJECT : SOIL INVESTIGATION FOR PROPOSE CONSTRUCTION OF INTAKE WELL FOR STPP KHARGONE AT THE SITE OF RESERVOIR OF OMKARESHWAR DAM

SHEET NO. : 2 OF 2	DATE : 07/05/2012 TO 30/05/2012
BORE HOLE NO: BHW-2	METHOD : ROTARY DRILLING
GROUND R.L. : —	CASING : 100 MM 3.0 M AND NX 5.50 M BBL
GROUND W. T. : 6.0 M ABOVE BED LEVEL	DIAMETER : 100 MM AND NX
LOCATION: INTAKE WELL	

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
11.00	NX		Brownish coloured Fresh moderattely strong fine grained Basalt	10.50	CORE						39	NIL	
				11.50	CORE						30	NIL	
12.00				12.50	CORE						18	NIL	
13.00				13.50	CORE						30	NIL	
14.00				14.50	CORE						50	NIL	
15.00				15.50	CORE						55	NIL	
16.00	BORE HOLE TERMINATED AT 15,5 M DEPTH BELOW BED LEVEL												
17.00													
18.00													
19.00													
20.00													

SPT N =STANDARD PENETRATION TEST VALUE K = INSITU PERMEABILITY CR = CORE RECOVERY
UDS = UNDISTURBED SOIL SAMPLE DS = DISTURBED SOIL SAMPLE RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE TERMINATED AT 15,5 M DEPTH BELOW BED LEVEL

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

SCALE : 1: 50
JOB NO. : 0400

CLIENT ; NTPC

PROJECT : SOIL INVESTIGATION FOR PROPOSE CONSTRUCTION OF INTAKE WELL FOR STPP KHARGONE AT THE SITE OF RESERVOIR OF OMKARESHWAR DAM

SHEET NO.	: 1 OF 2	DATE	: 03/06/2012 TO —/06/2012
BORE HOLE NO:	BHW-3	METHOD	: ROTARY DRILLING
GROUND R.L.	: —	CASING	: 100 MM 4.5 M AND NX 6.0 M BBL
GROUND W. T.	: 2.20 M ABL	DIAMETER	: 100 MM AND NX
LOCATION:	INTAKE WELL		

DEPTH (m.)	DIA OF BORE HOLE	LOG	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
	100 MM		Sandy Silty Clay 0.50										
1.00			Brownish coloured highly weathered, highly fractured jointed, highly strong Basalt which is fresh and fine grained										
2.00				2.00	CORE						12	NIL	
3.00				3.00	CORE						29	10	
				3.00 / 3.05	SPT 1	50	–	–	–	R			
4.00				4.00	CORE						26	NIL	
5.00				5.00	CORE						23	NIL	
				5.00 / 5.05	SPT 2	50	–	–	–	R			
6.00				6.00	CORE						22	NIL	
7.00	NX		Brownish coloured fresh fractured jointed fresh fine grained Basalt	7.00	CORE						30	NIL	
				7.00 / 7.05	SPT 3	50	–	–	–	R			
8.00				8.00	CORE						30	NIL	
9.00				9.00	CORE						37	12	
10.00				10.00	CORE						25	NIL	

SPT N = STANDARD PENETRATION TEST VALUE K = INSITU PERMEABILITY CR = CORE RECOVERY
UDS = UNDISTURBED SOIL SAMPLE DS = DISTURBED SOIL SAMPLE RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE CONTINUES...

SCALE : 1: 50
JOB NO. : 0400

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

CLIENT : NTPC

PROJECT : SOIL INVESTIGATION FOR PROPOSE CONSTRUCTION OF INTAKE WELL FOR STPP KHARGONE AT THE SITE OF RESERVOIR OF OMKARESHWAR DAM

SHEET NO.	: 2 OF 2	DATE	: 03/06/2012 TO —/06/2012
BORE HOLE NO:	BHW-3	METHOD	: ROTARY DRILLING
GROUND R.L.	: —	CASING	: 100 MM 4.5 M AND NX 6.0 M BBL
GROUND W. T.	: 2.20 M ABL	DIAMETER	: 100 MM AND NX
LOCATION:	INTAKE WELL		

DEPTH (m.)	DIA OF BORE HOLE	LOG	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15 15 15 15	SPT N	CORE RECOVERY (%)	RQD %	UCS (KG/SQCM)
11.00	NX		Moderately strong Brownish Basalt	11.00	CORE			32	NIL	
12.00				12.00	CORE			30	NIL	
13.00				13.00	CORE			19	NIL	
14.00				14.00	CORE			48	12	
15.00				15.00	CORE			63	24	
16.00				16.00	CORE			55	41	
17.00				17.00	CORE			54	54	
18.00				18.00	CORE			60	51	
19.00										
20.00										

