BHARAT OMAN REFINERY LIMITED, BINA
3X33 MW CAPTIVE POWER PLANT -
SOLID MATERIAL HANDLING SYSTEM

SPECIFICATION FOR ASH & BED MATERIAL HANDLING SYSTEMS – GT 57491

Revisions & Date :	Prepared – BHEL	Approved-BHEL	Client Approval
R01/26-05-2008	(KRA)	(AVDR)	
Refer to record of revisions			
Prepared by –TCE	Checked by – TCE	Approved by - TCE	
(DS/KS)	(KG)	(KG)	

CONTENTS

BID DRAWINGS & DOCUMENTS ENCLOSED

1)	FLOW DIAGRAM - ASH HANDLING AND BED MATERIAL HANDLING SYSTEMS	BHEL DWG NO. 0-381-01-00814
2)	GENERAL ARRANGEMENT: ASH HANDLING & BED MATERIAL HANDLING SYSTEM:PLAN & SECTIONS.	BHEL DWG NO. 1-381-01-00815- SH1
3)	GENERAL ARRANGEMENT: ASH HANDLING & BED MATERIAL HANDLING SYSTEM:PLAN & SECTIONS.	BHEL DWG NO. 1-381-01-00815- SH2
4)	THERMAL MOVEMENT DIAGRAM FOR ESP	BHEL DWG NO.3-00-118-35050
5)	HOPPER MOVEMENT DIAGRAM	BHEL DWG NO.4-00-260-55001
6)	INSTRUCTIONS TO VENDOR FOR SITE PERFORMANCE GUARANTEE REQUIREMENTS FOR PACKAGE UNITS	STANDARD NO. 7-76-0103-REV.0
7)	GENERAL ARRANGEMENT OF ELECTROSTATIC PRECIPITATOR	BHEL DOC. NO. 1-00-111-28092
8)	TOPAGRAPHICAL SURVEY PLAN	---
9)	ELECTRICAL INTERFACE FOR MATERIAL HANDLING SYSTEM	BHEL DOC. PED/E/BORL/MH
10)	SIGNAL EXCHANGE BETWEEN ASH & BED MATERIAL HANDLING SYSTEM AND OTHERS	SKETCH-1

1.0 **SCOPE OF ENQUIRY**

1.1 This specification covers the design, manufacture, inspection and testing at manufacturers works, packing and forwarding, delivery to site, unloading from carriers/wagons, storing at site, transport to erection site, erection, painting, testing and commissioning and performance testing of the complete Ash Handling System at site as specified, except those specified in Section-C5 for 3 X 33MW Units of Bharat Oman Refinery Ltd (BORL) at Bina, Madhya Pradesh.

1.2 It is not the intent to specify completely herein all details of design and construction of the equipment/works. However, the equipment/works shall conform in all respects to high standards of engineering, design and workmanship and be capable of performing in continuous commercial operation up to the Vendor's guarantees in a manner acceptable to the EPCC, who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or materials which in his judgement is not in full accordance therewith.

2.0 This specification covers Sections A,B,C,D,E,F and drawings for Design, supply, Erection/ construction, testing and commissioning of Ash Handling System & Accessories.

3.0 The extent of supply under this contract includes all items shown in the appropriate flow diagram and drawings notwithstanding the fact that such items may have been omitted from the specifications or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and/ or schedule, notwithstanding the fact that such items may have been omitted in the flow diagram and drawings.

4.0 All specialised equipment/services necessary for proper erection, construction, commissioning and performance testing of all items of the Ash and Bed Material Handling System and accessories under this contract shall be arranged by the CONTRACTOR. The cost of the same shall be included in Contract price.

5.0 All necessary co-ordination with regard to sub-contracted equipment shall be carried out by the CONTRACTOR. The EPCC/ CEPCC will communicate only with the CONTRACTOR for all matters pertaining to this contract.

6.0 The total price quoted for this contract shall be on lump sum all inclusive basis and shall cover all items and services necessary for the successful completion of the contract. Even if all components/ items of the system included in this specification are not explicitly identified and/or listed herein, these shall be supplied under this contract to ensure completeness of the system and facilitate

proper operation and easy maintenance of the plant. Changes in quoted lump sum price would be permissible only in case of addition/deletion of one or more systems from the specification which may become necessary during detail engineering stage due to unforeseen circumstances.

7.0 Bidder shall confirm each of the following points while submitting the offer:

a) The design calculation for Ash and Bed material conveying system shall be vetted by bidder's design collaborator, if any. And also submit the reference letter from bidder's design collaborator for their pervious experience in similar kind of ash and bed material handling project using petcoke (as fuel) & limestone feed in the boiler with ash characteristics similar to those as specified.
b) Reference letter from Bidder's collaborator for their willingness to execute/participate in the project as per the tender.
c) Bidder shall submit their pervious experience in similar kind of ash handling project using petcoke, as fuel, & limestone feed in the boiler with ash characteristics similar to those as specified. If there is no direct experience by the bidder, the Bidder shall submit the experience list of his collaborator in this specific system.
d) Bidder shall submit performance certificate from the end user for similar kind of ash & bed material conveying system.

1.0 DEFINITION OF TERMS

1.1 'OWNER' shall mean the Bharat Oman Oil Refineries Ltd (BORL), who will own the plant and operate. BORL shall include his successors and assigns as well as his authorised officers/ representatives. "CONSULTANT" shall mean "Engineers India Limited" or their duly authorised representatives, who are the Consultants appointed by the OWNER as Project Management Consultants.

1.2 'EPC CONTRACTOR' (hereinafter called EPCC) shall mean Bharat Heavy Electricals Ltd, Hyderabad, (BHEL), who will be responsible for purchase, installation and commissioning of the plant and BHEL shall include his successors and assigns as well as his authorised officers/ representatives.

1.3 'Project ' shall mean 3x 33 MW LSTK project for Bharat Oman Oil at Bina, District Sagar, Madhya Pradesh, BORL, Bina 3 x 33 MW LSTK Project.

1.4 "ENGINEER"/'CONSULTANT TO EPC CONTRACTOR' (hereinafter called CEPCC) shall mean TCE Consulting Engineers Limited or their duly authorised representatives, who are the Consultants appointed by the EPCC for the 'Project'

1.5 'BIDDER' shall mean the firm / party who quotes against an enquiry.

1.6 'VENDOR/CONTRACTOR/ FABRICATOR' shall mean the successful BIDDER whose Bid has been accepted by the EPCC and on whom the 'contract' or Purchase Order is placed by the EPCC and shall include his heirs, legal representatives, successors and permitted assigns.

1.7 `SUB-VENDOR/ SUB-CONTRACTOR' shall mean the person named in the `Contract' undertaking a part of the work or any person to whom a part of the `Contract' has been sublet with the consent in writing of the EPCC and shall include his heirs, legal representatives, successors and permitted assigns.

1.8 `MANUFACTURER 'refers to a person or firm who is the producer and furnisher of material or designer and fabricator of equipment to either the EPCC or the VENDOR/CONTRACTOR or both under the `contract'

1.9 `OTHERS' shall mean other successful BIDDERS whose Bids have been accepted by the EPCC and to whom the orders have been placed by the EPCC and shall include their heirs, legal representatives, successors and permitted assigns.

1.10 `INSPECTOR 'shall mean the authorised representatives appointed by the EPCC or the CEPCC for purpose of inspection of materials/ equipment/ works.

1.11 `Site' shall mean the actual place of the proposed ` project' as detailed in the `specification' or other place where work has to be executed under the contract.

1.12 `Month' shall mean calendar month.

1.13 `Specification' shall mean collectively all the terms and stipulations contained in those portions of the `contract' known as General Conditions, the Specifications and such Amendments, Revisions, Deletions or Additions, as may be made in the Agreement and all written Agreements made or to be made pertaining to the method and manner of performing the work or to the quantities and qualities of the materials to be furnished under this `contract'.

1.14 `Bid' shall mean the proposal/ document that the BIDDER submits in the requested and specified from in the `Specification'.

1.15 `Plant ' or 'Equipment' and 'work' or `works' shall mean respectively the goods to be supplied and services to be provided by the VENDOR/ CONTRACTOR/ FABRICATOR under the 'purchase order' or 'contract'.

1.16 `Contract ' or `Purchase Order' shall mean the order and associated specifications executed by the EPCC and the VENDOR including other documents agreed between the parties or implied to form a part of the `contract'

1.17 'Effective Date of contract' shall mean the calendar date on which the EPCC have issued to the VENDOR the `Letter of Intent'..

1.18 `Contract period' shall mean the period during which the `contract' shall be executed as agreed between VENDOR/ CONTRACTOR/ FABRICATOR and EPCC in the 'Contract'.

1.19 'Guarantee period' shall mean the period during which the 'plant' or `Equipment' shall give the same performance guaranteed by the VENDOR in the schedule or guarantee as in the `Specification' .

1.20 `Approved' and `Approval' where used in the 'Specification' shall mean, respectively approved by / approval of the EPCC or the CEPCC.

1.21 When the words 'Approved' 'Approval' 'subject to Approval', 'satisfactory' 'Equal' to 'proper' 'Requested' 'As directed' 'Where directed' `When Directed, 'Determined by' 'Accepted' 'Permitted' or 'words' and phrases of like import are used the approval, judgement, direction etc, is understood to be a function of the EPCC or the CEPCC..

1.22 'CEPCC`s Instructions' shall mean any drawings and /or instructions oral and/or in writing details, direction and explanations issued by the CEPCC or the EPCC from time to time during the contract period.

1.23 'Writing' shall include any manuscript, type written or printed statement under or over signature and /or seal as the case may be.

1.24 'Notice in Writing 'or' Written Notice' shall mean a notice in written, typed or printed characters sent (unless delivered personally or other wise proved to have been received) by registered post to the last known private or business address or registered office of the addressee and shall be deemed to have been received when in the ordinary course of post it would have been delivered.

1.24 `CONTRACTOR`s works ' or ' MANUFACTURER`s works' shall mean and include the land and other places which are used by the VENDOR/CONTRACTOR/FABRICATOR or SUB-VENDOR. SUB CONTRACTOR, SUB FABRICATOR for the manufacture of equipment or performing the ' works'

1.25 'Mechanical Completion' shall be defined to be a state or readiness for 'Preliminary Operation' after due erection of all the materials and items of `Equipment' covered under the scope of the 'Contract'.

1.26 `Commissioning' shall mean integrated activity covered under 'Preliminary operation' ' Initial operation' ' Trial operation' and carrying out `Performance Tests'.

1.27 'Preliminary operation' shall mean all activities undertaken as part of commissioning after 'Mechanical Completion' up to commencement of 'Initial Operation' and include mechanical and electrical checkouts, calibration of instrument and protection devices, commissioning of sub / supporting system and equipment covered under the contract.

1.28 'Initial operation' shall mean all operations undertaken as part of Commissioning after completion of 'preliminary operation' up to commencement of 'Trial operation', It shall be the first integral operation of the complete plant/ system /equipment covered under the contract and shall include; no load/ partial load /full load runs for mechanical/electrical try-out and gathering of operational data ; calibration, setting and commissioning of control systems; and shutdown inspection and adjustment after running trials of the plant/ system /equipment covered under the Contract.

1.29 'Trial operation' shall mean the integrated operation of the plant system/Equipment covered under the contract for a specified period at specified load for proving trouble -free operation of the plant/ /system/Equipment covered under the contract

1.30 'Performance Tests' shall mean such tests as are prescribed in the specification to be done by the VENDOR before the EPCC takes over the plant under guarantee.

1.31 'Virtual Completion' shall mean that all work is completed as directed and the site is cleared to the satisfaction of the EPCC or the CEPCC.

1.32 'Commercial Use' shall mean that use of the Equipment or work which the contract contemplates or that for which Equipment or work is commercially capable.

1.33 'Minor Modification' as applied to equipment erection contracts only, shall mean the modification work required to be done on the Equipment and works which need a maximum of 48 man-hours per item of work.

1.34 'Major Modification' as applied to equipment erection contracts only, shall mean the modification work required to be done on the equipment and works needing more than 48 man hours per item of work, where such work is required to be done for no fault of the VENDOR/CONTRACTOR.

1.35 Words importing persons shall include Firms, Companies Corporations and other Bodies whether incorporated or not.

1.36 Words importing the singular only shall also include the plural and vice versa where the context requires

1.37 Drawings shall mean all:

a) Drawings furnished by the EPCC or the CEPCC as a basis for proposals.

b) Supplementary drawings furnished by the EPCC or the CEPCC to clarify and to define in greater detail the intent of the 'Contract'.

c) Drawings submitted by the VENDOR with his proposal provided such drawings are acceptable to the EPCC or the CEPCC.

d) Drawings furnished by the EPCC or the CEPCC to the VENDOR during the progress of the work:

e) Engineering data and drawings submitted by the VENDOR during the progress of the work provided such drawings are acceptable to the EPCC or the CEPCC.

2.0 SPECIFICATION DOCUMENTS

2.1 The ‘ specification ‘ consists of six sections as listed below and all of these are to be considered together for correct understanding and interpretation of the specification.

2.2 SECTION -A

2.2.1 For equipment supply and /or erection contracts. Section-A covers the scope of enquiry and description of the specification document and the list of contents.

2.3 SECTION-B

2.3.1 Section -B furnishes relevant `Project’ information for the reference and use of the BIDDER

2.4 SECTION-C

2.4.1 For system /equipment supply and /or erection contracts. Section-C covers the following:

a) Brief description of system/equipment to be supplied and /or to be erected
b) Codes and standards
c) System performance, availability, design, layout, maintenance and other general requirements not covered in Section-D and Section-E.
d) Specific manufacturing process, shop inspection and test requirements not covered in Sections -D&E.
e) Performance test and guarantee requirements not covered in Section-D.
f) Conditions for rejection of plant, if applicable
g) Bid evaluation criteria. if applicable
h) Equipment to be supplied and /or erected.
i) Miscellaneous services such as equipment start-up and system commissioning services, training of EPCC`s personnel etc.
j) Terminal points of supply and /or services
k) Equipment and services by OTHERS and or EPCC as applicable.
l) System Data Sheet-A giving data for system design and specifying system parameters
m) List of data to be furnished by the BIDDER with his Bid in system Data Sheet-B and by the VENDOR /CONTRACTOR after award `Contract ‘in System Data Sheet-C not covered in Section -D.

n) Site facilities to be provided by the OWNER/ BOARD/ EPCC at charge/free of cost.

2.5 **SECTION-D**

2.5.1 For equipment supply and/or erection contracts, Section -D comprises detailed technical specifications for individual component/ equipment in the system and for welding. Every Component Specification is made up of a write up covering standard technical requirements, Data Sheet-A indicating specific requirements, Data Sheet-B specifying the data to be furnished by the BIDDER and Data sheet-C specifying the data to be furnished by the VENDOR/CONTRACTOR, in the case of a supply contract: and comprises specific confirmation data required from the CONTRACTOR in the case of an erection contract.

2.6 **SECTION-E**

2.6.1 For equipment supply and /or erection ,Section -E includes general technical specification for painting, packing, etc, and general and commercial requirements like inspection , drawings and instruction manuals, in the case of a supply contract: and general conditions of contract for erection , general specifications for painting. material handling and storage etc. in the case of an erection contract.

2.7 **SECTION-F**

2.7.1 For equipment supply and /or erection contracts, Section-F consists of Schedules of Prices and Delivery, Schedules of Deviation: Schedule of Guarantee: Schedule of Construction Equipment : Schedule of Personnel for Supervision for erection , start-up commissioning and performance testing : schedule of places of tests and inspection, respective schedules for spare parts, maintenance tools, experience of the BIDDER, distribution of drawings, ,manuals etc, and enclosures ,as applicable. Schedules are to be filled up by the BIDDER for purpose of BID analysis.

2.8 The BIDDER shall be deemed to have carefully examined the Specification in its complete from and to have fully informed and satisfied himself as to the details, nature, character and quantities of the work to be carried out, site conditions and other pertinent matters and details.

2.9 In case of conflict between different sections of the Specification, requirements of Section-C including its Data Sheet-A and Data Sheet-A of section -D shall govern.

2.10 It is the intent of the EPCC to incorporate these specification documents in the final 'Contract' or Purchase order ' for the supply of material , equipment and services .The BIDDERS are required to review these documents and clearly state in their proposals their acceptance of the same. Exceptions , if any, shall be clearly stipulated in the appropriate bidding schedule. The final `Contract' between the EPCC and the VENDOR/CONTRACTOR shall be subjected to such changes, if any mutually agreed upon between the EPCC and the VENDOR/CONTRACTOR and included in the main text of the `Contract ' or 'Purchase Order'

2.11 The BIDDER shall specify all the deviations with respect to this specification in the appropriate schedule.

2.12 The BIDDER shall furnish the data called for in Data Sheet -B and the Schedules in the standard proforma to facilitate correct evaluation of his 'Bid' in a most expeditious manner. It is in the interest of the BIDDER to submit the Bid in the above manner. failing which it is likely that his Bid may not be considered.

2.13 The VENDOR /CONTRACTOR shall furnish the data called for in Data Sheet-C for CEPCC`s/EPCC's approval.

2.14 Wherever Data Sheet -C forms are enclosed with the Specifications. The VENDOR/CONTRACTOR should furnish all data in the specified forms only. After approval, reproducibles as per Specification No TCE. M4 -903. clause No.1.17 of section E1 shall be furnished.

2.15 It is not the intent to specify completely herein all details of design and construction of the equipment/works. However, the equipment/works shall conform in all respects to high standards of engineering, design and workmanship and be capable of performing in continuous commercial operation upto the Vendor's guarantees in a manner acceptable to the EPCC, who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or materials which in his judgement is not in full accordance therewith.

2.16 This specification covers Sections A,B,C,D,E,F and drawings for Design, supply, Erection/construction, testing and commissioning of Ash and Bed Material Handling System & Accessories.

2.17 The extent of supply under this contract includes all items shown in the appropriate flow diagram and drawings not withstanding the fact that such items may have been omitted from the specifications or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and/ or schedule,

notwithstanding the fact that such items may have been omitted in the flow diagram and drawings.

2.18 All specialised equipment/services necessary for proper erection, construction, commissioning and performance testing of all items of the Ash and Bed Material Handling System and accessories under this contract shall be arranged by the CONTRACTOR. The cost of the same shall be included in Contract price.

2.19 All necessary co-ordination with regard to sub-contracted equipment shall be carried out by the CONTRACTOR. The EPCC/ CEPCC will communicate only with the CONTRACTOR for all matters pertaining to this contract.

2.20 The total price quoted for this contract shall be on lump sum all inclusive basis and shall cover all items and services necessary for the successful completion of the contract. Even if all components/ items of the system included in this specification are not explicitly identified and/or listed herein, these shall be supplied under this contract to ensure completeness of the system and facilitate proper operation and easy maintenance of the plant. Changes in quoted lump sum price would be permissible only in case of addition/deletion of one or more systems from the specification which may become necessary during detail engineering stage due to unforeseen circumstances.

INSTRUCTIONS TO BIDDERS

1.0 EPCC's General terms and conditions of Contract shall form an integral part of this specification. In the event of conflict between EPCC's terms and conditions and this specification, the former shall govern.

2.0 BIDDER shall submit 4 hard copies and 1 soft copy of the Bid to EPCC. Along with the Bid, the BIDDER shall furnish all the information called for in Data Sheet-B of Section-D and various schedules in Section-F failing which the bid will be considered incomplete and EPCC reserves the right to reject the bid.

3.0 For the equipment offered, all deviations from the specification i.e. Deviations from "technical specifications" as well as General Terms and Conditions" of the specification shall be clearly listed in the "Schedule of Deviations". If no deviations are indicated, it will be presumed that the offer conforms to the specification in all respects and EPCC reserves the right to evaluate the bids as such without any further reference to the BIDDER. It is binding on the BIDDER to supply the Equipment in accordance with the specification except for the deviations accepted by the EPCC. No extra claims on this account will be entertained later by the EPCC.

4.0 In the event of conflict between Data Sheet-A and write up of Section-D, the Data Sheet-A shall govern. In the event of conflict between Sections C & D, the former shall govern.

5.0 Three (3) copies of the illustrated catalogue or leaflet for the Equipment offered shall be enclosed with each copy of the bid.

6.0 The BIDDER shall furnish list of Recommended spare parts with unit price of each spare part which, in his opinion, is necessary for the trouble free operation of the equipment for a period of 3 years, over and above, the essential spare parts list given in this specification.

7.0 The BIDDER shall indicate the name of the original manufacturer/ make of the major Equipment in his bid.

8.0 The makes of all auxiliary equipment and electricals shall be as per the acceptable makes given in system Data Sheet-A4. In case BIDDER wants to include any other repute makes he should obtain approval from EPCC/CEPCC during bid stage itself.

9.0 The servicing facilities available either with the BIDDER or the Manufacturer, along with the name, phone number and address of service centre must be indicated in the offer.

10.0 Bids complete in all respects shall be submitted to EPCC in sealed envelopes as explained in EPCC's general terms and conditions of contract.

11.0 Time of completion and work schedule

11.1 The entire work of Ash and Bed Material Handling System handling system comprising the design, construction, manufacture, inspection at manufacturers' works packing and forwarding, delivery to site, unloading from carriers/wagons, storage at site, transport to erection site, erection, testing and commissioning and carrying out acceptance tests at site shall be carried out as per the schedule indicated below from the date of issue of letter of intent (LOI).

(a) All works and equipment of Stream-A : 10 months

Note: The Bids offering completion period beyond the above specified periods are liable to be rejected.

11.2 BIDDER shall furnish a Bar Chart or Net Work Schedule along with his Tender incorporating significant milestone dates eg. For completion of design and engineering, submission of drawings, procurement of critical raw materials or boughtout items, manufacture and shop testing, transportation to site, erection, testing and commissioning as may be applicable. The total period should not exceed the completion period for the above activities given in the specification. The Bar Chart or Network Schedule furnished shall be binding on him should the contract be awarded to him. The successful BIDDER will have to furnish a detailed PERT Network Schedule within a month after the award of contract covering all the activities in the critical path for completing and commissioning. This schedule shall also contain a detailed programme for submission of design calculations, supporting drawings, and foundation details with load data etc. for the EPCC's/CEPCC's review.

11.3 EPCC reserves the right to revise the schedules at his discretion in order to keep up the scheduled completion period and to suit the project commissioning requirement and such alterations shall not entitle the Contractor for any extra payment.

11.4 Within four weeks from the date of receipt of the Letter of Intent, the Contractor shall submit the following for CEPCC/ EPCC's review and approval. Failure to do s would result in a hold up in payment and no time extension will be granted for any delay.

(a) The detailed design criteria and design philosophy including full details of all reference data, assumptions made etc. that will be used for the design of all systems/equipment/construction works/ structural work etc. included in this Contract. These shall be reviewed by EPCC/CEPCC and Contractor shall commence design only after EPCC/CEPCC's approval is obtained in writing. The design criteria shall incorporate the requirements of all relevant Indian Standards or Codes of Practice and shall conform to good engineering practice. All comments made by EPCC/CEPCC shall be incorporated in the designs/drawings at no extra cost to the EPCC and no deviations from the same shall be allowed.

(b) A detailed work schedule with dates giving the sequence of preparation and issue of (a) all design calculations and supporting drawings (b) all construction drawings and sequence of construction of various structures for the system shall be furnished. The construction sequence shall follow the design engineering sequence.

11.5 The complete work shall be carried out with, within such sections and at such times and in such order and manner as described in this specification and as directed by the ENIGNEER/EPCC.

11.6 The drawing/ design calculations/document which are submitted by the Vendor for the approval of EPCC/CEPCC will normally be commented upon/approved within fur (4) weeks from the date of receipt of same by the EPCC/CEPCC. No claim, however, shall be entertained due to any delay in approval of the drawings.

11.7 In the event of Force Majeure conditions as defined in General Terms and Conditions of Contract, extension of time for completion of work shall be granted by the EPCC equal in amount to period of existence of such force majeure condition at his discretion. No extra claim due to escalation on any reason on this account will be entertained.

11.8 CONTRACTOR shall furnish to the EPCC monthly progress reports before the end of the first week of the succeeding month to enable satisfactory monitoring of the progress on the job. The progress report should indicate the following :

Name of equip-ment	Item of work/ activity	Schedule for the month & year	Actual progress	Reasons for short-fall, if any	Action take to make up the short fall

12.0 **INSPECTION OF SITE BY BIDDER**

12.1 BIDDER is strongly advised to inspect the site and examine and obtain all information required and satisfy himself regarding all matters and things such as access to site, areas likely to be allotted to him for his storage yard and for his site works, communication, transport, right of way, the type and number of equipment and facilities required for the satisfactory completion of work, the quantity of various sections of the work, the existing facilities which will have to be modified and those which may get affected, the availability of local labour, availability and rates of materials, local working conditions, extreme weather conditions, uncertainty of weather, obstructions and hindrances that may arise, etc. which may affect the work or cost thereof before the submission of his Tender.

12.2 The price quoted by the BIDDER shall be based on his own knowledge and judgement of the conditions and hazards involved and shall not be based on any representations of EPCC/CEPCC.

12.3 Ignorance of site conditions shall not be accepted as basis for any claim for compensation. The submission of Tender by the BIDDER will be construed as evidence that such an examination was made and any later claims/disputes in regard to price quoted shall not be entertained or considered.

13.0 BIDDER shall also indicate in is bid all the major assumptions, including major design, assumptions/criteria, made by him on which bid is based. The BIDDER shall also furnish along with his bid a list of major sub-contractors and consultant (if any) he proposes to employ for the execution of this contract, with sufficient back up details of their experience, previous jobs executed etc.

14.0 **SERVICES & FACILITIES BY THE EPCC**

14.1 CONTRACTOR shall discuss with the EPCC after issue of letter of Intent, regarding the availability of some areas at site to enable the CONTRACTOR to make his own arrangements of stores, temporary site office, etc.

BIDDER shall note that no level ground shall be provided by EPCC for setting up his temporary site office, fabrication and storage yards, etc. The CONTRACTOR shall arrange at his cost to get the areas allotted to him cleaned of all debris, levelling etc. to suit his requirements, to set up his temporary establishment.

14.2 Other services/ facilities shall be as per clause Nos. 1.2 and 7.4 of section-A3 of Volume-I of this specification.

14.3 Prior to installing his temporary extension lines for water/power (including switchboard etc.). CONTRACTOR shall prepare a detailed layout drawing and obtain the approval of EPCC/ CEPCC and all other statutory agencies as may be required. However, should any change in the layout be required by EPCC/CEPCC at any later date from project considerations, then such change as directed shall be made by CONTRACTOR at no extra cost to the EPCC.

14.4 **BENCH MARKS**

Permanent reference bench marks established and maintained by the EPCC shall be available on or close to the project site. CONTRACTOR shall arrange to build and maintain at his cost any additional temporary bench marks that may be required by him to layout lines, levels, etc. Required for the completion f the work covered in this contract. The CONTRACTOR shall also arrange at his cost for all necessary survey work , to be carried out to standardise the co-ordinates and levels of these additional temporary bench marks with reference to the nearest permanent bench marks mentioned above. The responsibility for the accuracy of the temporary bench marks and for any works carried out based on these bench marks lies entirely with the CONTRACTOR.

15.0 **CONTRACTOR'S SCOPE OF SUPPLY**

15.1 In addition to the scope of supply as indicated in Section-C, CONTRACTOR will be required to provide at his own cost all facilities for his fabrication yard, site office, approaches required by them for construction, stores/warehouse, tool room, dress change room, or any other building or structure required to execute the work.

15.2 CONTRACTOR shall procure and supply all materials, including structural steel, aggregates, doors, windows, etc. required to complete in all respects the full scope of works covered in this contract.

16.0 **CONSTRUCTION TOOLS AND MATERIALS**

16.1 CONTRACTOR shall provide and maintain at the site all tools, plant and equipment, including all survey instruments in good working condition necessary for the proper setting out and execution of the works covered under this specification. All arrangements for transporting the equipment to and from the site shall be done by CONTRACTOR at his own expense.

16.2 CONTRACTOR shall at his cost, arrange for all his requirements of materials such as, (but not limited to the same) oxygen, acetylene, pipes, ropes, welding electrodes, form ties, wiping ranges, clamps, turnbuckles, sand paper, etc. which are required to satisfactorily perform his works.

16.3 CONTRACTOR shall provide all fuels and lubricants required for the operation and maintenance of his construction equipment at his cost.

17.0 It shall be ensured by the CONTRACTOR that work is carried out in uninterrupted manner even in the event of power failure. As such, adequate number of diesel operated machinery (such as welding sets) shall be provided by the CONTRACTOR, as an alternative arrangement, in case electrically operated machineries are proposed to be brought to the site.

18.0 **NIGHT WORK**

The completion periods defined shall be deemed to exclude working during night shifts. However, EPCC may consider granting permission for working during night shifts, if considered essential to complete the work in the stipulated time, on a specific require by the CONTRACTOR Night work shall not entitled CONTRACTOR to any extra payment, Where night work is in progress, sufficient lights shall be provided by the CONTRACTOR his cost to safeguard the workmen and the public and also suitable precautions shall bet taken to prevent accidents.

19.0 WORK EXECUTION AND SUPERVISION

19.1 The EPCC reserves the right to order in writing from time to time during progress of the work, either at CONTRACTOR's shop or at site, removal and re-execution of any work which is not, in the opinion of the EPCC, in accordance with the specification quality/inspection reports, etc.

19.2 Prices quoted shall include cost of all materials, labour, supervision, setting out, machinery and equipment transport charge, wastage of material, all consumables such as but not limited to petrol, oil, diesel, lubricants, drill bits, pipes, ropes, welding rods, etc. construction facilities such as scaffolding, cribbing tarpaulins, wind break, etc. Taxes, duties, octroi and any other levies payable on all transaction all leads and lifts, etc. overheads profits of CONTRACTOR for the performance of the work under this contract. The rate shall also include cost for mobilisation/demobilisation of equipment.

19.3 Prices and rates quoted shall be deemed to include every thing necessary to satisfactorily complete the work as determined by the EPCC.

19.4 The EPCC reserves the right to split up the work in the scope of this contract among more than one CONTRACTOR at the stage of initial award of contract or during progress of work due to unsatisfactory progress of work of the CONTRACTOR. The OWNER will not entertain any claim from the CONTRACTOR as a result of such splitting up.

19.5 In the vent of occurrence of any accidents at/or near the site of work or in connection with execution of the work a report shall be made by the CONTRACTOR immediately to the EPCC, giving full details of the accident. He shall also report such accidents to all the competent authorities wherever such reports are required by them.

19.6 CONTRACTOR shall have qualified and competent engineers and supervisors with adequate number of years of experience in execution of similar works at the site for satisfactory progress and completion of the work as prescribed in the General terms and conditions of Contractor. CONTRACTOR's site engineer shall be responsible for all the works at the site and shall take instructions. All temporary electrical installations shall be supervised by qualified electrical supervisor appointed by the CONTRACTOR.

19.7 **INSPECTION AND TESTING**

CONTRACTOR shall extend all co-operation and help at his office, workshop/fabrication yard/construction area at site or elsewhere, including sub-contractor's sub-consultant's offices/construction or fabrication yard, at any time to the Inspection appointed by the EPCC/CEPCC and to the CONSULANT or his representative for the purpose of inspection and/or progress monitoring. CONTRACTOR shall arrange at his cost all he instruments tackles, gadgets, etc. required for the inspection and testing of the equipment by the EPCC or his representative.

19.8 During incremental weather or rain, CONTRACTOR shall suspend concerning and or other works for such time as ENGINER may direct and shall protect from damage all works already in progress or completed just then. All such temporary protective measures shall be at CONTRACTOR's cost and any damage to works shall be made good to the satisfaction of EPCC by the CONTRACTOR at his own expense.

19.9 Should the work be suspended by reason of strikes/riots by CONTRACTOR's own employees or any other cause whatsoever save and except the force majeure condition, CONTRCTOR shall take all precautions necessary for the protection of works and make good at his own expense, any damage arising from any of these causes.

19.10 EPCC site engineer will be at liberty to check any work during various stages of work and his instructions shall be carried out by the CONTRACTOR.

20.0 **OTHER WORKS**

During the course of the CONTRACTOR's work, other works either by the EPCC or by the other CONTRACTOR or by both simultaneously will be in progress within the plant area. CONTRCTOR is expected to work in harmony with others in the overall interest of the project and its speedy completion and comply with CEPCC' instructions

in making alternate arrangements at any time for maintaining the works schedule at no extra cost to the EPCC.

21.0 **BID EVALUATION**

BIDDER shall note that in case any information is missing or any details furnished are ambiguous, the EPCC will evaluate the offer on their own based on their judgement.

22.0 **VALIDITY OF TENDERS**

Tenders shall be kept valid for acceptance for a minimum period of 120 days from the date of opening of the tender. Offers with shorter validity period will be liable for rejection.

23.0 The BIDDER shall furnish with the Bid the general arrangement drawings indicating all the sizes, dimensions, elevations and all other details.

PROJECT INFORMATION

1.0	OWNER	:	BHARAT OMAN OIL REFINERY LTD
2.0	EPC Contractor	:	Bharat Heavy Electricals Ltd. (BHEL)
3.0	Consultant to EPC contractor	:	TCE Consulting Engineers Ltd.
3.0	Project Title	:	BORL, Bina 3 x 33 MW LSTK Project
4.0	Location	:	Bharat Oman Oil Refinery Ltd., Bina, District Sagar, Madhya Pradesh
5.0	Elevation above mean sea level	:	411.6m
6.0	Nearest railway station	:	Bina Railway station - Broad Gauge Line
7.0	Nearest Town	:	Bina
8.0	Nearest Airport	:	Bhopal
9.0	Barometric pressure		
	Minimum	:	936.3 mbar
	Normal	:	947.4 mbar
	Maximum	:	954.2 mbar
10.0	Ambient Air Temperature		
	Minimum	:	1.1^{o} C
	Maximum	:	45.6^{o} C
11.0	Relative Humidity		
	Minimum	:	16.4%
	Maximum	:	80%
	Design	:	54%
12.0	Data for Equipment Design		
	Design dry bulb/ wet bulb temp.	:	42^{o} C/23.7^{o} C
	Low ambient temp. for Min. Design Metal temperature	:	1.1^{o} C
	Coincident temp. and humidity for Air Blower and Air compressor design	:	42^{o} C & 54% RH

13.0	Design air temperature for air cooled exchangers in general	:	42^{o} C
	Design air temperature for air cooled exchangers in critical services not followed by water cooled trim exchangers	:	45.6^{o} C
14.0	Design ambient temperature for electrica Equipment like switchgear, transformer, motor, Battery chargers, Control/Relay Panels etc.	:	45.6^{o} C
15.0	Design ambient temperature for battery sizing and electric heat tracing.	:	20^{o}C
16.0	Rainfall		
	(a) For a 1 hour period	:	No data
	(b) For a 24-hour period	:	284.5 mm
17.0	Wind data		(As per IS 875)
	Wind velocity	:	
	Minimum	:	2 km/h
	Maximum	:	25 km/h
	Direction of prevailing wind	:	W to E
18.0	Earthquake design criterion:	:	As per site spectra curve (IS : 1893)

19.0 <u>Auxiliary Power Supply</u>

All auxiliary electrical equipment brought to site or to be supplied against this specification shall be suitable for operation on the following power supply system.

(a)	Primary HV distribution voltage	:	3300V, 3-phase, 50 Hz, effectively earthed
(b)	For AC motors rated 132kW & above	:	6600V, 3-phase, 50 Hz, non-effectively earthed

(c)	For AC motors rated below 132kW & greater than 0.18kW	:	415V, 3 phase, 3-wire, 50 Hz non-effectively earthed
(d)	For AC motors rated below 0.18kW	:	240V, 1 phase, 2 wire, 50 Hz AC supply with neutral lead earthed.
(e)	AC control & protective devices	:	240V AC, 1-Phase, 2 Wire, 50Hz AC supply with one point earthed.
		:	Auxiliary power supply listed against this item shall be derived by from 415V supply by providing adequately rated dry type control transformers ± 10% off-circuit taps on 415V side, switch and HRC fuses and link on secondary side. One point of the secondary shall be earthed through an isolating link.
(f)	Lighting fixtures / space heaters	:	240V, 1 phase, 2 wire, 50 Hz AC supply with neutral lead earthed.
(g)	DC motors control and protective devices	:	110V, 2 wire, unearthed DC supply from battery / battery charger.
(h)	For control of switchgears, switchyard equipment, DC emergency drives, DC emergency lights, switchyard and CPP control & protection panels, etc.	:	110V, 2 wire, unearthed DC supply from battery / battery charger.
(i)	Uninterrupted power supply	:	415V, 3 Phase, 50 Hz, AC supply

20.0 Construction supply : 415V, 3-Phase, 4-Wire, 50 Hz, supply neutral lead earthed.

21.0 Unless otherwise specified all electrical system shall be designed for the following voltage and frequency variations :

21.1 A C System

a) Voltage variations : ± 10 %
b) Frequency Variation : ± 3 %
c) Combined Voltage & Frequency Variation : ± 10 %

21.2 DC System

a) Voltage variation : 110 V ± 10%

21.3 UPS : ± 10 %

1.0 CODES AND STANDARDS

1.1 All equipment, system and works covered under this specification shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment will be installed. Also, all equipment shall conform to the latest applicable Indian or other International Standards established to be equivalent or superior to the Codes and Standards specified in Section-D. In case the BIDDER offers equipment conforming to any standards other than those specified in companion specifications, the BIDDER shall furnish copies of standards translated in English while submitting his proposal.

1.2 In the event of conflict between the Codes and Standards referred to in the specification and the requirement of this specification, the latter shall govern.

1.3 The latest issue of IS codes prevailing at the time of submission of final offer shall be applicable. However, if there are any revisions during the execution of the contract, the same shall be applicable and the cost implication if any shall be mutually discussed.

2.0 SYSTEM DESCRIPTION

(Refer Dwg. No. 0-381-01-00815 titled "General Arrangement : Ash Handling & Bed Material Handling Systems – Plan & Sections " and Drg. No. 1-381-01-00814 titled "Flow Diagram – Ash Handling & Bed Material Handling Systems").

The ash handling and Bed material systems consists of the following sub systems :

- Bed ash handling system including storage
- Fly ash handling system including storage
- Bed ash & fly ash disposal system
- Bed material handling system
- Auxiliary enabling systems

2.1 Bed Ash Handling System

Bed ash is collected in 2 Nos. of Bed ash collection cooler hoppers in each boiler. A surge hopper, which is water cooled, is provided below the boiler hoppers. The ash discharges from the surge hopper to the denseveyor. The inlet valve to the denseveyor is closed and conveying air is admitted into the denseveyor. This pressurises the denseveyor. The admission air inlet valve is closed and the discharge valve of the denseveyor is opened. The bed ash is carried along by the air stream up to the Bed ash silo. The ash separates out and gets collected in the silo. The air escapes through the bag filter, which is provided to minimise dust escape to atmosphere. Separate denseveyor cum piping arrangement is provided for each hopper.

The capacity of the system is arrived at based on the maximum ash collection rate in the hoppers furnished by the boiler manufacturer.

The Bed ash silo capacity is arrived at based on 16 hours maximum collection rate of Bed ash from 2 Nos. of boilers.

2.2 Fly ash handling System

Fly ash is collected in the following hoppers in each boiler as indicated in BHEL boiler drgs. No.0-00-511-93210 Rev 01 & 0-00-511-93211 Rev.01 :

- Air pre-heater (APH) hoppers (2 Nos. per boiler)
- ESP hoppers (2Nos. in I field, 2 Nos. in the II field, 2 Nos. in the III field, 2 Nos. in the IV field & 2 Nos. in the V field, thus totalling to 10 Nos.)

Fly ash collected in the hopper gets discharged to denseveyor. The ash inlet valve to the denseveyor is closed. The conveying air is admitted into the denseveyor and it is pressurised. The conveying air valve is closed and the denseveyor discharge valve is opened. The fly ash is conveyed to the Fly ash storage silo along with the air. In the silo the fly ash gets separated and gets collected. The escaping air from the silo passes through a bag filter to minimise dust pollution.

The capacity of the system is arrived at based on the maximum ash collection rate in the hoppers furnished by the boiler manufacturer.

The Fly ash silo capacity is arrived at based on 16 hours maximum collection rate of Fly ash from 2 Nos. of boilers.