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
K = INSITU PERMEABILITY
DS = DISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BORE HOLE TERMINATED AT 18.0 M DEPTH BELOW BED LEVEL

SCALE : 1: 50
JOB NO. : 0400

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Bore hole data pipe line corridor

CLIENT : NTPC LIMITED

PROJECT : CONSULTANCY WORK FOR PRELIMINARY GEOTECH INVESTIGATION FOR INTAKE WELL LOCATION & MUW PIPE CORRIDOR FOR KHARGONE STPS

SHEET NO.	1 OF 1	DATE	09/03/2013 to 10/03/2013
BORE HOLE NO.	2 KM-0	METHOD	ROTARY DRILLING
LOCATION	Pipeline Corridor	CASING	Up to 1.50M BGL
CO-ORDINATES	E 619054; N 2458797	DIAMETER	150 MM AND NX
GROUND W. T.	NMW	REDUCED LEVEL:	

DEPTH (m.)	DIA. OF BORE HOLE	LOG	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	CORE RECOVERY (%)	RQD (%)	UCS (KG/SQCM)
1.00	150 MM		Yellowish brown completely weathered rock	1.50									
2.00				1.50/ 1.55	SPT 1	54	--	--	--	R			
3.00	NX		Brown fractured BASALT	3.00	CORE						16	NIL	
4.00				4.50	CORE						25	NIL	
5.00					CORE						30	NIL	
6.00				6.00									
7.00			BORE HOLE IS TERMINATED AT 6.00M BGL										
8.00													
9.00													
10.00													

SPT N = STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE

CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BOREHOLE TERMINATED AT 600M DEPTH BGL

SCALE : 1:50
JOB NO. : 0400

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A-1

CLIENT : NTPC LIMITED

PROJECT : CONSULTANCY WORK FOR PRELIMINARY GEOTECH INVESTIGATION FOR INTAKE WELL LOCATION & MUW PIPE CORRIDOR FOR KHARGONE STPS

SHEET NO.	: 1 OF 1	DATE	: 11/03/2013 to 14/03/2013
BORE HOLE NO.	: 2 KM-1	METHOD	: ROTARY DRILLING
LOCATION	: Pipeline Corridor	CASING	: Up to 1.50M BGL
CO-ORDINATES	: E 617078; N 2457466	DIAMETER	: 150 MM AND NX
GROUND W. T.	: NIL	REDUCED LEVEL:	

DEPTH (m.)	DIA. OF BORE HOLE	LOG	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	CORE RECOVERY (%)	RQD (%)	UCS (KG/SQCM)
1.00	150 MM		Yellowish brown completely weathered rock	1.50									
2.00	NX		Greyish brown fractured Basalt	1.50/ 1.55	SPT 1	54	–	–	–	R			
3.00				3.00	CORE						26	NIL	
4.00				4.50	CORE						25	NIL	
5.00					CORE						27	NIL	
6.00				6.00									
7.00			BORE HOLE IS TERMINATED AT 6.00M BGL										
8.00													
9.00													
10.00													

SPT = STANDARD PENETRATION TEST VALUE
USS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BOREHOLE TERMINATED AT 600M DEPTH BGL

SCALE : 1:50
JOB NO. : 0400

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

A-2

CLIENT : NTPC LIMITED

PROJECT : CONSULTANCY WORK FOR PRELIMINARY GEOTECH INVESTIGATION FOR INTAKE WELL LOCATION & MUW PIPE CORRIDOR FOR KHARGONE STPS

SHEET NO.	: 1 OF 1	DATE	: 20/07/2012 to 22/07/2012
BORE HOLE NO.	: 2 KM-2	METHOD	: ROTARY DRILLING
LOCATION	: Pipeline Corridor	CASING	: Up to 1.50M BGL
CO-ORDINATES	: E 616601, N 2456252	DIAMETER	: 150 MM AND NX
GROUND W. T.	: 2.50M	REDUCED LEVEL	:

DEPTH (m.)	DIA. OF BORE HOLE	LOG	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	CORE RECOVERY (%)	RQD (%)	UCS (KG/SQCM)
1.00	NX		SM	0.00/0.30	DS								
				1.50	CORE						16	NIL	
2.00			Yellowish brown completely weathered rock SW-SM	1.50/1.55	SPT 1	54	--	--	--	R			
3.00			3.00		CORE						19	NIL	49
4.00				3.00/3.07	SPT 2	58	--	--	--	R			
			Grey BASALT	4.50	CORE						31	15	49
5.00													
6.00			—	6.00	CORE						35	27	195
7.00			BORE HOLE IS TERMINATED AT 6.00M BGL										
8.00													
9.00													
10.00													

SPT N = STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE

CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BOREHOLE TERMINATED AT 600M DEPTH BGL