2.3 Bed ash & fly ash disposal system

2.3.1 Both bed ash silo and fly ash silos are provided with 2 & 3 Nos. of outlets respectively at the bottom:

- For disposal in dry form into closed trucks
- In an emergency to dispose in slurry form.

2.3.2 In fly ash silo 2Nos of the outlets of fly ash silo are fitted with plate valve, rotary feeder and flexible unloading spout. The unloading spout are directly connected to the closed trucks and the ash is unloaded onto the trucks. Both the unloading spouts will be used simultaneously for loading to both the trucks simultaneously, which the Bidder shall note.

In bed ash silo 1No of outlet of bed ash silo is fitted with plate valve, rotary feeder and flexible unloading spout. The unloading spout is directly connected to the closed truck and the ash is unloaded onto the truck.

2.3.3 The third outlet of fly ash silo and the second outlet of bed ash silo are fitted with a plate valve, rotary feeder which feed the ash to a mixing box, where the ash and water mix together and form ash slurry. The ash slurry thus formed reaches the ash slurry sump by gravity through pipe line. The ash slurry pumps take suction from slurry sump and pump to the disposal area to be identified by the Client. 2 Nos. of ash slurry pumps are provided (1 W + 1 S). Space for 2 Nos of pumps are kept for future installation, if need be depending on the future disposal area location.

2.4 Bed Material Handling System

Each boiler has 1 No. bed material storage bunker located in the boiler structure with the top elevation of the bunker at EL. 42200.

Fresh bed material with the specification as mentioned in Appendix – 3 is loaded on to a partly above ground surge hopper from the storage yard. Seven days requirement is provided in the storage yard. From the hopper the material is discharged into the denseveyor, from where the material is conveyed to the boiler bunkers through pipe line in trench in the boiler area and then along the boiler column. The boiler bunkers are to be equipped with bag filters to avoid dust pollution.

The capacity of the system (2x5TPH) is arrived based on the maximum capacity indicated for each boiler (5TPH) {Refer Note 3 under "Bed Material Requirement" in Appendix-3 furnished by Boiler Vendor} and also considering 2 Nos. of boilers in operation.

The bed ash collected in the boiler bed ash hoppers can also be taken to the bunkers, as required, as bed material. For this purpose, the bed ash discharge from the denseveyor is diverted and taken through pipe line run above ground along boiler column to reach boiler bed material bunker.

2.5 Auxiliary Enabling Systems

The following systems, which are auxiliary systems for the ash handling system, are considered :

2.5.1 Compressed air system: Compressed air required for conveying air is provided by air compressors. 3 x 100% water cooled screw type air compressors are proposed. During normal continuous running of ash handling systems 2 Nos. of compressors operate for meeting the evacuation of maximum ash generated from 2 Nos of boilers. The third compressor is a standby. 2 Nos of air receivers are provided.

2.5.2 2 Nos of air blowers (1W+1S) are proposed for providing fluidising air for all fly ash hoppers.

2.5.3 2 Nos of air blowers (1W+1S) are proposed for providing fluidising air for fly ash silos.

2.5.4 It is to be noted that the instrument air requirements are met by Instrument air system of the Plant supplied by BHEL (Hyd) and therefore no separate compressors are envisaged for this purpose in Ash Handling system.

2.6 System Capacity

2.6.1 For each boiler, Bed ash is evacuated from boiler Bed ash collection hoppers on a continuous basis. The evacuation rate matches with the maximum collection rate indicated by the boiler manufacturer as 8.7 TPH at each Bed collection hopper. With margin the Design capacity shall be 10TPH.

2.6.2 For each boiler, the fly ash evacuation rate on a continuous basis matches with maximum collection rates indicated by the boiler manufacturer. This works out to 20.75 TPH. Hence the rated capacity shall be 20.75 and with margin, Design capacity shall be 24 TPH.

2.6.3 The storage of Fly ash silo capacity is 665 Tonnes.

2.6.4 The storage capacity of Bed ash silo is 280 Tonnes.

2.6.5 Unloading (to 2Nos of trucks simultaneously) capacity from the Fly ash storage silo is taken at 83 TPH each. With a design margin, Design capacity shall be 96TPH each).

2.6.6 Unloading (to trucks) capacity from the Bed ash storage silo is taken at 35 TPH With a design margin, Design capacity shall be 40TPH.

2.6.7 The capacity of slurry formation and disposal system is considered at 60 TPH With a design margin Design capacity of slurry system including ash slurry pumps shall be 70 TPH.

2.6.8 The capacity of fresh bed material handling system is 2 x 5 TPH. The design capacity also shall be 2x 5 TPH.

2.7 SALIENT FEATURES OF THE SYSTEM

2.7 Bed Ash Removal System

2.7.1 Time Cycle

The bed ash draining normally takes place continuously in a shift. Accordingly bed ash handling system works continuously. During continuous running, the system operates with 20 cycle / hour.

2.7.2 Salient features of Mechanical Equipment

(a) Conveying Air Compressors

The conveying air requirement is met by the compressors used for fly ash removal system. Salient features of these compressors are as discussed under fly ash handling system.

(b) Bed Ash Denseveyors

The bed ash denseveyors are designed to operate on the principle of dense phase type pressure pneumatic system. One (1) bed ash denseveyor is provided below each outlet of the bed ash surge hopper.

(c) Target box on bed ash silo

A target box will be provided on bed ash silo which will be connected to the bed ash air mixture conveying pipes. The target box allows the bed ash to get discharged into the silo.

2.8 Bed Ash Silo

The silo is of RCC construction and of circular cross section. The side wall of the cone portion of silo has a minimum side wall angle of 70^0 to enable free flow of bed ash from bed ash silo. Access stairs is provided on external face of silo with an intermediate landing at operating floor. The bottom of beam of operating floor will be at height of 5 M above ground level to enable free movement of trucks. The columns are located in such a way to enable free movement of trucks. A bag filter vent unit is mounted on top of the silo to filter exhaust air before leaving it to atmosphere. Compressed air for reverse jet cleaning of bags is supplied from plant compressed air system. To safeguard the silo from over pressure on the silo top, a pressure relief vent will be provided. This is suitably rated to open at a predetermined pressure and discharge the air to atmosphere. A level probe is provided to give alarm annunciation when bed ash reaches high level. A structural steel shed with AC sheet covering on sides is provided over the silo to enable maintenance of equipment mounted on top of silo. A mono rail and manual hoist is provided below the roof of the shed for carrying out maintenance of equipment.

2.9 Fly Ash Removal System

2.9.1 Time Cycle

Fly ash removal system operates in cyclic manner continuously with 20 cycles / hour.

1.33.1 Transportation of dry Fly Ash from Silos

Fly ash collected in dry form is transported by trucks. The system shall be suitable for unloading into 2nos of trucks simultaneously.

2.9.2 Salient Features of Equipment

(a) Fly ash denseveyors;

The fly denseveyors are designed to operate on the principle of dense phase type of pressure pneumatic system. The size of the transmitter vessels below fly ash hoppers is selected based on number of cycles per hour specified.

(b) Conveying air compressors

Conveying air requirement of fly ash handling system and that of bed ash handling system are met by three (3) 100% capacity screw compressors. Each air compressor would be adequate to meet the conveying air requirements of ash handling system **design capacity** of one boiler. This means that 2 compressors will meet ash handling system design capacity of 2 Nos. of boilers. The third compressor will be standby. The operating compressors normally operate on load unload regulation.

Air receivers should be normally large enough to supply air without pressure fluctuations. 2 Nos. of air receivers are proposed. The cooling water requirement for compressors is met by plant cooling water system. Compressors are located inside the Ash Handling Equipment House.

(c) Silo unloading System

The silo is provided with three outlets – two outlets with an isolation gate, a rotary feeder and a unloading spout which can unload fly ash in to container trucks. The third outlet is used for slurry formation and onward pumping to ash disposal area. The rotary feeders and dust conditioners are rated same as the unloading system capacity. Salient features of above equipment are furnished below.

(i) Rotary feeders

Rotary feeder, which is air lock feeder is provided with a rated & design capacity as given in clause 2.6 above fitted on both the outlets.

(ii) Unloading spout

A retractable unloading spout is provided on 2Nos of the outlets for unloading fly ash into two container trucks simultaneously. The retractable unloading spout is capable of telescoping into inlet of container trucks thus reducing dust nuisance. The retractable unloading spout would also be fitted with a level probe which when touches fly ash closes the isolating gate and also retracts the retractable spout. The level probe touches fly ash when fly ash has reached maximum level below the inlet. The retractable spout is fitted with a vent filter for venting clean air in to atmosphere. The air entrapped inside the container truck escapes through the retractable chute during fly ash unloading. Since this air contains ash particles, the above vent filter discharges clean air after retaining the dust.

(iii) Silo fluidisation blowers

The requirement of compressed air for fluidisation of fly ash silos is met by two (2) blowers – one operating and one standby. Heaters will be provided on discharge lines of these blowers for heating the air before air is let in to the silos. A connection is given to the bed ash silo to unsettle the bed whenever there is a blockage.

(vi) ESP hopper fluidising blowers

The requirement of compressed air for fluidisation of ESP hoppers of the boilers, is met by two (2) blowers (one (1) operating + one (1) standby). Adequately sized heaters will be provided on discharge lines of blowers to heat the air before air is let in to the hoppers. These blowers will be located in Ash Handling Equipment House. A separate connection will be given to APH hoppers to unsettle the ash collected in those hoppers, if some blockage is there. This is used only whenever there is a blockage. Similarly connection is given to bed ash surge hoppers also to unsettle the bed ash in case there is a blockage. In this case also fluidising air is supplied, only in case a blockage occurs.

2.10 **Fly ash silo**

Silo is of RCC construction, flat bottomed and circular. The silo diameter and positioning of silo support columns shall be such that it will facilitate

simultaneous loading of 2 trucks side by side. The entire bottom of the silos is covered with air slides to enable proper aeration of the silos to enable positive flow of fly ash to each of the outlets of the silos. Access stair case is provided on the external face of the silo for access to top with a landing to operating platform.

The bottom of supporting beam of operating platforms is at a height of 5 M from ground level to enable free movement of trucks. Columns are so located which will enable free movement of trucks. The control panel for operating silo unloading system is also located on the operating platform. A bag filter unit is mounted on top of silo to filter exhaust air before venting same to the atmosphere. Compressed air for reverse jet cleaning of filter bags is supplied from plant compressed air system.

Fly ash pipe lines from the boilers are terminated on to a terminal box mounted on the fly ash silos. To safe guard silo against over pressure, a pressure relief vent is mounted on the top of the silo. This is rated suitably to open at predetermined pressure and discharge to atmosphere. A high level probe will also be mounted on top of silo to give annunciation when fly ash level has reached a certain predetermined high level. A structural steel shed with AC sheet covering on sides and also on roof is to be provided over the fly ash silo to enable maintenance of equipment mounted on top of silo. A monorail and manual hoist is provided below the roof of the shed for maintenance of equipment mounted on top of the silo.

2.11 **Common features for both bed ash & fly ash handling system**

2.11.1 Bed Ash and Fly Ash pipes and valves

Bed and fly ash pipes for conveying air ash mixture from fly ash hoppers to storage silos and for conveying from bed ash surge hoppers to bed ash silo have the following specification.

a) Bed ash conveying pipes – 7 mm MS ERW if available or schedule 40 pipes, if 7 mm thick MS ERW pipes are not available.

b) For fly ash conveying MS black ERW heavy duty pipes as per IS 1239.
The fly ash hopper isolation valve, bed ash surge hopper isolation valves which handle ash are to be of knife gate type with plate made of stainless steel conforming to SS 304 stellited to minimum 1 mm thickness. Body and seat should be made of alloy cost iron with minimum hardness being 350 BHN.

2.11.2 Water Supply System (common to both bed and fly ash handling systems)

Water requirements for dust conditioner and cooling water supply for compressor cooling and air blowers, are to be supplied by plant service water and cooling water systems.

2.12 **Structures**

(a) Ash Handling Equipment House (AHEH)

There is a common AHEH, which is located to the south of Boiler No.1. The size of the compressor house is approximately 25 M long x 10.0 M wide. This houses all the equipment such as compressors, silo fluidising and bed ash and fly ash hopper fluidising blowers and a maintenance bay .

(b) Pipe rack

A structural steel pipe rack is provided for bed ash, fly ash, bed material, conveying air, instrument air piping in the vicinity of silos. The bottom of pipe rack shall provide a clear height of 7m at the road crossing.

2.13 **System Integration & Controls**

2.13.1 The I & C system shall be a stand-alone, microprocessor based control system. All the operations of bed ash handling system & fly ash handling system and bed material handling system are done through PLC based system located in centralized CPP material handling control room.

2.13.2 The operation & monitoring of the process will be through PLC. Connectivity between the PLC to main plant DCS is through fibre optic communication. Supply & laying of Fiber optic cable is by OTHERS.

2.14 **Operation Philosophy**

2.14.1 The instrumentation and control system would facilitate the operation of the ash handling system and bed material handling system from central control room to perform normal start-up, shutdown and emergency operations. The Bed and Fly ash handling system and bed material handling system operation will be through PLC **located in the material handling Control room**. However local sump pump, silo unloading in container trucks, etc., are operated from local control panel.

2.14.2 The silo unloading of both bed ash and fly ash into trucks are monitored and controlled from local control panels (LCP's) located on the operating floors of respective silos. This panel is a conventional relay based panel. Signals from these LCP's are made available in Material handling control room PLC for monitoring

2.14.3 The bed and fly ash are unloaded from the Fly Ash hoppers from storage silos (Bed and fly ash) either in auto mode or in manual mode. In auto mode, the operation is either in timer mode or in level probe mode. However normal operation is in level probe mode. In manual mode, the operation is hopper by hopper selectively. Level probes are mounted in the bed ash, surge and fly ash hoppers to enable operation of the bed and fly ash handling systems. The system operation initiation is by both the level probes in the bed ash surge hopper and those in the Bed & Fly Ash silos.

2.14.4 Local push button stations with start/stop push buttons are provided near the drives of all equipment to enable the local start/stop of the equipment or open/close of valves in the de-interlock mode during testing and maintenance. This "De-interlock mode" will be provided with permissive (OK) from the Material Handling Control Room.

2.15 Ventilation

Ash Handling Equipment House (AHEH) is ventilated using supply and exhaust fans.

2.16 Maintenance Facilities

Mono rail with manually operated hoist and trolley is provided for handling during maintenance of air compressors, air blowers and ash slurry pumps. Power plug points are provided in AHEH to enable carryout maintenance.

2.17 Drainage

The drainage for below ground pits under Bed ash hoppers is done by connecting to the plant drainage system, if drainage by gravity is possible. If not, sumps will be provided from where pumps can be used to pump to the nearest storm water drainage .

EQUIPMENT TO BE SUPPLIED, ERECTED / INSTALLED AND TESTED & COMMISSIONED BY VENDOR

The Ash and Bed Material Handling System & Accessories supplied under this specification shall include but not be limited to the following equipment/items, works and facilities to make the system complete in all respects. Equipment to be supplied and works to be carried out as listed here under shall conform to the specific requirements listed in Section-C and D, relevant Data Sheet-A in Section-D and drawings. All equipment shall be supplied with necessary auxiliaries and accessories as per the system requirement envisaged in this specification.

3.1 EQUIPMENT/EQUIPMENT DESCRIPTION

Sl. No.	Equipment/ System Description	Quantity
1.	Fly Ash Handling System complete to carry out fly ash removal as outlined above and as indicated in PID for 3x33MW units.	Lot
2.	Bed Ash Handling System complete to carry out bed ash removal as outlined above and as indicated in PID for 3 x 33 MW units.	Lot
3.	Bed Material Handling System Complete as outlined above and as indicated in PID for 3 X 33MW units.	Lot

4. Any other items which are not listed above but are required to make the Ash Handling & Bed Material Handling System complete in all respects as per this specification for proper continuous functioning.

5. Drawings and details required as part of the Interface information for other system Engineering like civil, structural & electrical works.

3.2 **Mechanical**

3.2.1 Fly Ash Handling System

(a) One (1) lot of denseveyor, transmitter vessels along with isolating valves, expansion joints, inlet and outlet pneumatic operated valves, control system, level probes, adopter piece, supports for transmitter etc., below each ESP hopper (Refer Flow diagram).

(b) One (1) lot of fly ash piping, valves, fittings and instrumentation as required up to the terminal box on top of the fly ash silos.

(c) One (1) lot of conveying compressed air piping from air compressor plant to various fly ash hoppers with valves, fittings, etc.

(d) Two (2) blowers (one working + one standby) for ESP hoppers fluidisation along with fluidising pads, heaters, piping etc. Adequately sized heaters will be provided on discharge lines of blowers to heat the air before air is let in to the hoppers. These blowers will be located in Ash Handling Equipment House. A separate connection will be given to APH hoppers to unsettle the ash collected in those hoppers, if some blockage is there. This is used only whenever there is a blockage. Similarly connection is given to bed ash surge hoppers also to unsettle the bed ash in case there is a blockage. In this case also fluidising air is supplied, only in case a blockage occurs.

(e) One (1) lot of fly ash piping with fittings, instruments, valves, flanges, hangers, supports etc. comprising of the following services / equipment as per flow diagram.

(i) From all the fly ash transmitter vessels to the fly ash storage silo.
(ii) Branch isolation / diverter valves wherever required as per flow diagram and to meet the system operational requirement based on the type of BIDDER’s equipment.

(f) One (1) flushing box and associated piping between bed ash hopper and air preheater/economiser hopper for each air preheater/economiser hopper.

3.2.2 Fly Ash Silo

One (1) No. of fly ash RCC storage silo with associated accessories. The fly ash storage silo shall have the following auxiliaries and accessories.

(a) Two (2) Nos. of silo aeration blowers common for both fly ash silo and Bed Ash silo (one working + one standby) with associated drive units, heaters, valves, instruments, air slides, etc. to aerate the entire base of the fly ash silo to create positive flow to the outlet of the silo.

(b) One (1) no. bag type vent filter on the vent line at the top of each fly ash storage silo.

(c) One (1) no. Pressure relief vent on the top of each silo to safeguard the silo from getting pressurised.

(d) One (1) no. of fly ash unloading system to unload the ash in the slurry condition from silo to the ash slurry sump. The unloading system shall be complete with isolated shut off gate, rotary feeder, mixing tank / feed sump, at the outlet of fly ash storage silo and associated water/slurry piping, valves, controls etc. to make the system complete in all respects.

(e) Two (2) nos. of dry fly ash unloading through two outlets with isolation gates, rotary feeders and unloading spouts which can unload fly ash into two container trucks simultaneously. This unloading system shall be complete with retractable unloading spout, level probe, isolating gate, vent filter for venting clean air in to atmosphere etc. to make the system complete in all respects.

(f). One (1) no. Guided Radar type Level transmitter shall be considered for level measurement in each silo.

(g). One (1) lot of maintenance/operating floor for silo unloading, staircase to approach upto top of silo, handling arrangement at top of silo, hand-railings, ladder to approach inside silo etc.

(h) Terminal boxes with steel adopter pipes to be fixed for each inlet to the silo.

(i) All other items required to make the system complete in all respects.

3.2.3 Bed Ash Handling System

(a) One (1) lot of water cooled surge hopper (below ash cooler collection hopper) denseveyor, transmitter vessels along with isolating valves, expansion joints,

inlet and outlet pneumatic operated valves, control system, level probes, adopter piece, supports for transmitter etc. (Refer Flow diagram).

(b) One (1) lot of bed ash piping, valves, fittings and instrumentation as required upto the terminal box on top of the bed ash silos. Branch isolation / diverter valves wherever required as per flow diagram and to meet the system operational requirement based on the type of BIDDER's equipment.

(c) Compressed air fluidizing piping connection is given to bed ash surge hoppers from ESP hopper fluidising blowers to unsettle the bed ash in case there is a blockage. Fluidising air is supplied, only in case a blockage occurs.

3.2.4 Bed Ash Silo

One (1) No. of Bed ash RCC storage silo with associated accessories. The bed ash storage silo shall have the following auxiliaries and accessories.

(a) Compressed air fluidizing piping connection to unsettle the bed whenever there is a blockage, is given to bed ash silos from Fly ash Silo fluidizing blowers.

(b) One (1) no. bag type vent filter on the vent line at the top of each bed ash storage silo.

(c) One (1) no. Pressure relief vent on the top of each silo to safeguard the silo from getting pressurised.

(d) One (1) no. of bed ash unloading system to unload the ash in the slurry condition from silo to the ash slurry sump. The unloading system shall be complete with isolated shut off gate, rotary feeder, mixing tank / feed sump at the outlet of bed ash storage silo and associated water/slurry piping, valves, controls etc. to make the system complete in all respects.

(e) One (1) no. of dry bed ash unloading with isolation gates, rotary feeders and unloading spouts which can unload bed ash in to container trucks. This unloading system shall be complete with retractable unloading spout, level probe, isolating gate, vent filter for venting clean air in to atmosphere etc. to make the system complete in all respects.

(f) One (1) no. Guided Radar type Level transmitter shall be considered for level measurement in each silo.

3.2.5 Bed Material Handling System

(a) One (1) lot of denseveyor, transmitter vessels along with isolating valves, expansion joints, inlet and outlet pneumatic operated valves, control system, level probes, adopter piece, supports for transmitter etc. (Refer Flow diagram).

(b) One (1) lot of piping, valves, fittings and instrumentation as required upto the boiler bed material bunker with branch isolation / diverter valves wherever required, for transferring fresh bed material and recirculation/diversion of bed material/bed ash as per flow diagram and to meet the system operational requirement based on the type of BIDDER's equipment.

(d) One RCC bed material receiving station complete with fresh material receiving hopper, complete below grade level works as indicated in flow diagram & GA drawing

(e) One (1) no. Guided Radar type Level transmitter shall be considered for level measurement in each bunker.

3.2.6 Piping interconnection between Bed Ash and Fly Ash near Silo

Suitable piping interconnections with diverter valves, pipings, fittings, flanges, hangers, supporting shall be provided between fly ash conveying lines and bed ash conveying lines for diverting bed ash to fly ash silo and vice versa to prepare a mix consisting of fly ash and bed ash in silos. (refer flow diagram).

3.2.7 Compressed Air System (Common for bed ash, fly ash & bed material handling systems)

(a) Three (3) screw compressors of adequate capacity (2 working to meet bed and fly ash handling requirements of 2 boilers + 1 stand by) with drives and all accessories.

(b) Two (2) air receivers of sufficient capacity.

(c) 2 Nos. of air driers, as required

(f) One (1) lot of conveying compressed air piping as per requirement (Refer Flow diagram) with fittings, instruments flanges, supports, etc.

(g) One (1) lot of Instruments, cables, LCP/ PLC based system as envisaged , instrument erection hardware, necessary interface of the control system offered for Compressed air system with the ash handling PLC located in material handling control room. The scope includes supply, installation & commissioning of complete I&C system.

3.2.8 Instrument air system – (Common for bed ash, fly ash & bed material handling systems)

(a) One (1) lot of instrument air piping as per the vendor's system requirement (refer flow diagram) with fittings, instruments, flanges, supports etc. Instrument air will be provided at one point by EPCC.

3.2.9 Ash Slurry Disposal System (Common for bed ash & fly ash handling systems)

(a) One set of ash slurry pumps (one working + one standby) with ash slurry pipe lines, valves and fittings upto the disposal area (ash pond) along with necessary supports, fixtures/clamps.

3.2.10 One (1) lot of supports with access platforms, ladders, handrails, concrete sleepers (if required), etc. for all the air, water, fly ash, bed ash, bed material and slurry piping.

3.2.11 One (1) no. suitable capacity manually/electrically operated hoist complete with its accessories and auxiliaries, for maintenance air compressors, air blowers, water / ash slurry pumps in AHEH pump house complex. Also, one lot of suitable capacity electrically operated hoists for handling material in top of each fly ash silo shall be included in the Bidder's scope of work.

3.2.12 All instruments such as pressure indictors, pressure switches, relays, level control instruments, level indicators, level switches with alarm contacts, control valves and other instruments together with root valves as shown in the flow diagram. Any other instruments even though not shown in the flow diagram but considered necessary for safe and satisfactory operation of the system shall also be included. All board mounted pressure indicators will get signals through pressure transmitters.

3.2.13 All base plates, guards, holding down bolts, anchorage channels, pipe sleeves, inserts etc. required for the complete ash handling equipment.

3.2.14 One (1) lot of water piping with fittings, valves, etc .

3.2.15 One (1) lot of compressed air and instrument air piping with fittings, valves etc.

3.2.16 One(1) lot of motor operated/cylinder operated valves.

3.2.17 The fly ash, bed ash and Bed material handling systems shall be provided with complete PLC based control system with marshalling cabinets, control cabinets, multiplier contacts, with the complete operation based on CRT. All operating parameter status indications shall be duplicated in power plant CRT.

3.2.18 Bidder shall quote for all piping systems as a lump sum price. However for the piping between ash slurry sump to ash disposal area (ash pond), the bidder shall indicate lump sum price for the total lengths with an incremental for every 50m or part thereof. Cost of fittings shall also be included in quoted pipe straight lengths. Units rates will be applicable for any variation in the B.O.M.

3.2.19 Any other items which are not listed but are required to make the ash handling system complete in all respects as per this specification.

3.3 Civil and Structural Works

3.3.1 Scope

Complete civil works for all structures that are at/on/above/below ground/ grade level as listed below including (but not limited to) detailed analysis, design, preparation of all detailed design/construction/fabrication drawings, list of steel inserts, bar bending schedules, procurement and supply of all materials. Execution of the entire civil works including testing and everything else necessary whether specified or not for the safe, smooth and trouble free operation of the ash handling system for all the structures envisaged as listed below :

Ash Handling Equipment House (AHEH) complex consisting of :
Air compressor (for conveying), air blowers for fly ash hopper fluidising, air blowers for silo fluidising, accessories and other items as indicated in the GA complete with lighting, ventilation, earthing, manual / electrical hoist for equipment handling, cable trenches etc. on turnkey basis

3.3.2 RCC fly ash storage silo – 1 No. complete civil works including foundation, a common staircase for both fly ash silo and bed ash silo with handrails, etc.

3.3.3 RCC bed ash storage silo – 1 No. complete civil works including foundation

3.3.4 RCC Bed material hopper – 1 No. complete civil works including foundation

3.3.5 Structural steel work for monorails, pipe/cable racks including painting and RCC slurry sump.

3.3.6 Foundations for all equipment and their drives and all other foundations required for ash handling system. This shall include supply and fixing of all rails, steel inserts, pipe sleeves, anchor bolts/anchorage, assemblies, bolts, nuts, washers, etc. and grouting of anchor bolts and below base plates.

3.3.7 Suitable access and maintenance platforms with the supporting structures including ladders and hand rails wherever required at below economiser, air pre heater stack

hoppers – or for any other equipment for its safer operation and maintenance.

3.3.8 Access ladders on both sides of the ash slurry sump, & safety hand rails for ash slurry sump and ash water tank. Access stair case to wherever required.

3.3.9 Puddle pipes for all water, ash slurry and sump pump suction and discharge pipes as per the requirement.

3.3.10 RCC supports/thrust blocks for routing the slurry pipe lines upto the disposal points.

3.3.11 Pipe racks (viz. from buildings/trenches/ silos to main pipe rack etc.) as required.

3.3.12 Pit, foundation, sump, receiving hopper, roof over pit, access staircase to go to pit etc for the bed material handling system

3.3.13 All other civil and structural works pertaining to the ash handling system, even though not brought out specifically in this specification, but considered necessary shall also be included.

3.4 GENERAL

Miscellaneous services requirement have been covered under this clause and are as follows :

3.4.1 Complete lot of base plates, foundation bolts, inserts, emedments, clamps, nuts, washers etc. as required for the system.

3.4.2 One (1) set of recommended maintenance and erection tools and tackles.

3.4.3 Grouting for all equipment, structures, pipe racks etc.

3.4.4 One (1) lot of starts up and commissioning spares.

3.4.5 One (1) lot of essential spare parts for three (3) years of trouble free operation as per the system data sheet – A3 of this specification.

3.4.6 Instruction manuals for installation, start up, maintenance and operation of all the equipment, supplied by the VENDOR as per the distribution schedule.

3.4.7 The VENDOR shall furnish all the design calculations and drawings as listed in this specification.

3.4.8 One lot of recommended spares by BIDDER for three years trouble free operation.

3.4.9 Attending meetings at the CEPCC/EPCC/OWNER's office/site or at any other station that may be fixed by the EPCC/CEPCC for planning, co-ordination, clarifications, review, discussions etc.

3.4.10 Preparation and testing of test specimens as and when required by the EPCC/CEPCC including setting up of (if required) test laboratory with all necessary test equipment/instruments etc.

3.4.11 Proper packing, transport to site, unloading from carriers/wagons, inspection, storing at site, and transportation to erection site.

3.4.12 The VENDOR shall submit the erection procedure of the Purchaser's approval well ahead of the start of erection at site.

3.4.13 Equipment shall be tested for all the tests called for in Section C and D of the specification. All test equipment and labour shall be provided by the VFENDOR. Start up, commissioning and putting all the equipment into satisfactory commercial operation are included in Vendor's scope.

3.4.14 Supply of lubricants, grease, oil etc. required for the equipment during testing, commissioning and till handing over of the complete system after putting it into satisfactory operation.

3.5 Erection

3.5.1 Installation, trial testing and commissioning of all equipment covered in the scope and performance testing of complete ash handling system and individual equipment to prove guarantees offered.

3.5.2 Laying, termination, testing and commissioning of all power cables, control and instrumentation cables.

3.5.3 Installation, jointing and termination of earthing conductor to form a main earthing grid for ash handing system and connection of the same to the EPCC's earthing grid and earthing of all electrical equipment covered in the scope of the VENDOR.

3.5.4 Installation, testing and commissioning of lighting system for ash handing package.

3.6 All instruments and manpower necessary for carrying out performance testing of various ash handling system equipment and complete system to prove the performance guarantee shall be arranged by the VNEDOR. The instruments supplied by the CONTRACTOR during such performance testing can be taken back by him after providing the performance of the system.

3.7 All other equipment, material structures and work not specifically mentioned herein but is considered essential to make the system complete in all respects ie. Mechanical, electrical, structural and civil except those excluded vide equipment to be furnished by others shall be deemed to be included in the scope of VENDOR.

3.8 **GENERAL WORKS & SERVICES**

1.	Installation, operation and maintenance manuals	Lot	For all equipment of envisaged in this spec.
2.	All initial fillings and consumables such as lubricating oils, greases, etc., required during erection, testing and commissioning	Lot	
3.	Preparation and submission of design calculations, drawings for approval of EPCC / CEPCC in required numbers	Lot	
4.	All general arrangement drawings / information required for the EPCC/CEPCC and input requirements for electrical design and drawings and interface details.	Lot	
5.	Co-ordination & co-operation with the other Vendor and contractors to complete the Ash Handling & Bed Material Handling System		
6.	Painting of all equipment, structures, etc. as per specification	Lot	
7.	Maintenance & erection tools and tackles as listed in System Data Sheet-A5 of Section-C13	Lot	
8.	Training of OWNER’s/EPCC’s personnel		

Note : The equipment / items of work not indicated in Section C-5 (equipment / services by others) but are required to complete Ash and Bed Material Handling System for satisfactory performance in all respects are to be rendered under this contract, even if the same are not listed out in this section / specification. It is the responsibility of the CONTRACTOR to supply all the required items and complete all the works and to provide all services to make the Ash and Bed Material Handling System complete in all respects.

3.9 **ELECTRICAL**

EPCC will arrange for power supply feeders to Ash and Bed Material Handling System *package near the user points as specified by Vendor. Vendor shall refer the attached interface details for Electrical works between EPCC and Vendor and shall furnish the preliminary data along with bid.*

3.10 **Painting (Other than structurals)**

Painting of equipment other than structural shall be carried out as per the specifications indicated below and shall conform to the relevant IS specification for the material and workmanship. Painting of structural shall be carried out as described in Section-C-8 of this specification.

3.10.1 **Surface_preparation**

The surfaces of steel work to be painted shall be thoroughly cleaned of all grease, oil, loose mill scale, dirt, rust and any other foreign matter mechanical cleaning by power tool, scrapping with steel wire brushes shall be adopted to clean the surfaces to the entire satisfaction of the EPCC/CEPCC. However, in certain locations where power tool cleaning cannot be carried out, EPCC/CEPCC shall permit hand scrapping with steel wire brushes and/abrasive paper. Cleaning by solvents shall be resorted to by the CONTRACTOR, only in such areas where the other method specified above has not achieved the desired results. Cleaning with solvents shall be adopted only after obtaining written approval of the EPCC'S/ CEPCC. Derusting and descaling by blasting is not contemplated. The workmanship shall, in general, be in accordance with IS.1477.

3.10.2 **Primer_Paint**

After the surface is prepared in a manner acceptable to EPCC / CEPCC, one coat of red oxide primer conforming to IS.2074 shall be applied on the steel surfaces. After this first coat is dried up completely, second coat of red oxide primer shall be

applied. Primer shall be applied by brushing to ensure a continuous film without 'holidays'. The dry film thickness of each coat shall be minimum 30 microns.

3.10.3 **Finish_Paint**

Synthetic enamel paint conforming to IS.2932 shall be used for finish coats. The manufacturer and colour/shade shall be as approved by the EPCC/ CEPCC.

After cleaning the dust on the dried up primer, an optimum coat of first coat of synthetic enamel paint shall be applied. After this first coat dries up hard, the surface is wet rubbed cutting down to a smooth finish and ensuring that at no place the first coat is completely removed. After allowing the water to get evaporated completely, the second finish coat of synthetic enamel paint shall be applied.

The second finish coat with synthetic enamel paint shall be applied only after the first finish coat is hard dry and its gloss is gently removed over the entire surface and carefully dusted off.

After erection of equipment at site, touch-up paint to be applied to cover scratches. The requirements of workmanship shall be as specified in IS.1477.

Paint shall be applied by brushing and it shall be ensured that the brush marks are minimum. Paint used shall be stirred frequently to keep the pigment in suspension. Paint shall be of the ready mixed type in original sealed containers as packed by the paint manufacturer and using the thinners is not permitted.

The dry film thickness of each of two finish coats shall be minimum 30 microns.

No painting shall be done in frostly/foggy weather or when the humidity is high enough to cause condensation on the surface to be painted. Paint shall not be applied when the temperature of the surface to be painted is 5 deg C or lower.

4.0 MISCELLANEOUS SERVICES FROM THE CONTRACTOR

4.1 SHOP INSPECTION

Shop Inspection and tests as per specified codes and standards shall be arranged by the VENDOR through an inspection agency approved by the EPCC. Adequate number of copies of inspection/test certificates shall be furnished as per the Distribution schedule. The BIDDER shall include these services in his scope.

4.2 START-UP AND COMMISSIONING

The VENDOR's scope of work shall include erection, trial runs, testing, start-up and commissioning of the equipment covered in this specification.

4.3 TRAINING OF EPCC'S PERSONNEL

4.3.1 The VENDOR shall undertake to train a reasonable number of engineers/operators (Minimum six personnel including two Engineers) selected and sent by the EPCC/OWNER.

4.3.2 These engineers/operators shall be given special training in the shop, laboratory and drawing office of the VENDOR where the equipment shall be designed, manufactured and in any other power plant where similar capacity and type of coke handling systems designed, manufactured and supplied by the VENDOR are under installation, testing, operation and maintenance, to enable the engineers to become fully familiar with the equipment to be supplied under this contract. The period of training shall be maximum 15 days and shall be extended on mutual agreement.

4.3.3 The VENDOR's supervisory personnel at site shall continuously and intensively instruct and train adequate number of the EPCC's operating and maintenance personnel at site during commissioning of the plant to enable them to take over the proper operation and maintenance of the plant after commissioning.

4.4 Performance testing of complete Ash & Bed Material Handling Systems and individual equipment to prove the guarantees offered during the bid/detail engineering stage.

4.5 The VENDOR shall furnish design calculations/drawings and data as called for in the Data Sheet-C of equipment/system after award of Contract.

5.0 EQUIPMENT AND SERVICES TO BE PROVIDED BY OTHERS

The equipment to be provided and the work to be performed by others under this specification shall be as follows :

5.1 Fly ash hoppers (of ESP, air preheater, duct backpass & stack) upto outlet flange.

5.2 Service water supply at one single specified terminal point for cooling purposes.

5.3 6.6 kV / 415V switchgear for ash handling plant located in switchgear room.

5.4 All 6.6 kV/ 433 V transformers located at switchgear room.

5.5 Plant roads and drains as shown in Plan drawing. Any other kutcha/pakka roads required for movement of Bidder's men and material shall be Bidder's responsibility.

5.6 Ash dyke.

5.7 Fire protection and alarm system.

5.8 Potable water system.

5.9 EPCC will arrange for power supply feeders to the nearest junction box of the user. However the input data for this is to be provided by Vendor.

5.10 Road and Fences as shown

5.11 Potable water system.

5.12 Bidder shall provide the necessary Electrical Systems as per the "*Electrical Interface for Material Handling Systems"* attached to this specification.

6.0 SYSTEM CAPACITY, LAYOUT, MAINTENANCE, DESIGN AND OTHER GENERAL REQUIREMENTS

6.1 SYSTEM CAPACITY

The system capacity of bed ash handling, fly ash handling, ash slurry disposal and ash water recovery system shall be as follows :

6.1.1 For each boiler, the Bed ash is evacuated from boiler Bed ash collection hoppers on a continuous basis. The rated capacity of evacuation shall be 8.7 TPH at each Bed collection hopper. With design margin, the design capacity shall be 10TPH for each bed ash collection hopper

6.1.2 For each boiler, the fly ash shall be evacuated on a continuous basis at the rated capacity of 20.75 TPH. With design margin, the design capacity shall be 24 TPH.

6.1.3 The fly ash & bed ash removal system and conveying same upto the storage silo shall be designed on a continuous basis with 20 cycles per hour.

6.1.4 The rated capacity of each slurry making unit together for fly ash & bed ash silo shall be 60 TPH and design capacity 70TPH. The pump shall be sized for handling ash at 70 TPH design capacity.

6.1.5 The rated capacity of each unloading system from the fly ash storage silo through unloading spout shall be at 83 TPH, and with margin the design capacity shall be 96 TPH each.

The rated capacity of unloading system from the bed ash storage silo through unloading spout shall be at 35 TPH and with margin the design capacity shall be 40 TPH.

6.1.6 The rated & design capacity of Bed Material System shall be 2 x 5 TPH

6.1.7 The velocity of the ash slurry in the ash slurry pipe line shall be between 2.5 m/sec and 3 m/sec.

6.1.8 Ash slurry sump shall have storage capacity of five (5) minutes.

6.2 SYSTEM LAYOUT REQUIREMENTS

6.2.1 The location of ash slurry sump, Ash Handling Equipment House, fly ash storage silos, pipe rack etc. are indicated in the general arrangement drawings enclosed along with this specification. Based on the location shown, the ash handling system equipment shall be suitably designed. However, minor changes to suit the system/equipment offered by the BIDDER and plant layout requirement by the EPCC/OWNER shall be carried out by the VENDOR during the contract execution stage, at no extra cost to the EPCC/OWNER.

6.2.2 Fly ash removal system will operate in a cyclic manner.

6.2.3 Pipe trench with pipe rack as indicated in the attached GA shall be considered for fly ash removal system between ESP hoppers, bed ash hoppers and fly ash silo. .

6.2.4 The layout shall be such that it shall be possible to maintain any equipment without disturbing the operating equipment. It shall be possible to remove the equipment for maintenance by disconnecting the coupling. It should not be necessary to dismantle the piping for removing any slurry pump/water pump.

6.2.5 The overall dimensional details of AHEH, indicated in the bid drawing are the minimum requirement to be considered by the BIDDER in their offer. In case any dimensions which are shown in the drawings are inadequate for the system offered, the BIDDER may increase the dimensions suitably.

6.2.6 The layout of water piping for the ash handling system shall ensure that all valves are located so as to be conveniently accessible. However, the bottom ash slurry pipe lines from the Jet pump outlet to slurry sump shall run in the pipe trenches up 5to the nearest pipe rack and then routed in the pipe rack.

6.2.7 All piping shall be arranged to provide clearance for the removal of equipment requiring maintenance and for easy access to valves and other piping accessories required for operation and maintenance. Layout drawings shall also indicate orientation of valves and availability of access to valves and specialities.