SCALE : 1:50
JOB NO. : 0400

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

A-3

CLIENT : NTPC LIMITED

PROJECT : CONSULTANCY WORK FOR PRELIMINARY GEOTECH INVESTIGATION FOR INTAKE WELL LOCATION & MUW PIPE CORRIDOR FOR KHARGONE STPS

SHEET NO.	1 OF 1	DATE	22/ 07/ 2012 to 24 / 07/ 2012
BORE HOLE NO.	2 KM-3	METHOD	ROTARY DRILLING
LOCATION	Pipeline Corridor	CASING	Up to 1.50M BGL
CO-ORDINATES		DIAMETER	150 MM AND NX
GROUND W. T.	1.70M	REDUCED LEVEL	

DEPTH (m)	DIA. OF BORE HOLE	LOG	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm	SPT N	CORE RECOVERY (%)	RQD (%)	UCS (KG/SQCM)
1.00	150 MM		Yellowish brown complete weathered rock	0.00/ 0.50	DS					
				1.50						
2.00	NX			1.50/ 1.60	SPT	52	R			
3.00			Grey BASALT	3.00	CORE			33	NIL	
4.00				4.50	CORE			39	17	230
5.00			BORE HOLE IS TERMINATED AT 4.50M BGL							
6.00										
7.00										
8.00										
9.00										
10.00										

SPT N = STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BOREHOLE TERMINATED AT 4.50M DEPTH BGL

SCALE : 1:50
JOB NO. : 2400

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A-4

CLIENT : NTPC LIMITED

PROJECT : CONSULTANCY WORK FOR PRELIMINARY GEOTECH INVESTIGATION FOR INTAKE WELL LOCATION & MUW PIPE CORRIDOR FOR KHARGONE STPS

SHEET NO.	: 1 OF 1	DATE	: 04/08 /2012 to 06/08/2012
BORE HOLE NO.	: 2 KM-4	METHOD	: ROTARY DRILLING
LOCATION	: Pipeline Corridor	CASING	: Up to 3.00M BGL
CO-ORDINATES	:	DIAMETER	: 150 MM AND NX
GROUND W. T.	: 3.20 M	REDUCED LEVEL	:

DEPTH (m.)	DIA. OF BORE HOLE	LOG	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	CORE RECOVERY (%)	ROD (%)	UCS (KG/SQCM)
1.00													
2.00	150 MM		Yellowish brown completely weathered rock	1.50/ 1.60	SPT 1	51	--	--	--	R			
3.00			3.00	3.00/ 3.08	SPT 2	53	--	--	--	R			
4.00	NX		Yellowish brown weathered BASALT	4.50	CORE						23	NIL	48
5.00					CORE						28	8	
6.00			—	6.00									
7.00			BORE HOLE IS TERMINATED AT 6.00 M BGL										
8.00													
9.00													
10.00													

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS BOREHOLE TERMINATED AT 6.00 M DEPTH BGL

SCALE : 1: 50
JOB NO. : 0400

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A-5

CLIENT : NTPC LIMITED

PROJECT : CONSULTANCY WORK FOR PRELIMINARY GEOTECH INVESTIGATION FOR INTAKE WELL LOCATION & MUW PIPE CORRIDOR FOR KHARGONE STPS

SHEET NO.	1 OF 1	DATE	03/08/2012 to 05/08/2012
BORE HOLE NO.	2 KM-5	METHOD	ROTARY DRILLING
LOCATION	Pipeline Corridor	CASING	Up to 3.50M BGL
CO-ORDINATES	E 614254;N 2451343	DIAMETER	150 MM AND NX
GROUND W. T.	2.80 M	REDUCED LEVEL	207.60M

DEPTH (m)	DIA. OF BORE HOLE	LOG	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	CORE RECOVERY (%)	RQD (%)	UCS (KG/SQCM)
1.00	150 MM		Black clayey Sand 1.00	DS 1									
2.00			CH Very stiff Yellowish brown sandy silty Clay	1.50/ 2.10	SPT 1	4	7	8	10	15			
3.00			CH 3.50	3.00/ 3.45	SPT 2	7	10	12	---	22			
4.00	NX		Grey fractured BASALT	5.00	CORE						25	17	395
5.00				6.50	CORE						29	18	
6.00													
7.00			BORE HOLE IS TERMINATED AT 6.50 M BGL										
8.00													
9.00													
10.00													

SPT N =STANDARD PENETRATION TEST VALUE
UDS = UNDISTURBED SOIL SAMPLE

CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION

REMARKS : BOREHOLE TERMINATED AT 6.50 M DEPTH BGL

SCALE : 1:50
JOB NO. : 2402

PARESH CONSTRUCTIONS AND FOUNDATIONS PVT. LTD.

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