6.2.8 Flushing water connection shall be provided.

6.2.9 All pipe joints to be provided inside slurry sump and slurry pump shall be flanged type with suitable gaskets.

6.2.10 To avoid erosion, corrosion and pitting of ash slurry pipes at support locations rubber paddings shall be provided between the bottom of the pipe lines and the pedestals on which pipelines are supported. The rubber padding shall be made of

wire inserted red rubber as per ANSI 16.21 with minimum 10 mm thickness.

6.2.11 Ash storage silos shall be located as shown in the specification drawing. A minimum clear head room of 5 m shall be provided below ash silos platform floor for the movement of trucks.

6.2.12 Access walkways/steps shall be minimum 1000 mm wide. Suitable hand railing shall be provided for personnel safety, wherever required.

6.2.13 All local panels, distribution boards, lighting panels, junction boxes, terminal boxes, marshalling boxes, push button stations etc. shall be located in accessible locations permitting maintenance. Minimum rear space for local panels and distribution boards shall be 1000 mm from the nearest obstruction. Cabling shall be done clearing any interference between collars, greasing points and dust collection. There shall be minimum 2 meters head room below run of cable trays. All embedments required for supporting cable supports and other electrical services should be supplied and laid by VENDOR during civil construction.

6.2.14 Local control panels requiring operators attention shall not be located in dust prone areas. Local panels in each area shall be housed in a dust proof cabin to minimise dust nuisance as well as any theft of components.

6.3 MAINTENANCE REQUIREMENTS

6.3.1 The BIDDER shall provide facilities for carrying out online and off-line maintenance of ash handling plant and auxiliaries. In general, this should include adequate handling equipment, working space platforms and safety devices.

6.3.2 In order to carry out on-line maintenance, it is necessary that the equipment supplied can be readily disassembled, repaired and reassembled in the shortest period. It should also be possible to attend to the equipment by a minimum disassembly of parts.

6.3.3 Wherever required, the BIDDER shall supply the necessary lifting equipment and accessories to suit his equipment without any extra cost to the PURCHASER.

6.3.4 One complete set of erection and maintenance tools required for ash handling plant shall be included. The BIDDER shall clearly indicate in his bid, the number and type of tools offered along with the equipment.

6.3.5 The discharge piping of the sump pumps shall be connected to slurry sump. All blind flange with a gate valve in the discharge line shall also be provided, to enable diverting the water to plant drain instead of discharging into slurry sump, if required.

6.3.6 Maintenance platform of minimum one meter width with handrails and access ladders shall be provided below air preheater hopper and duct hopper back pass (if required). The supports for the platform below hoppers may be taken from the boiler structures. The supports for the platform below air preheater hoppers shall be taken from the ground level avoiding interference.

6.3.7 The ash slurry pipe lines shall be provided with flange connections at every 6 m. Suitable thickness gasket shall be provided at each joint. However, there shall be sleeve coupling connection between the pipe lines at interval of 18 meters (i.e. every third joint) in order to take care of the expansion of ash slurry pipe lines and misalignments, if any, during erection.

6.3.8 All overflow drains from sumps/tanks and equipments shall be provided by the Contractor upto the nearest Plant drain. Bidder may consider an average pipe/trench length of 15 meters outside the building for bidding purpose.

6.3.9 Sufficient length shall be considered for expansion joint between ESP hopper and transmitter vessel, so that connecting equipment need not be disturbed during the replacement of expansion bellows.

6.4 DESIGN & OTHER GENERAL REQUIREMENTS

6.4.1 Percentage distribution of ash produced and ash composition are indicated in the system Data Sheet-A1 shall be considered for the system design.

6.4.2 Though the specification calls for dense phase system, the Bidder can offer dense phase or lean phase or combination of both at arrive at a system, which will meet the specification requirements. While doing so the Bidder can use Air compressors or Air Blowers or combination of both for providing conveying air for the system. The bidder shall keep the standby philosophy as specified, while choosing the air compressors or air blowers or combination of both ie one or one set of compressors or air blowers or combination of compressors & blowers shall be standby for operation of bed ash and fly ash requirements of one boiler. The Bidder shall state the system offered by him giving explanation of the same.

6.4.3 Bed ash handling systems and fly ash handling system shall have a design capacity as indicated elsewhere in this specification. Hence all the concerned equipment such as ash transmittal vessels, piping, flexible unloading spout etc. shall be selected considering this. The performance tests shall be carried out to

prove the design capacity with a tolerance of –0.00.

6.4.4 Provision for mounting all instruments required to carryout performance tests of water pumps and slurry pumps shall be incorporated in the system piping.

6.4.5 Ash slurry pumps shall be designed considering a ash disposal piping length of 1200mm, with a static lift of 6m to handle the ash with a characteristics as indicated in System Data Sheet A-1 of this specification

6.4.6 Ash handling system drive motors shall be designed for continuous operation of 24 hours per day. The bearings of all pumps and motors shall be of heavy duty and shall have a useful life of minimum 50,000 operating hours.

6.4.7 Necessary air release valves shall be provided in slurry pumping to avoid water hammer effect. The details of the same shall be furnished along with the bid. The VENDOR shall furnish design calculations for surge analysis after award of the contract.

6.4.8 For sizing of water piping, the maximum velocity of water in the pipe lines shall be considered as 2.5 m/second.

6.4.9 Compressed air piping shall be considered a maximum pressure drop of 0.3 kg/sq.cm from air receiver/compressor to the farthest consumption point as specified in IS 6206.

6.4.10 Ash water shall be used for flushing the ash disposal lines at the end of slurry disposal.

6.4.11 The details regarding the movements of the fly ash hoppers (economiser air preheater and electrostatic precipitator hoppers) due to the expansion is furnished. The expansion joints shall be of stainless steel construction only.

6.4.12 The ash slurry pumps, air compressors, air blowers and other rotating equipment shall run continuously without exceeding the levels of noise and vibrations as specified in Section C12.

6.4.13 In case of twin casing type of ash slurry pumps, the inner casing shall be rigidly fixed with the outer casing such that during the operation of the pump or due to wearing of seating portion of the inner casing the position of the inner casing shall not get affected.

6.4.14 The discharge points will be shifted in steps of 200 meters. The BIDDER shall furnish detailed calculations to arrive at TDH of slurry pumps at various

distances and how to achieve the same. The slurry pumps shall have drooping characteristic and shall be designed to operate in series.

6.4.15 The arrangement and number of agitating nozzles provided in the ash slurry sump shall be such that the nozzles create whirlpool action in order to avoid any heap formation of ash inside the ash slurry sumps.

6.4.16 Valves which are provided for 50NB and smaller sizes pipes shall have three piece ball valves.

6.4.17 The valve at fly ash silo outlet for truck loading shall be provided with pneumatic actuator for quick operation in order to minimise the spillage.

6.4.18 Fluidising pads in fly ash hoppers and silos shall be preferably of woven stainless steel and should withstand temperature upto 170°C.

6.4.19 All instruments & Panels shall have an enclosure protection of IP65.

6.14.20 The compressors for generation of conveying air for bed ash and fly ash system shall be non lubricated type or lubricated type with filters, which can limit oil in the in the conveying air to not more than 3 ppm.

6.14.21 For handling material from top of each of fly ash silo and bed ash silo electric operated hoist and trolley shall be provided.

6.14.22 Bidder shall use bag filter for venting and ensure that the dust emission in ash handling system is less than 50mg/Nm^3 or meeting local PCB/environmental norms, whichever is more stringent.

6.14.23 The water requirement for slurry will be provided by BHEL at a pressure of 5kg/cm2(g) near bed ash silo. The Bidder shall indicate the quantity of water requirement in his Bid

7.0 **SPECIFIC PERFORMANCE / TECHNICAL REQUIREMENTS OF ELECTRICAL WORKS AND OTHER GENERAL REQUIREMENTS**

The Ash and Bed Material Handling System shall comply with the requirements specified herein.

7.1 DRIVE_MOTORS

7.1.1 Drive motors rated above 132kW shall be suitable for 6.6kV, 3-phase, 50 Hz. high resistance earthed (non-effectively earthed) system and shall conform to TCE.M4-203-01 & 02.

7.1.2 Motors rated 132kW and below shall be suitable for 415V, 3 phase, 3 wire, 50 Hz, high resistance earthed (non-effectively earthed) supply system and shall conform to TCE.M4-203-01 & 02.

7.1.3 The motors shall be of reputed and reliable make and the same shall be subject to approval of EPCC.

7.1.4 Degree of Protection of terminal boxes of all motors shall be IP 55. They shall be totally enclosed & weather proof. Motors installed in underground tunnels shall be flameproof as per IS:2148.

7.1.5 Polarisation index test shall be carried out as a routine test on each 6.6 kV motor. (The minimum value of P.I. should not be less than 2 as per IS-7816).

7.1.6 The insulation class for all the H.T. motors shall be Class 'F' and the temperature rise by winding resistance method shall be limited to that of Class 'B'.

7.1.7 One bearing of 6.6 kV motors shall be insulated to prevent shaft circulating current.

7.1.8 6.6 kV motors shall be provided with embedded temperature detectors with a DC resistance of 100 ohms at 0oC for each bearing.

7.1.9 The insulation system for 6.6 kV motor shall withstand the negative or positive, 0.3 microsecond to crest and 2.7 p.u. rated peak line to earth operating voltage switching surges originating from a non-effectively earthed power system during switching operations. The motors shall have a BIL of 31 KV (Peak) 1.2/50 microsecond wave. The motors shall withstand 23 kV (rms) for one (1) minute. Vendors shall confirm compliance to this requirement and carryout tests to prove the insulation levels at national test laboratories in the event of

an order. The switching and lightning impulse tests shall be performed on one motor while the power frequency withstand test shall be performed on all 6.6 kV motors.

7.1.10 The equipment supplied shall have the maximum reliability. Only the reputed and the proven makes and type of equipment/components shall be supplied. The make, type reference of the equipment is subject to EPCC's approval and only the makes and type acceptable to EPCC shall be supplied.

7.2 DE-INTERLOCK SWITCH AND PUSH BUTTON STATIONS AND SAFETY SWITCHES

7.2.1 De-interlock switch station shall be provided with de-interlock switch, start/stop/belt bridging PBs or forward/reverse/stop PBs as applicable in each case. De-interlock switch shall have three positions viz. interlocked, de-interlocked and off. The switch shall be key operated type so that any position can be changed only by operation of the key. When put in de-interlock position the switch shall bypass the sequential interlock and allow for testing from this station. Under this condition switch shall block permissive interlocks for running the equipment in the upstream. The stop button shall be press to lock, key to release type. The enclosure of the de-interlock switch station shall be flame proof type complying with I.S. 2148

7.2.3 The equipment supplied shall have the maximum reliability. Only the reputed and the proven makes and type of equipment/components shall be supplied. The make, type reference of the equipment is subject to EPCC's approval and only the makes and type acceptable to EPCC shall be supplied.

7.2.4 The bidder has to refer to the attached interface details for Electrical Systems being engineered by EPCC and shall follow the same for provision of Electrical services.

8.0 SPECIFIC TECHNICAL REQUIREMENTS FOR CIVIL & STRUCTURAL WORK

8.1 SCOPE

8.1.1 It is not the intent to specify completely herein all details of design and construction of the works involved under this specification. However, the works shall conform in all respects to high standards of engineering, design and workmanship.

8.2 APPLICABLE CODES, SPECIFICATIONS & REFERENCES

8.2.1 The latest editions including all applicable official amendments and revisions of the following codes shall be used.

8.2.2 Codes

IS:456 Code of Practice for Plain and Reinforced Concrete

IS:800 Code of Practice for general construction in Steel.

IS:816 Code of Practice for use of metal arc welding for general construction in mild steel

IS:875 Code of practice for design loads (other than earthquake) for buildings and structures.

IS:1161 Steel tubes for structural purposes

IS:1786 Specification for high strength deformed steel bars and wires for concrete reinforcement

IS:1893 Criteria for earthquake resistant design of Structures.

IS:1904 Code of practice for design and construction of foundations in soils

IS:1905 Code of practice for structural use of un-reinforced masonry

IS:2062 Weldable structural steel for General structural purposes.

IS:2950 Code of practice for design & construction of raft foundations

IS:2974 Code of practice for design & construction of machine foundations

IS:4326 Code of Practice for earthquake resistant design and construction of buildings

IS:4995 Criteria for design of reinforced concrete bins for storage of granular and powdery materials (All parts)

IS:9595 Recommendations for metal arc welding of carbon and carbon manganese steels.

8.3 BIDDER shall quote a lump sum price for the civil works, along with the break-up of prices for separate structures as per requirement enumerated in Section-F2.

8.4 Quoted price of the BIDDER is deemed to include for the preparation of detailed design calculations, construction drawings, supply of all materials, construction, testing and commissioning for satisfactory performance of the ash handling plant.

8.5 BIDDER shall specifically note that cement, reinforcement steel and structural steel required for the works, will not be supplied by the OWNER. BIDDER shall make his own arrangements.

8.6 Generally, the nature of civil works involves excavation, backfilling, disposal of surplus soil, dewatering as necessary, concrete works, in foundations, trenches, columns, beams, walls, tanks, sumps, trenches, equipment foundations, grouting, testing, etc. including fabrication, erection and painting of structural steel sections, internal water supply/plumbing services wherever required, etc. complete.

8.7 It is not the intent to specify completely herein, all details of design and construction of the structures/works covered under this enquiry. All works shall conform in all respects to high standards of engineering design, workmanship and shall fulfil the anticipated performance during the guarantee period in a manner, acceptable to the OWNER/EPCC who will interpret the meaning of the specifications and shall have the right to reject any work or material which, in his judgement, are not in full accordance with the requirements.

8.8 **WORK SCHEDULE**

8.8.1 Within two weeks of the date of the letter of intent issued by the EPCC, the CONTRACTOR shall submit the following for EPCC's review and approval.

(a) Detailed design criteria based on the specific requirements enumerated in the specifications. This shall also incorporate and comply with relevant Indian standards/Codes of Practices and conform to good engineering practice.

(b) Detailed work schedule indicating the sequence of preparation and submission of :
   (i) Detailed design calculations with supporting drawings
   (ii) Construction drawings/fabrication drawings.
   (iii) Execution of various structures
   (iv) Testing and commissioning

8.8.2 The construction sequence shall follow the design engineering sequence. The whole of the works must be proceeded with, within such sections and at such times and such order and manner as directed by EPCC/CEPCC. No extra or relaxation in the prices/rates will be permitted on this account.

8.8.3 The BIDDER shall furnish along with their bid the particulars of their sub-contractors/sub-consultants (if any) they propose to employ for design and execution of the civil works, with adequate back up details of experience, particulars of similar jobs executed, etc. as called for in the scheduled format in Section F14.

8.9 **MATERIALS OF CONSTRUCTION**

8.9.1 All materials supplied by the CONTRACTOR shall be of the best quality and shall conform to the specification and latest BIS codes. Approval in writing shall be obtained from the EPCC before any alternative or equivalent material is proposed to be used by the CONTRACTOR.

8.9.2 The CONTRACTOR shall furnish manufacturer's test certificates for the materials supplied by him. When such certificates are not available, the specimen of the material shall be got tested at a recognised testing laboratory at the Contractor's cost.

8.10 **SITE CONDITION**

8.10.1 A detailed geotechnical investigation has been conducted at the site and the report is available with the OWNER/EPCC. In case BIDDER requires any further information in regard to the site conditions, he may contact EPCC.

8.11 The BIDDER shall furnish the total quantity of concrete of different grades requirement of cement, structural steel and steel reinforcement bars which are considered for the entire civil works included in the lumpsum offer, duly taking into account the design criteria in the following format. Bids received without this data are liable to be rejected by the EPCC.

Sr. No.	Structural / Civil works	Grade of concrete	Concrete quantities	Cement quantity	Reinforce-ment		Structural Steel
			M^3	Tonnes	(MT) HYSD Bars	MS Bars	(MT)
1							
2							
3							
4							

8.12 **SUBMISSION OF DESIGN CALCULATIONS AND DRAWINGS**

8.12.1 Civil task drawings for design of structural systems showing all equipment loads, cutouts, embedments, etc. based on approved mechanical GA drawings shall be submitted by the CONTRACTOR. Drawings and design calculations submitted without prior approval of relevant mechanical GA drawings will not be considered for review.

8.12.2 After approval of the CONTRACTOR's GA drawings, the CONTRACTOR shall submit detailed design calculations and construction drawings for obtaining EPCC/CEPCC's approval.

8.12.3 Design drawings shall clearly indicate structural arrangements, member sizes, reinforcement details etc. so that all the necessary information in relevant design calculations is brought out.

8.12.4 Design drawings showing typical connections and details conforming to design assumptions shall be submitted for approval by the CONTRACTOR.

8.12.5 Design drawings submitted shall be accompanied by supporting design calculations.

8.12.6 Approval/comments conveyed by the EPCC/CEPCC neither relieves the CONTRACTOR of his contractual obligations and his responsibilities for correctness of dimensions, materials of construction, weights, quantities, design details, assembly fits, performance particulars and conformity of supplies with the statutory laws as may be applicable, nor does it limit the EPCC's right under the contract. No change in the approved design/drawings shall be permitted without prior approval of the EPCC/CEPCC.

8.12.7 Designs and drawings shall be submitted in a phased manner progressively so that design calculations/ drawings for several structures are not submitted at the same time. For this purpose, design/ drawing submission schedule shall be submitted by the CONTRACTOR for EPCC/CEPCC's review and approval. Design calculations and drawings will be reviewed generally within four (4) weeks form the date of receipt of the same by the EPCC/CEPCC. Timely delivery of calculations and drawings for review is the sole responsibility of the CONTRACTOR and postal or other delays, as reasons for late/non-submission of calculations and drawings will not be entertained.

8.12.8 Preparation and review of structural steel fabrication drawings wherever required is entirely the responsibility of the CONTRACTOR and will not be approved by the EPCC/CEPCC. However, all fabrication drawings shall be submitted by the contractor for OWNER's reference.

8.12.9 In no case will design, calculations/drawings be considered complete or be acceptable if,

(a) They are not thoroughly checked and duly signed in the appropriate places by the CONTRACTOR before despatch.

(b) Design calculations are not accompanied by supporting engineering drawings.

(c) Design calculations are incomplete or are shabbily done and are without adequate references or other necessary back up data/calculations/information.

(d) Any comments previously made are not incorporated on revised drawings/calculations.

Such drawings/design calculations as described above will be summarily rejected and the CONTRACTOR shall arrange to despatch fresh prints duly signed and checked. No claim for extension of time or of extra cost on account of this will be entertained under any circumstances.

8.12.10 Once drawings are approved further revisions in structural sections shall be got approved with necessary supporting calculations and reasons for the change.

8.12.11 If any dismantling, alteration, re-erection or other repairs become necessary owing to any errors/discrepancies in calculations/drawings, the CONTRACTOR shall carry out all the necessary rectification work as required at no extra cost. Further CONTRACTOR will not be entitled to any extension of time on account of this.

8.12.12 CONTRACTOR shall commence erection/construction only after the approval of design/construction drawings by OWNER/EPCC/CEPCC .

8.12.13 All modifications suggested by CEPCC to meet specification requirements and sound engineering practice shall be incorporated by the CONTRACTOR at no extra cost to the EPCC. In this respect decision of the OWNER shall be binding on the CONTRACTOR. CEPCC will accord his approval only after the CONTRACTOR has incorporated in the designs/drawings all modifications required by the CEPCC.

8.12.14 Construction work shall commence only after obtaining written approval of drawings by the EPCC/CEPCC. However, the CEPCC's/EPCC's approval of designs/drawings shall not absolve the CONTRACTOR of his total responsibility for the correctness of design, accuracy of dimensions, loadings, details, safety and stability of the structure including foundations, accessories, appurtenances, etc.

8.12.15 OWNER/EPCC's Scope of Review

The OWNER shall review the design calculations and drawings only in respect of the following :

a) Correctness of centre-to-centre dimensions, elevations, important/ typical details, orientation, sizes of important members general design principles and approach, adherence to requirement of the relevant BIS or other statutory codes, compliance with the technical specifications, general specific notes and with the requirements of good engineering practice and whether the details shown in drawings conform to design. Check for any interference is the responsibility of the CONTRACTOR.

b) The CONTRACTOR shall note no check will be specifically carried out by the OWNER to verify arithmetical/numerical accuracy of the calculations, which shall remain entirely the CONTRACTOR's responsibility, irrespective of any approval that may have been accorded thereto by the OWNER. Approval given by the OWNER shall not relieve the CONTRACTOR form his total responsibility to correctness and sound engineering practice.

8.12.16 Computer Aided Design

(a) In case the CONTRACTOR adopts computerised designs only validated computer programs shall be used for analysis and design. The computer output listing should include all input data covering the loads listed under 'Loads and Load Combinations'.

(b) The CONTRACTOR shall submit typical manual calculations for a few important members/structures to be chosen by the OWNER in order to validate the computer program used for analysis/ design.

8.12.17 All design calculations and drawings shall be in SI system.

8.13 DESIGN CRITERIA

Following design criteria shall be adhered to for designing the civil structures included in the scope of this contract. Any additional assumptions considered by the CONTRACTOR shall be incorporated and the detailed design criteria proposed to be adopted for the structures shall be submitted for obtaining EPCC/CEPCC's approval prior to commencement of detailed designs/drawings. Design shall be based on duly considering the following loads in combinations to give the worst effect, in addition to all the dead loads of the structures.

8.13.1 Live Loads

Live load on all floors, walkways, platforms, staircases shall be not less than 500 kg/sq.m. Reduction of the load under seismic condition shall be as per IS:1893. Live load on roofs shall be 150 kg/sq.m.

The CONTRACTOR shall ensure that his erection loads are less than the loads specified above. However, if the erection loads are higher than the specified live loads on any floor or part thereof, then the erection loads are to be considered for the design.

Live load on roof of ash silo shall be 500 kg/sq.m + 150 kg/sq.m for dust load. Density of ash to be considered for the design shall be 1.5 t/cu.m.

8.13.2 Wind Loads

Design for wind loads shall be in accordance with IS:875 (Part 3) /site specific data.

8.13.3 Seismic Loads

Design for Seismic loads shall be in accordance with IS: 1893 / site specific spectra

8.13.4 **Impact Factor**

For design of hoist runway girders and monorails an impact factor of 1.25 for electrically operated hoist shall be considered.

8.13.5 **Foundations**

(a) The net allowable safe bearing capacity of strata for design of open foundations shall be considered as 30 t/sq.m at depth of 5.0m from FGL.

(b) OWNER/EPCC/CEPCC reserves the right to revise at his discretion the safe bearing capacities of the soil and or founding levels, on exposure of the founding strata and physical inspection of the same. CONTRACTOR shall amend his designs and drawings to suit the revised founding levels/bearing capacities at no extra cost to the OWNER. The additional works shall be paid for at the respective unit rates quoted. CONTRACTOR will have to submit for EPCC's/CEPCC's review and approval, the design calculations for both the original and revised founding levels/bearing capacities in order to ascertain the quantum of additional works.

8.13.6 An imposed surcharge load of 1.5t/sq.m on the ground surface shall be considered for design of all underground structures.

8.13.7 Static/dynamic loads of equipment.

8.13.8 Static and seismic earth pressure on underground structures.

8.13.9 Pressure on walls/base slabs of underground structures due to ground water duly considering the uplift conditions. For design of all underground structures, foundations etc ground water table will be assumed at 1.5 m below FGL at that location.

8.13.10 Ensuring stability, strength and safety of all structures during all stages of construction/erection.

8.13.11 Reinforced concrete structures shall be designed as stipulated below :

(a) All buildings shall be of RCC framed construction.

(b) Limit state method as per IS: 456 shall be adopted for design of all RCC structures.

(c) (i) All water retaining structures shall be designed based on 'uncracked section" by working stress method in accordance with the latest edition of IS:3370 with suitable provision of contraction, expansion and construction joints. Water cement ratio shall not exceed 0.5. Minimum thickness of any structural concrete element shall be 225 mm.

(ii) Water retaining structures shall be designed for the worst condition such as :

Tank full condition without earth filling form outside.
Tank empty condition with submerged earth pressure and any surcharge form outside.

(iii) Whenever partition walls are provided in water retaining structures, these shall be designed for the condition with one compartment full while the other is empty.

All culverts shall be designed as per class AA tracked and wheel loading as per recommendation of IRC and the worst condition shall be considered for design. In case culverts are required at railway loadings and the design got vetted by railway authorities.

(d) All equipment foundations shall be designed as per IS:2974 code of practice for design and construction of machine foundations. These foundations shall be isolated from the building/grade slab with the provision of 25 thick premoulded joint filler allround.

(e) (I) The silos shall be designed as per the requirements of IS:4995 (Parts I & II).

(ii) For design purposes the temperature of the ash shall be considered as 150^{o}C.

(iii) The RC staging for the silo shall be planned to consider clear headroom of 4.5 m for truck movement and an adequate height to provide ash extraction with as per the requirement of the Vendor. A minimum clear way of 4.5 m wide shall also be considered to enable truck movement.

(iv) The conical portion valley angle of the silo shall be in line with that specified elsewhere in the specification..

(v) The height of the silos shall be arrived at by considering the required capacity of the silo and an additional free board of 500 mm over the apex of the ash heap collected in the silo.

(vi) All openings of silos shall be provided with suitable inserts/ fittings as per the requirement of the Vendor.

(vii) The minimum thickness of the silo wall/hopper/roof slab shall be 200 mm.

(viii) The minimum grade of concrete shall be as follows :

(ix) Two layer reinforcement theory shall be adopted in the design.

M25 for the silo wall/hopper/roof slab
M25 for staging columns/beams, rafts

(x) The type of foundations shall be decided by the Vendor as per requirements of CL 8.13.5.

8.13.12 Steel Structures (Wherever required)

The steel structures shall be designed in accordance with IS 800.

(a) All structural steel works shall be of welded construction to the maximum possible. All shop connections shall be welded while for field connections welding/bolting shall be adopted. Bolts shall be black hexagonal headed conforming to IS:6639.

(b) Minimum thickness of gusset used for connection shall be 8 mm.

(c) Angle sections shall not be used as flexural members except for roof trusses, purlins, side girts bracings and walkway runners.

(d) Tack welding is not permitted.

(e) For auxiliary loaded members in frame work, minimum angle section used shall be ISA 50 x 50 x 6.

(f) All moment connections will be designed for its full moment carrying capacity of the connecting member with 60% of full shear carrying capacity of the section.

(g) For shear connections
   i. For rolled sections minimum 60 % of full member shear capacity.
   ii. For built up beams such as rolled sections with additional plates and for plate girders 80% of the member shear capacity.
   iii. In the bracing members end connection will be designed for 75% of full tensile capacity of the member force.

(h) All foundation bolts shall be provided with double nut or a nut with a lock nut.

(i) Grouting below column bases is in the scope of the CONTRACTOR.

(j) Moments shall be considered for the design of columns arising due to eccentricity of floor beam connection with column. Minimum eccentricities on column shall be considered as per IS: 800.

All structural steel members shall be painted with one coat of inorganic zinc silicate primer after fabrication but before erection. One coat of inorganic Zinc silicate primer as touchup paint at all damaged surfaces plus two coats of chlorinated rubber zinc phosphate primer shall be applied after erection. Finish paint shall be two coats of chlorinated rubber finish paint.

8.14 **GRADE OF CONCRETE**

8.14.1 The structural concrete for building works including ash & bed material hopper, precast slabs, foundation and trenches etc. shall be M25 with 20 mm down graded coarse aggregates (10 mm down graded aggregate for precast slab) and minimum cement content of 360 kg/cu.m.

8.14.2 Grade slab shall be in concrete of M20 with a minimum cement concrete of 340 kg/cu.m.

8.15 Grade of Steel

Where high yield strength deformed bars are used they shall conform to IS 1786 and shall be designed accordingly for a yield strength of steel Fy = 415 N/ sq.mm. Mild steel bars shall conform to IS:432.

8.16 Cover

Clear cover to main reinforcement shall be as follows :

8.16.1 **<u>Under ground structures</u>**

(a) Shutter sides (concrete laid against shuttering or against levelling course or lean concrete) : 50 mm
(b) Grade Beam – Bottom : 50 mm
Top and Sides : 50 mm
Foundation Slab, Base Slab : 50 mm
(c) Water retaining structures
Face in contact with liquid : 30 mm
Face away from liquid but in contact with earth : 50 mm
Free Face : 30 mm
(d) Retaining Wall, Basement & Pit Wall
Face in contact with earth : 50mm
Free Face : 30mm

8.16.2 Above Ground Structures
Slab (roof & floor), Canopy, Cantilever, Waist Slab : 30mm
Beam (Roof, Floor & Tie), Lintel : 30mm
Column, Pedestal : 50mm

8.16.3 Only the latest editions of all Indian Standards Codes shall be used.

8.17 **CONSTRUCTION REQUIREMENT**

8.17.1 The structures shall be water tight with continuous PVC water stops of approved quality provided at all joints.

8.17.2 All controlled concrete shall be by mix design adopting weigh batching.

8.17.3 The CONTRACTOR shall resort to dewatering where necessary by pumping. Dewatering shall be maintained for atleast seven days after the last pour of concrete for concrete work below ground water table including the period required for back filling. CONTRACTOR shall maintain reasonably dry, the excavation for structures and for concrete works such that the progress of construction work is not hindered and quality of works is not hampered. Contractor shall also suitably divert/ dispose off the ground water obtained during dewatering to safeguard men, materials, structures and equipment. The cost of the dewatering shall be included in the lumpsum quotation. BIDDER' unit rates for items of excavation, concreting etc. below ground level shall be deemed to include for the cost of dewatering. Quotation of a separate rate for dewatering shall not be accepted by the EPCC and no separate payment shall be made for dewatering for any reasons whatsoever.

8.17.4 The EPCC reserves his right to revise at his discretion the founding depth at any time, particularly after the excavation is done and the funding strata is exposed for Engineer's inspection.

8.17.5 No through bolts will be permitted in the formwork for all water retaining structures.

8.17.6 Grading in the vicinity of excavation shall be such as to exclude rain surface water driving not excavated area. Excavation shall be kept clear to rain and such water the Contractor may be using for his works or water from any source by suitably pumping out of the same at no extra cost to the EPCC. The scheme for pumping and discharge of such water shall be approved by the OWNER/EPCC.

8.17.7 Vertical construction joints in the walls of water retaining structures shall not be permitted. The base slabs of the water retaining structure shall be cast in lengths not exceeding 7.5 m. Sequence of concreting of base slabs shall be in alternate blocks leaving about 1 m clear gap between them. This gap shall be concreted later after the adjacent blocks are cured for a minimum period of 7 days.

8.17.8 Use of water proofing admixtures in concrete will be permitted only on obtaining written approval for the EPCC/CEPCC. However, no extra expense on account of this is payable by the EPCC.

8.17.9 Responsibility of ensuring the quality and strength of concrete used in the works lies entirely with the CONTRACTOR. Any modifications required to take care of shortfall in the requirement shall be as directed by the EPCC/CEPCC at the CONTRACTOR's cost.

8.17.10 All rungs bent to shape, hand rails, ladders with safety cage shall be hot dip galvanised with minimum zinc coating of 800 gms.sq.m.

8.17.11 Water retaining structures shall be tested for water tightness as per IS:3370. In the event, the structure fails to satisfy the requirements, the CONTRACTOR shall carry out all rectification measures at his own cost and re test to ensure that test criteria is met with. The rectification measures shall be as approved by the EPCC which shall include, but not be limited to, pressure grouting using cement/epoxy etc.

8.17.12 All construction joints in structures below the ground or in continuous contact with water shall be made completely water tight and PVC water stops shall be provided at all such joints.

8.17.13 The CONTRACTOR shall take special note that it is his responsibility entirely to ensure the quality and minimum crushing strength of concrete used in the works. Any shortfall in strength or later problems that may arise on this account shall be solved and corrected to the EPCC's satisfaction by the CONTRACTOR at his own cost.

8.17.14 <u>Structural Steel Inserts</u>

Supply, fabrication and erection of all structural steel work shall be as per IS: 800.

All pipe inserts shall be provided with suitable welded collars that will act when embedded in concrete as water stops.

Adequate care shall be exercised by the CONTRACTOR to ensure that inserts are not disturbed from their position while placing and vibrating the concrete.

The BIDDER shall indicate along with his bid the workshop equipment he proposes to install at the project site, the handling and erection equipment he proposes to bring to the site for the execution of the work covered under this specification.

8.17.15 Upon the completion of concrete work, all forms equipment, construction tools, protective coverings and any debris resulting from the work shall be removed from the premises.

8.17.16 All debris ie. empty containers, scrap wood, etc. shall be removed to "Dump" daily or as directed by the ENGINEER.

8.17.17 The finished concrete surface shall be left in a clean condition to the satisfaction of the ENGINEER.

8.18 **GROUTING FOR EMEBDMENT PLATES IN EQUIPMENT FOUNDATIONS**

8.18.1 Grout shall be used for embedment plates in equipment foundations to ensure complete filling of the space between base plates and the equipment foundations.

8.18.2 Surfaces to be grouted shall be thoroughly roughened and cleaned of all foreign matter and laitance. The concrete surfaces to be grouted shall be saturated with water. No free water shall be left on the surface.

8.18.3 The embedded plates/anchor bolts/bolt holes shall be cleaned of all oil, grease, dirt and loose material, or any material which will react with Portland cement. The use of hot, strong caustic solution for this purpose will be permitted. Water in anchor bolt holes shall be removed before grouting is started.

8.18.4 When the base is to be flow grouted, forms shall be built and securely anchored outside the base plate so as to completely confine and withstand the pressure of liquid grout under working and rodding conditions without leaking and high enough to ensure the grout is in contact with the underside of the base plate, and provide a head of minimum 100 mm above the underside of the base plate. Provision of grout holes is base plate, rodding arrangement shall be checked prior to commencement of grouting.

8.18.5 Grouting once started shall be done quickly and continuously to prevent segregation, bleeding and breakdown of initial set. Grout shall be worked from one end to other to prevent entrapment of air. To distribute the grout and to ensure complete contract between base plate and foundation and to help release entrapped air, link chains or doubled over flexible steel strappings can be used to work the grout in place.

8.18.6 Forms and shims shall not be removed and the anchor bolts shall not be tightened for atleast twenty four hours after placing the grout. After the removal of forms and shims, area occupied by shims shall be filled and the area between the base and the edge of the foundation shall be finished smooth to allow drainage foundation shall be finished smooth to allow drainage away from the base. Interconnecting piping of machinery shall not be attached to the machinery before anchor bolts are tightened. It is desirable to make these connections atleast three days after grouting. During this period cure the grout with wet rags.

8.18.7 All materials, workmanship and finished construction shall be subject to the continuous inspection and approval of the ENGINEER.

8.18.8 All materials supplied by Contractor and all works or construction performed by Contractor rejected as not in conformity with the specifications and drawings, shall be immediately replaced at no extra expense to the EPCC.

8.18.9 Preliminary approvals of any materials or phase of work shall in no way relieve the CONTRACTOR from the responsibility of supplying grout and or producing finish grout in accordance with the specifications and drawings.

8.18.10 Upon the completion of grouting work, all forms, equipment, construction tools, protective coverings and any debris shall be removed from the area as directed by the ENGINEER.

8.18.11 All grouting shall be provided against damages until final acceptance by the OWNER/EPCC or his representative.

8.18.12 Premixed non-shrink free flow grout to be provided shall be having minimum 28 day strength of 600 kg/sq.cm. all as per manufacturer's instructions without any additional admixtures such as cement, etc.

8.19 **WATERSTOPS**

8.19.1 PVC waterstops 225 mm wide, 6 mm minimum thickness, ribbed with centre bulb and end grips shall be of approved manufacture. Prior approval of the ENGINEER shall be obtained by the CONTRACTOR before procurement for incorporation in the work.

8.19.2 Waterstops shall be cleaned before placing them in position. Any dirt/grease shall be removed using water/detergent as directed by the ENGINEER. Water stops shall be procured in long lengths as manufactured to reduce joints as far as possible.

Standard intersection pieces shall also be procured depending on their requirement. Splicing/jointing and installation shall be as per manufacturer's instructions. Projecting portion of waterstops shall be thoroughly cleaned of all mortar/concrete coatings as directed by the ENGINEER before resuming further concrete works.

8.19.3 PVC water stops shall have properties that satisfy the minimum requirements listed in IS: 12200.

8.20 HAND RAILS

8.20.1 Hand railing shall be provided at the edges of platforms, landing slabs, stairs and walkways.

8.20.2 Hand railing shall be of hot dip galvanised construction out of 32 mm NB pipes of medium class conforming to IS 1161 with threaded ends and necessary bends, tees, sockets, etc.

8.20.3 Hand railing shall be 1000 mm high with two horizontal rails, one at 500 mm and another at 1000 mm above the base level along with vertical post space at not more than 1500 mm centres.

8.21 **CEMENT CONCRETE FLOORING**

8.21.1 Cement concrete flooring shall be laid in average 25mm thickness over sub base (as per structural drawings/ specifications) and shall generally conform to IS: 2571

8.21.2 The flooring shall be laid in panels and shall consist of 25 mm thick base course of M-15 grade cement concrete (with 6mm and down size stone aggregate) laid on the sub-base in panels (each panel not exceeding 1 Sq. Mtr. in area) in desired shape and pattern.

8.21.3 The panels shall be bound by 3x20mm PVC strips panel dividers; fixed in position with their top at proper level maintaining the required levels, slopes, linearity etc. as required.

8.21.4 Base course shall be laid in alternate panels. Before laying the base course, neat cement slurry @ 2.75Kg. of cement per Sq. Mtr. of area shall be applied (brushed) over the prepared sub base surface.

8.21.5 Cement concrete shall be placed in position and beaten with trowel, including tamping and finishing smooth.

8.21.6 Finishing of the surface shall follow immediately after completion of laying of base. The bed for flooring shall be prepared either level or sloped as per drawings and as instructed by Engineer-in-charge.

8.21.7 Neat cement @ 2.75Kg. per Sq. Mtr. mixed with water to form a thick slurry applied over the base course (when the concrete is green), spread over the surface, pressed twice by means of iron floats; once when the slurry is applied and second time when the cement starts setting.

8.21.8 The junction of floor with wall plaster, cladding, skirting shall be rounded off uniformly upto a radius of 25mm unless otherwise mentioned.

8.21.9 Each finished portion of floor, on completion shall be kept wet with ponding for a minimum period of 7 days.

8.22 PREMOULDED BITUMINOUS JOINT FILLER AND SEALING COMPOUND

8.22.1 Materials

Premoulded joint fillers shall be of non-deteriorating and resilient type conforming to IS:18328. Sealing compound shall be grade ‘A’ as per IS:1834, Bitumen shall conform to IS:3384.

8.22.2 Fixing of Joint Filler

The concrete surface shall be made clean, smooth and free from dirt or loose particles. When the surface is completely dry a coat of hot blow bitumen conforming to IS:702 of grade 85/25 shall be given with brush or spray. When the bitumen is still hot, the premoulded joint filler fibre board shall be pressed against the surface and held in position, till the time it automatically remains fixed in position. Where the joint filler has been specified in two layers, the second board will be fixed on to the board fixed as above with a few jacking patches of bitumen between the two. After placing the filler in position, the surface of the fill against which further concreting is to be done is given a coat of bitumen.

8.23 **CONNECTIONS IN STRUCTURAL STEEL**

All shop connections will be welded.

Field connections shall be bolted or welded. Bolts used shall be black hexagonal headed bolts conforming to IS:1363 for erection bolts and IS:6639 for permanent bolts.

8.24 General

8.24.1 Brick wall shall be in cement mortar 1:4 for walls 230 mm thick and above. 115 mm thick wall shall be in cement mortar 1:4 with HB netting provided at every fourth course properly anchored with cross walls or pillars. Bricks used shall be of class 7.5 conforming to IS 1077.

8.24.2 ISA 50 x 50 x 6 (min) angles with anchor lugs shall be provided as edge protection around cutouts/openings in floor slabs and trenches.

8.24.3 Roof water proofing shall be of Polyurethane (PU) based roof treatment. The Polyurethane (PU) based roof treatment/ waterproofing shall consist of:

a) Two component coating which will be highly resistant to impact, abrasion and cracking. It will be perfectly smooth and dust free glossy finish. It should also be resistant to acid, alkalies and have a very low water absorption rate (0.5 % maximum at ambient temperature after 7 days).
b) One component system which will be in two or more coats of urethane based high solid content elastomeric membrane (having high viscosity to give a high build film) at approx. coverage of 0.5 kg/m² each coat.
c) The final coat of PU when tacky shall be sprinkled with 300 micron layer of clean sand.

Finishing protective layer of minimum 35 mm thickness P.C.C. (1 cement: 2 coarse sand: 4 stone aggregate of 6mm 7 down size by volume) mixed with cement based polymer modified waterproof compound shall be laid over waterproof coating. The PCC shall be laid in panels of maximum size 1200mm x 1200mm and shall be reinforced with 24 SWG chicken wiremesh (20mm x 20mm) as per IS 1566. The joints between panels shall be sealed with suitable urethane based elastomeric compound as per manufacturers specifications. The final coat of PU when tacky shall be sprinkled with 300 micron layer of clean sand.

8.24.4 All brick walls shall be plastered on both sides with cement mortar 1:4. External surfaces shall be provided with 18 mm thick plaster in two layers, first layer of 12mm in cement mortar 1:4 and second layer of 6mm thickness in cement mortar 1:2 using approved sand for second layer on all RCC and brickwork. 12mm thick in 1:4 cement mortar for all plumb of the internal masonry walls & RCC columns coming in line (flush) with this side of wall. 15mm thick in 1:4 cement mortar for rough side of internal masonry walls & RCC columns coming in line (flush) with this side of wall. Plastering shall be rough textured for external surfaces and plain for internal surfaces. All external plastered surfaces of brick walls shall be provided with one coat of water based 100% acrylic exterior emulsion primer and final coat shall be two coats of water based 100% acrylic exterior emulsion primer

8.24.5 All RCC ceilings shall be plastered with a 6 mm thick plaster in cement mortar 1:4.

8.24.6 Adequate numbers of sized CI rain water down take pipes shall be provided from the roofs of all buildings. Minimum diameter of pipe shall be 150 mm.

8.24.7 Doors and windows on external walls of buildings with brickwall cladding shall be provided with sun shades (chajja) over the openings, with width atleast 300 mm more than the opening widths. Projections from the wall shall be minimum 600 mm over window openings and 1000 mm over door openings. Minimum area of doors and windows shall be 20% of floor area.

8.24.8 All building shall be provided with 1000 mm wide plinth protection all around. Plinth protection shall be with 100 mm thick PCC 1:2:4 over compacted sand.

8.24.9 Finished levels of all ground floors shall be 300 mm above adjacent grade level unless otherwise specified.

8.24.10 Steel door frames shall conform to the requirements of IS: 1038. Door shutters shall double plate flush door shutters. Pressed steel door shutter shall be made with 18 gauge steel sheets formed by machine bending in the form of hollow box. (overall 40mm thick). The cavity inside shall be packed with rigid PU foam/ phenolic foam or glass wool insulation to fill into the box cavity without gap.

8.24.11 Steel windows and ventilators shall conform to IS: 1038 and shall be glazed with 4 mm thick wired glass

8.24.12 Floor finishes shall be as indicated below :

Flooring in all control roms shall consist of mosaic tiling over which 3 mm thick anti-static flooring is to be provided.

All other floors shall have 50 mm thick cement concrete floors

8.24.13 RC pipes for culverts shall be of class NP3 conforming to IS:458.

8.24.14 Wherever specified RCC roofs shall be made accessible either thrugh staircase or by structural steel case ladders.

8.24.15 225 mm wide PVC waterstops (ribbed with centre bulb and end strips to withstand 25 m water head) of approved quality and manufacture shall be provided at all construction joints of underground RCC structure, 225 mm wide or equivalent under slab (surface type) PVC water stops to withstand 25 m water head shall be provided at all construction joints in the base slabs of underground structures. Water stops shall conform to IS 12200.

8.24.16 PCC used as blinding concrete shall be of mix 1:4:8 with minimum thickness of 100 mm.

8.24.18 Necessary openings in walls for fixing exhaust/supply air fans.

8.25 Source of Aggregates

8.25.1 Aggregate for use in concrete works conforming to grading as per IS: 383 shall be used.

8.26 SAMPLE TESTING

For day to day quality control of concrete, Contractor will provide for labour and materials for test samples as per direction of Engineer/EPCC. However, this shall be carried out free of cost by CONTRACTOR.

8.27 SPECIFIC TECHNICAL REQUIREMENTS

8.27.1 INSPECTION AND TESTING OF WELDS

8.27.1.1 All butt welds shall be of radiographic quality. EPCC shall select at random, locations and extent of welds to be radiographed. Tests shall be conducted on at least 10% of the moment/splice connections done using butt welding.

8.27.1.2 Liquid penetration tests shall be conducted on at least 1% of the extent of fillet welds. Location and extent of test to be conducted shall be as decided by the EPCC . At least one test shall be conducted on each connection done at site.

8.27.1.3 In case of fillet welds where more than one run of welding is required, the first run of weld shall be tested and cleared by the EPCC before further runs are done.

8.27.1.4 Testing of welds to the extent stipulated above shall be at CONTRACTOR's cost.

8.27.1.5 Only welders who satisfy the appropriate tests and requirements as per IS:817 and IS:7318 shall be employed on welding work. Should the welder fail in the first test, two further tests shall be undertaken immediately and the welder, to qualify, must satisfactorily pass both these tests.

8.27.1.6 Routine tests of all welders shall be required every six months. EPCC reserves the right to have any welder re-tested at any time.

8.27.1.7 a) CONTRACTOR shall supply all test specimens duly prepared as per standard codes and as required at no extra cost to EPCC. EPCC reserves the right to decide on the type and number of tests to be conducted from time to time.

b) The following non-destructive tests are proposed to be conducted :

i) Liquid penetrant test
ii) Dry powder magnetic particle test
iii) Wet magnetic particle test
iv) Radiographic test

c) The above tests shall be conducted by the CONTRACTOR or shall be got done by an approved agency in the presence of the EPCC.

d) The acceptance of welded work shall depend upon correct dimensions and alignment, absence of distortion in the structure, satisfactory results from the examinations and testing of joints, soundness of welds and general good workmanship. EPCC's decision will be final and binding on CONTRACTOR in this regard.

e) Intermittent welds shall not be permitted without the approval of EPCC.

f) CONTRACTOR shall give sufficient advance notice to EPCC before welding is taken up at site.

8.27.1.8 Safety Precautions

a) CONTRACTOR shall take all necessary precautions for the safety of his own personnel as well as that of other contractors working in the area.

8.28 Painting of Structural Steel Work

Painting shall generally conform to the following :

(a) All the structural steel members of building and structures, both exterior and interior surfaces shall be considered as exposed to normal corrosive atmospheric condition. Following painting system will be applied over blast-cleaned surface to near white metal conforming to Sa 2½ finish as per Swedish standard SSPC-SP-10. Painting system for concrete and steel surfaces is as given below.

(b) One coat of inorganic zinc silicate primer (1 x 65 microns) shall be applied at shop after fabrication but before erection.

(c) After erection one coat of inorganic zinc silicate primer (1 x 65 microns) as touchup paint at all damaged surfaces plus two coats of Chlorinated Rubber Zinc Phosphate primer (2 x 40 microns) shall be applied.

(d) Finishing paint shall be two coats of chlorinated rubber finish paint (2 x 40 microns).

9.0 SAFETY AND SEQUENTIAL INTERLOCK AND PERMISSIVE CONDITIONS AND STARTING AND STOPPING OF EQUIPMENT

9.1 SAFETY AND SEQUENTIAL INTERLOCKS

9.1.1 Introduction

The safety interlock system for Ash and Bed Material Handling System shall include complete protection for operating personnel and equipment under conditions that may jeopardise their safety without causing unnecessary trips or imposing undue delay during start up from a standstill condition or following a trip.

9.1.2 Design Considerations

The design of the safety interlocking system is based on the following basic principles and is intended to shut down the Ash and Bed Material Handling System and/or disconnect the same electric power supply under certain abnormal operating conditions.

(a) To trip the minimum equipment in the sequence during abnormal operating conditions leaving all the other equipment running which may safely be permitted to continue operation.

(b) To annunciate and indicate initiating cause for equipment which is tripped.

(c) To prevent restarting of equipment until safe conditions are restored.

(d) To retain as much flexibility of operation as is consistent with safety.

(e) To operate from rugged, reliable initiating elements independent of normal control or alarm devices.

(f) To prevent mal-operation of equipment on interruptions and restoration of control voltage.

(g) To eliminate the necessity, for any manual bypassing of an interlock to permit starting and stopping of equipment

(h) To emphasise eliminating false trips by providing component reliability.

For interface of the Ash & Bed material handling system with OTHER systems, refer the enclosed Sketch-1 in this tender.

9.2 **Instrumentation and Control (I&C) System**

a) The instrumentation and control equipment system called for in this specification consists of a microprocessor based programmable logic control (PLC) system comprising of system cabinet, marshalling / relay cabinet and operator station housed in Material Handling Control Room. Status indication of all parameters will be made available in CPP control room through Fiber optic communication. Scope of work shall include supply & installation of field instruments, PLC system, cabling between field to control room / MCC for BA, FA & BM handling systems. Necessary erection hardware for installation shall be in the scope of the BIDDER. Necessary hardware for interfacing the PLC in Material handling control room with the DCS is by the BIDDER. The Fiber optic communication cable shall be supplied & installed by OTHERS.

b) **Operation Philoshophy**

- A microprocessor based programmable logic control (PLC) system with CRT/Keyboard interface shall be provided for the safe operation, control and monitoring of the entire ash handling plant, bed material handling plant except for operation of dry fly ash unloading into trucks, dry bed ash unloading into trucks from storage silos. The operation of silo unloading shall be carried out in “Dry form” or “Slurry form” selectively. The “Dry form” operation is local and “Slurry form” operation is through PLC either in remote/manual mode.

- The fly ash will be removed from the ESP hoppers and bed ash will be removed from bed ash hoppers and transported to main storage silos either under auto mode (timer mode operation or level probe mode operation) or manual mode (one hopper by one) selectively. Level probes will be provided for each fly ash hopper to enable control operation of the fly ash handling system.

- The fresh bed material shall be transported to Bed Material either under auto mode (timer mode operation or level probe mode operation) or manual mode (one hopper by one) selectively. Level probes will be provided on denseveyor to enable control operation of the Bed Material handling system. Also diverter valves provided in the bed ash conveying lines, shall divert the bed ash to the bed material bunker selectively.

c) Individual local control panel shall be provided for operation of fly ash and bed ash silo unloading into trucks. The status indication of the fly ash silo unloading and bed ash silo unloading operation shall be available in Material handling control room.

9.3 **Microprocessor Based Programmable Logic Control System**

a) PLC shall be of SIEMENS make of latest model.

b) The microprocessor based PLC shall be configured with redundant CPU in Hot Standby mode, redundant power supply, redundant communication module and Non redundant I/O's. The system shall provide for sequencing of automatic startup / shutdown bringing standby equipment into operation on failure of main equipment, and manual intervention facility for all the equipments.

c) The PLC shall be provided with a PC based programmer station for performing software changes. The input / output modules of the PLC shall be configured in non redundant mode. The PLC shall be provided with a CRT / Keyboard operator interface equipment.

d) A central processing unit with bulk memory and floppy disk drive and CRT/Keyboard for man machine interface shall also be provided. The CRT/Keyboard shall support a printer.

e) The PLC shall be provided with one dot matrix printer and one A4 size B&W laser jet printer.

f) PLC shall perform the following minimum functions:

- Controls required for remote operation of all systems covered under this package, except for Fly ash & bed ash silo unloading in dry form.
- Annunciations and indications for all systems covered under this package including fly ash, bed ash silo unloading in dry form and compressed air system.
- Relays and other hardware required for protection, safety interlocks for all systems covered under this package.

- Graphic Display Page of the entire Ash handling system including the bed material handling system, fly ash, bed ash silo unloading system and compressed air system. In addition, this Page shall include the 6.6 kV and 415V power supply arrangement for the complete ash & bed material handling system and shall show the two incoming and bus coupler breakers connected to the 415V and 6.6 kV. The synchronising arrangement (consisting of double voltmeter, double frequency meter, synchroscope, synchronising switch and synchronising lamp) shall be provided on the desk cum panel.

- The page shall also display control switches or push buttons, 'auto-manual' selector switch (as applicable) for all equipment and valve motors and solenoid valves except those pertaining to the fly ash & bed ash silo unloading in dry form.

- The Page shall include indicating lamps for all equipment motors.

  i) 'Red' to indicate motor running.
  ii) 'Green' to indicate motor stopped.
  iii) 'Amber' to indicate tripping of motor by the action of protective relays.

- The Page should also include following indicating lamps for all motor-operated and solenoid-operated valves :

  i) 'Red' to indicate valve closed.
  ii) 'Green' to indicate valve open.

  - Minimum graphics required are listed below .BIDDER to provide additional graphics to suit the operational & system requirements.

  Graphic 1 : Bed Ash Handling system upto Bed Ash Silo.
  Graphic2 : Fly Ash Handling system upto Fly Ash Silo.
  Graphic 3 : Bed Material Handling system.
  Graphic 4 : Fly Ash & Bed Ash Unloading system.
  Graphic 5 : Ash slurry formation & Disposal system
  Graphic 6 : Air compressor System
  Graphic 7 : Air Blower System

f) All hardware required for protection / safety interlocks for all systems covered under this package except bed ash handling system, fly ash silo unloading system.

g) Annunciation shall be provided but not limited to the list given below:-

i)	Pump motor tripped	One (1) for each pump motor
ii)	Pump motor earth fault	
iii)	Pump water over load	
vii)	Loss of conveying air pressure.	
viii)	Fly ash line plugged.	
ix)	Loss of instrument air pressure.	

x) Low pressure in water pump discharge header. One for each type of water pump sets.

xiii) Ash slurry sump level very low.

xiv) Ash slurry sump level low.

xv) Ash slurry sump level high.

xvi) Ash slurry sump level very high.

xvii) 110V AC control supply failure.

xviii) 415V AC supply failure.

xix) 48 V DC supply failure (shall also be annunciated separately on 110 V AC system

xx) Air pressure not available for transmitters.

xxv) Air compressor tripped, one for each compressor.

xxviii) Bed Material handling system ON.

xxx) Diverter valves from fly ash silo to bed ash silo – ON

xxx) Diverter valves from bed ash silo to fly ash silo – ON

h) Annunciation for following conditions of the electrical power system :-

i) 6.6 kV ACH Swgr-C Incomer breaker ON/OFF/TRIP

ii) 6.6 kV ACH Swgr-D Incomer breaker ON/OFF/TRIP

iii) 6.6 kV ACH Bus coupler breaker ON/OFF/TRIP

iv) 415V ACH Swgr-C Incomer breaker ON/OFF/TRIP

v) 415V ACH Swgr-D Incomer breaker ON/OFF/TRIP

vi) 415V ACH Bus coupler breaker ON/OFF/TRIP

vii) 6.6 kV Swgr DC Supply 1 and 2 failure

viii) 415V Swgr DC Supply 1 and 2 failure

ix) 6.6 kV ACH Swgr-C Outgoing Feeder Breaker ON/OFF/TRIP

x) 6.6 kV ACH Swgr-D Outgoing Feeder Breaker ON/OFF/TRIP

xi) AH transformer A/B winding temperature high.

xii) AH transformer A/B Buchhloz alarm.

xiii) AH transformer A/B winding temperature high trip.

xiv) AH transformer A/B Buchhloz trip.

xv) Individual annunciation 6.6 kV motor O/L alarm.

xvi) Individual annunciation for 6.6 kV motors for bearing temperature high alarm.

xvii) Individual annunciation for 6.6 kV motors for winding temperature high alarm.

9.3.1 One (1) local control panel shall be provided for the control of silo unloading in dry form for bed ash and fly ash. This panel shall incorporate the following :

a) Controls required for local operation of all equipment in bed ash, fly ash unloading into trucks through flexible unloading spout, i.e. rotary feeder, gates, silo fluidizing nozzle controls, etc.

b) Following indicating lamps for each motor of the bed ash handling system :

i) 'Red' to indicate motor running.
ii) 'Green' to indicate motor stopped.
iii) 'Amber' to indicate tripping of motor by the action of protective relays.

c) Selector switch for 'Auto-Manual' mode for slurry disposal.

d) Indicating lamps to show the following :

i) Bed ash in dry form is operating.
ii) Bed ash in Slurry form is operating.

e) All hardware required for protection/safety interlocks for bed ash silo unloading system with suitable annunciations

f) Annunciations and indications for equipment.

g) Relays and other hardware required for protection/safety interlocks.

9.3.2 Local control panel shall be of totally enclosed, sheet steel cubicle design, completely dust-tight, weather and vernin-proof complying to IP65.

9.3.3 All cable entries shall be from the bottom of the panel.

9.3.4 The annunciation system provided in the panels shall be suitable for 48 V DC and shall comprise audible alarm and facia type illuminating annunciator windows. Protection / safety interlock system shall operate on 110V AC supply for 415V system.

9.3.5 Initiating devices such as pressure switches, level switches, limit switches, etc., for all annunciations and protection /safety interlocks shall be included in this contract.

9.3.6 A local push button station shall be supplied and installed near each motor supplied under this contract. This push button station shall comprise of :

a) Local start / stop push buttons for all equipment motors including air compressor motors and close / open / stop push buttons for all valve motors. The push buttons shall be of lockable type.

b) Lockable de-interlock switch with two positions (interlocked and de-interlocked). When put in de-interlocked position, the switch shall bypass the sequential interlock to allow individual starting of each motor for testing and maintenance.

9.3.6 Supply & installation of cables within the silo unloading package up to the local control panel is in the BIDDER's scope.

9.3.7 **Local Instruments**

Necessary local instruments such as thermometers, temperature switches, level switches, pressure switches, flow meters, pressure gauges etc., shall be provided. The quantity of the local instruments shall be as per the enclosed flow schemes.

9.3.8 **Power Supply**

The power supply used for control shall be derived from UPS of required capacity. The supply & Installation of UPS for the estimated capacity as required for the complete Instrumentation & Control system in the scope of the BIDDER. The UPS shall have 30 min battery backup.

All other power supplies required by I&C system shall be derived from this UPS power supply and power supply shall be redundant.

9.3.9 Cable shall include instrument cables, control cables and special cables as required to make the system compete. The cables shall be of FRLS type.

9.3.10 Cabling between field instruments to junction box is in BIDDERs' scope. All other cables shall be in BHEL scope as per "Electrical Interface" document enclosed with the enquiry specification. However BIDDER will engineer the cable routing and give the cable schedule, cable tray layout, BOM of cable, cable trays and accessories. The cables will be procured and installed by BHEL.

9.3.11 After award of the contract, the VENDOR shall furnish a write-up for the control scheme, block logic diagram with suitable write-up, System Configuration diagram indicating clearly the redundancy requirements in CPU, Power supply & communication modules, I/O list, logs / reports, FAT / SAT Procedure and other PLC system related documents for EPCC / CEPCC's approval.

9.4 **Protective Features and Safety Interlocks**

a) It shall be possible to start "slurry form" only if preset water pressure is available, and it shall be possible to start silo aeration blower only if preset jacket cooling water pressure is available.

b) It shall be possible to start the rotary ash feeder (below silo) only if preset water pressure is available. In the absence of the above, the running motor shall trip.

c) The emptying of fly ash/bed ash hoppers shall be controlled automatically in a predetermined sequence. The command signals for automatic switching over from one hopper (as soon as the hopper is completely empty) to next hopper shall be obtained from level probes and timers. Initiation of fly ash removal system shall be based on low level probe signal backed up by timers. However, the fly ash controls shall be possible to empty the fly ash hoppers one by one and by pass any particular hopper without emptying.

d) The air compressor / blower motor shall trip in the event of high preset discharge air pressure and jacket cooling water pressure not available at the preset value.

9.5 The BIDDER shall include a detailed description of the control system offered by him in hid Bid, complete with bill of materials, block interlock and control diagram with write up, schematic diagrams component ratings, explanation notes and cable interconnections between control panel, switchgears and local devices like limit switches, pressure switches, level switches, push buttons etc., for the entire ash handling plant. FAT of the system shall be conducted in integrated test facility prior to shipment.

10.0 SYSTEM PERFORMANCE, GUARANTEES REQUIREMENTS AND PERFORMANCE TESTS

10.1 System Performance

10.1.1 The following items of ash handling system/equipment performance shall be guaranteed at site performance test either under 'penalty' or 'correction' as specified below. The performance test shall be conducted for each system/ equipment. The parameters indicated under 'correction' shall also be guaranteed by the VENDOR during performance tests. If the parameters are not attainable during the performance tests, the VENDOR shall make all efforts to achieve these parameters (bonafide).

10.1.1.2 Capacity of pressure type pneumatic conveying system for fly ash	:	24 TPH (-) 0.00%
10.1.1.3 Capacity of pressure type pneumatic conveying system for bed ash	:	10 TPH (-) 0.00%
10.1.1.4 Capacity of fly ash unloading system in dry form from fly ash silo	:	96 TPH (-) 0.00%
10.1.1.5 Capacity of bed ash unloading system from bed ash silo	:	40TPH (-) 0.00%
10.1.1.6 Capacity of ash disposal system in slurry form	:	70TPH (-) 0.00%
10.1.1.7 Capacity of each Bed material handling System	:	5 TPH (-) 0.00%
10.1.1.8 Other equipments	:	As mentioned in the respective data sheets
10.1.1.9 Emission level of dust extraction system	:	100 mg/cu.m + 0.00%
10.1.1.10 Auxiliary Power Consumption for Equipment	:	Figures furnished during detailed engineering +0.00%

10.1.2 The VENDOR shall guarantee for the system availability during first year of commercial operation. The system availability shall be as indicated by the BIDDER. However, the minimum guaranteed system availability shall not be less than 90% as specified in section -C. BIDDER shall furnish along with the bid, how he is going to cover the guarantee for system availability

10.2. **Performance Tests and Guarantee Requirements**

10.2.1 After the ash handling system equipment is erected and commissioned successfully and completed in all respects, the system shall be tested within twelve (12) months to prove the performance of the system and equipment in regard to the following which have to be specifically guaranteed. The capacity figures specified in relevant data sheets for the equipment will have to be achieved with tolerance on the positive side. The guarantee requirements, shall be met without undue vibrations in the foundations, structures, etc.

10.2.2 The final test to prove the performance shall be conducted at site by the VENDOR's commissioning engineers in the presence of the EPCC's nominees. The VENDOR shall make the equipment ready for such tests and assist the EPCC as required.

10.2.3 The VENDOR shall make all necessary provisions in piping to mount the testing instruments that will be used for performance testing of all pumps including slurry pumps.

10.2.4 These tests shall be binding on both the parties of contract to determine compliance of the equipment and system with performance guarantees.

10.2.5 All test instrumentation, tools, tackles and equipment as required for the performance tests shall be supplied by the VENDOR and shall be retained by him till the completion of the performance tests. All expenses associated with the supply, calibration, installation and return of the test instrumentation shall be included in the contract price. All test instrumentation, testing and calibration procedures and standards shall be subject to EPCC's approval.

10.2.6 The BIDDER shall furnish a brief write up on how he proposes to conduct various performance tests to prove the performance of the system and equipment with reference to the guarantees indicated and the same shall be got approved from EPCC / ENGINEER.

10.2.7 The guaranteed performance figures of the equipment with tolerances specified shall be proved by the VENDOR during performance tests. If the VENDOR fails to achieve the guarantees set forth he shall investigate the causes and shall rectify the

defects and / or replace the equipment, free of cost to the EPCC with in a period of three (3) months from the date of commencement of the performance tests and again prove the guarantees. In such a case, all costs for modifications including labour, materials and costs of additional testing to prove that the equipment meets the guarantees shall be borne by the VENDOR. Even after necessary alterations and modifications are effected, if the performance guarantees are not fulfilled, the EPCC reserves the right to reject the equipment. In the event of exercising of this right, the VENDOR shall replace the defective equipment with equipment that meets the performance guarantee requirements of this specification. The cost of replacement inclusive of labour materials, transport and repeat testing to prove compliance with the performance guarantee shall be borne by the VENDOR.

10.2.8 The energy consumption of the ash handling plant equipment running at the rated capacity as offered by the BIDDER shall be indicated in the proposal and guaranteed. If the energy consumption of various drive motors exceeds the guaranteed figures indicated by the BIDDER in the proposal, the VENDOR shall investigate the causes of excessive energy consumption and shall rectify or modify the system / equipment so that the guaranteed power consumption figures are not exceeded, without under running in any way the performance of the equipment.

10.2.9 Performance tests of all pumps shall make allowance for instrumentation errors as per relevant standards. However, the tolerance on power consumption is inclusive of instrument errors and tolerance on efficiency, capacity of pumps etc.

10.2.10 The specific tests shall be conducted on the sub systems as given below :

i) Bed ash handling system operation.
ii) Bed Material handling system operation.
iii) Bed ash disposal system.
iv) Fly ash handling system operation – for ESP hoppers.
v) Fly ash handling system operation – for fly ash hoppers, other than ESP hoppers.
vi) Ash slurry pumps.
vii) Compressors.
viii) Fly ash & bed ash unloading from respective silos system operation.
ix) Functioning of interlocks, protection and sequential control systems as required.

10.3 The following items of the ash handling plant performance shall be guaranteed under penalty or correction as specified below :-

10.3.1 **General**

a) Compressors shall be tested as per relevant IS for capacity (FAD), power consumption, etc.

b) The capacities of all equipment shall be equal to or more than the capacity figures specified in relevant data sheet-A in Section-D. The capacities shall be achieved with positive tolerance only.

c) All drive motors shall be suitable for direct-on-line starting and capable of starting fully loaded equipment included in the VENDOR's scope.

d) The energy consumption of all equipment shall be equal to or less than the guaranteed power consumption figures furnished during bid stage, when the power consumption is measured, about from the Voltmeter and Ammeter readings, the power factors shall also be measured and recorded.

e) All equipment, machinery, etc., shall be for the intended operating programme as stated therein.

Noise Level

f) Measured noise level produced by the rotating equipment, individually and collectively should not exceed 80 dBA at a distance of 1.86 metre from it in any direction under any load condition.

Vibration

g) Vibration level of equipment at bearings shall not exceed the following limits for different equipment. Vibration levels shall be measured and shall be acceptable as per VDI 2056/BS 4675 or as specified.

At the bearing of motor and gear box for the equipment (both driving and non-driving ends)	: 75 microns

Illumination Levels :

h) Minimum illumination levels specified shall be achieved during normal operation of the plant with dust laden for about one month's period.

Earthing Resistance

i) An earthing resistance of less than 1 ohm shall be achieved when measured after isolated AHP earthing system.

Others

j) All water lines, shall be hydraulically tested at 1.5 times the maximum operating pressures.

k) All slurry pipe lines shall be tested hydraulically at a pressure of 1.5 times the maximum operating pressure at a closed discharge end condition.

l) All the instruments shall be guaranteed for proper functioning within an accuracy of ± 1%.

m) The performance guarantee testes shall be conducted after the unit is commissioned and carrying load. The BIDDER may note that this can be any time within a period of twelve (12) months from the date of commissioning of the ash handling system and therefore the cost of either continuing minimal site facilities for carrying out the tests or deputing personnel at a later date may be suitably considered in the offer.

11.0 TERMINAL POINTS

The limits of supply for Ash & Bed Material Handling Systems and accessories shall be as indicated in this specification/enclosed drawings.

11.1 Fly ash hoppers will be supplied by others and terminated at the outlet flanges and the BIDDER shall include in his scope connecting flange, adopters, bolts, nuts, gaskets, etc., for attaching equipment.

11.2 From the outlet flange of fly ash hoppers to the outlet flange of the unloading spout for dry ash disposal and up to the ash slurry disposal at the coordinate point N - 50942 / E – 48200 in Ash Pond area shall be carried out by Ash & Bed Material Handling System Vendor.

11.3 From the outlet flange of bed ash hoppers to the outlet flange of the unloading spout for dry ash disposal and up to the ash slurry disposal at the coordinate point N - 50942 / E – 48200 in Ash Pond area shall be carried out by Ash & Bed Material Handling System Vendor.

11.4 From the outlet flange of bed ash hoppers to the inlet flange (including the companion flanges) of the Bed Material bunkers including the bag filters and dust suppression systems for Bed Ash recirculation.

11.5 From the Bed Material receiving hopper to the inlet flange (including the companion flanges) of the Bed Material bunkers for fresh bed materials.

11.6 Service water will be supplied near layout location and further connection to the equipment shall be done by Vendor.

11.7 Electrical System
EPCC will arrange feeders for power supply to the nearest junction boxes based on Vendor inputs/requirements.

11.8 Instrument air system
The vendor shall execute the Instrument air piping as required for the Ash & Bed Material Handling System. Instrument air header will be provided by EPCC at one point for further distribution.

12.0 BID EVALUATION

12.1 BIDDER shall comply with the Ash & Bed Material Handling System specifications laid out in various sections. No credit will be given in tender evaluation if parameters better than those specified, are offered by the BIDDER. In case the BIDDER's recommendation is different from the specification in regard to any aspect, the BIDDER shall quote basically in line with the specification indicating price change for adopting his recommendation, failing which his bid is liable for rejection.

12.2 BIDDER shall ensure that there are no deviations from technical specifications. In case BIDDER takes major deviations from the specifications, his Bid will be summarily rejected. No deviation after award of contract from the agreed technical specification will be permitted. Any such deviation noticed by EPCC/ CEPCC/CONSULTANT at any stage after award of contract will not be permitted and VENDOR shall carry out necessary modifications to bring the system in line with agreed technical specification at no extra cost.

12.3 The BIDDER shall furnish the information called for in the 'schedule of Drive Motors and other Electrical Equipment' giving ratings and number of all electrical equipment under the scope of contract. BIDDER shall also furnish all the data called for various equipment of section- D in their offer. Offers which do not contain all the data will be treated as incomplete and are liable for rejection.

12.4 Deviations from the specification, if acceptable to the EPCC, will be evaluated suitably to compensate for the deviations from the specification.

12.5 Commissioning spares required during commissioning shall be quoted separately, which will be considered while evaluating the Bids.

12.6 Similarly maintenance tools & tackle (listed in system Data Sheet A4), Essential spares shall be quoted separately, which will also be included for tender evaluation.

12.7 Deviations from the specification, if acceptable to the EPCC, will be evaluated suitably to compensate for the deviations from the specification.

SYSTEM DATA SHEET –A1

13.1	Bulk density of fly ash for volume calculation	:	0.8 T/m^3
13.2	Bulk density of fly ash for structural calculation	:	1.6 T/ m^3
13.3	Bulk density of bed ash for structural calculation	:	3.6 T/ m^3
13.4	No. of silos for bed ash	:	1 No. for both boilers
13.5	No. of silos for fly ash	:	1 No. for both boilers
13.6	Bed ash silo design Criteria	:	16 hours max. collection rate in 2 boilers
13.7	Fly ash silo design Criteria	:	16 hours max. collection rate in 2 boilers
13.8	Source of water for bed ash and fly ash, air compressor, air blower requirements	:	From plant service water and cooling water system to be provided by EPCC.
13.9	Source of instrument air for bed ash and fly ash system requirements	:	From plant instrument air system to be provided by EPCC
13.10	Design basis for bed ash handling capacity	:	Based on maximum collection rates -(Refer attached Bed Material data)
13.11	Design basis for fly ash handling capacity	:	Based on maximum collection rates -(Refer attached Bed Material data)

Ash Collection Data as furnished by BHEL

Sl.No.	Location	No. of outlets	Flow rate Kg/hr	Grain size mm	Avg Bulk density Kg/ m^3	Max. temp ° C	Gas side Operating Pressure (mmwc)
1	Ash cooler out let (1)	2	900-8700	0.05-0.5	1500-1800	200	0
2	APH Bottom hopper outlet	2	1100-2200	0.05-0.1	450-750	300	-50 to -220

(1) Normally only one ash cooler will be in service and the quantity indicated is for one ash cooler.

Rate of Ash Collection at different fields/hoppers of ESP

Sl.No.	Field No.	Stage Efficiency	Ash collection per hopper (kg/hr)	Ash collection for 2 hoppers (kg/hr)
1	1	78	7254	14508
2	2	15.3	1423	2846
3	3	4.6	428	856
4	4	1.4	130	260
5	5	0.452	42	84

Bed Material Requirement

1	Material handled	Crushed refractory Grog/Bed ash
2	Size (1)	
	100%	Less than 1mm
	80%	Less than 180 to 200 micrometer
	50%	Less than 150 to 170 micrometer
	3%	Less than 63 micrometer
3	Bulk density	1500 – 1800 kg/m3
4	Chemical composition (% by weight) as per IS 1355	
	Al2O3	30-40%
	SiO2	50 to 60%
	Alkalis (Na2O+K2O)	Not more than 3%
	Iron Oxide	Not more than 3.5%
	Moisture (H2O)	Less than 1%
	Initial Deformation Temperature	Greater than 1300deg.C As per ASTM D 1857 / 1968
5	Quantity required for initial fill	260 tons
6	Quantity to be supplied for initial fill	260 tonnes
7	Bunker capacity	130 tonnes
8	Quantity recommended for stocking	520 tonnes

Notes

1) Conditions to be maintained by the supplier.
2) Bed material bunker is to be filled with Fresh Bed Material and / or Bottom Ash from the storage bins.

Indicative Ash Composition Data

Ash analysis (%by weight)

Description	Unit	Value
SiO_2	%wt	5-7
Al_2O_3	%wt	0-1
Fe_2O_3	%wt	0-0.01
MgO	%wt	0.3-3.0
CaO	%wt	54-56
Na_2O	%wt	0-0.05
K_2O	%wt	0-0.2
P_2O_5	%wt	0-0.15
$CaSO_4$	%wt	31-33
$Me_x O_{xy}$	%wt	0-2
C	%wt	2-3
Others	%wt	Rest

Note :

Actual composition dependent on fuel & limestone composition and boiler operating characteristics.

SYSTEM DATA SHEET – A2

ESSENTIAL SPARE PARTS LIST

The list of essential spare parts for three (3) years of trouble free operation of plant is indicated below. In case the BIDDER recommends additional quantities and /or items of spares to meet three years maintenance requirements, he shall furnish the same under recommended spare parts list in section –F along with unit rates and total price. EPCC reserves the right to procure/add/delete any of the following items also.

SL.NO.	DESCRIPTION	QUANTITY
A.	MECHANICAL SPARE PARTS (IN ADDITION TO THOSE INDICATED IN DATA SHEETS)	
1.0	Fly Ash Transmitters	
1.1	Level probe	4
1.2	Seals	10sets
2.0	Inlet valve/outlet valve	4 sets
3.0	Air Compressors	
3.1	‘O’ rings for each type	6
3.2	Washers	30
3.3	Gasket, for each type	6
3.4	Valve spring for each type	4
3.5	Piston ring for each type	2
3.6	Bearing for both compressor & motors	2 sets each
4.0	Water Pumps	
4.1	Rings	2 sets in each type of pump
4.2	Shaft sleeve	- do -

4.3	Bearings for pump with seal	- do -
4.4	Gland packing	- do -
4.5	Impeller	- do -
4.6	Bearings for motor	- do -
5.0	Ash Slurry Pumps	
5.1	Impeller	2
5.2	Shaft sleeve	2
5.3	Lantern ring	2
5.4	Gland packing	2 sets
5.5	Bearings for pump with bearing seal	2 sets
5.6	Labyninth seal complete set	2 sets
5.7	V-Belts (complete set for pump)	2 sets
5.8	Bearings for motors	2 sets
5.9	Casing for single casing pumps (if applicable)	2
5.10	Twin casing pumps onner casing (if applicable)	2
6.0	Ash slurry sump liners	20 sq.m
7.0	Valves (for gate, check, globe and diaphragm valves)	
7.1	Bonnet / cover gasket	Two (2) sets for every set of four (4) valves & specialities or part thereof subject to a minimum of 2 sets for each size and type of valve and speciality.
7.2	Gland packing	Two (2) sets per valve speciality for each size and type.

7.3	Spring for check valve	One (1) for each size of valve
7.4	Valve stem for NB50	Two (2) per set of 15 valves or part there of subject to a maximum of 25 for each size and type of valve.
7.5	Disc or Disc Seat as applicable for Gate / Globe valves and disc with binge pins for check valves	One (1) per set of 10 valves or part thereof for each size and type of valve.
7.6	Diaphragms	20% of total quantity in each type of size subject to a minimum of 5 in each type of size.
7.7	Body seat ring for Gate, Globe and check valves	One (1) per set of 25 or part thereof for each size and type of valve.
8.0	Ash Slurry Valves – Knife Gate	
8.1	Slide gate	4
8.2	Diversion cone & seat assembly	4
8.3	Valve stem	4
8.4	Gland follower & packing	4 sets
8.5	Associated spares for valve actuators	4 sets
9.0	Pipe Lines	
9.1	Pipe lines in standard lengths for each size and type of pipe lines	10% of the total quantity used in the system for each size & type
9.2	Gaskets for each size	10% of total quantity used in the system for each size
9.3	Sleeve couplings of different sizes with fasteners	10% of the total quantity used in the system, minimum two sets of each size
9.4	Pipe bends	3 nos. of each type and size
10.0	Drain Sump Pumps	

10.1	Impeller	2 sets
10.2	Bearing for motor & pump with seal	2 sets
10.3	Shaft sleeve	2 sets
10.4	Shaft enclosing tube (column pipe)	2 sets
11.0	Blowers (For each fluidizing blowers and silo aeration blowers)	
11.1	Impeller	2 sets in each type of blower
11.2	Bearings for motor & blower	- do -
12.0	Vent Bag Filters	
12.1	Bags with fixing clamps	10% of total bags
12.2	Solenoid valve	4 Nos.
12.3	Timers	2 Nos.
13.0	Pressure switches	2 nos. in each service
14.0	Pressure gauges	2 nos. in each service
15.0	Any other spares recommended by Vendor which is essential for the operation.	

C. NOTES

1.0 BIDDER should furnish a certificate indicating that the spare parts are as per original equipment and would fit properly with the mother equipment.

2.0 BIDDER should furnish a certificate indicating that the spare parts are as per original equipment and would fit properly with the mother equipment.

3.0 BIDDER HAS TO PROVIDE ESSENTIAL SPARES REQUIRED FOR SMOOTH OPERATION OF THE PLANT. HOWEVER THIS SHALL BE DISCUSSED DURING THE BID REVIEW WITH EPCC.

LIST OF ACCEPTABLE SUB-VENDORS

PART – A – MECHANICAL

PART-A MECHANICAL

1.	Ash slurry pump / sludge pumps	:	SAM / McNALLY BHARAT / HYDERABAD INDUSTRIES
2.	Water pumps	:	M & P / KBL (KIRLOSKAR) / BEACON WEIR (BEST & CROMPTON / KSB (KIRLOSKAR) / WORTHINGTON
3.	Fluid couplings – For LT Drives	:	PERBRILL / FLUIDOMAT / VOITH / ELECON SIME PERBRILL / VOITH
	- For HT Drives	:	/ FLUIDOMAT
4.	Reilient flexible couplings	:	GBM / WELLMAN / INCANDESCENT
5.	Gear boxes	:	GREAVES COTTON / ELECON / NAW / FMG
6.	Compressors	:	INGERSOL RAND / KIRLOSKAR PNEUMATICS / CONSOLIDATED PNEUMATIC
7.	Pipes	:	SAIL / GST / ITC / JINDA
8.	Centrifugal Fans (For ventilation)	:	FLAKT / DUVENT / THERMAX / GEC
9.	Expansion joints	:	SURI IND. / KELD ALLENTOFT
10.	Bag filter	:	THERMAX / FLAKT / RATHI
11.	Valve (general service)	:	L&T / DEZURIK/FORESS/BDK/KIRLOSKAR/DEWRENCE McNEILL/LEADER
12.	Sump pumps	:	SAM/HYDERABAD

			INDUSTRIES/SU MOTORS/ BEACON/McNALLY BHARAT
13.	Chain Pulley Blocks	:	W.H. BRADY / INDEF / KANUBHAT / REVA/ EDDY CRANES/TRACTEL TIRFOR
14.	Electric Hoists / Overhead cranes	:	ARMSEL/KANUBHAI/EDDY CRANES/INDEF/HERCULES
15.	Bearings	:	SKG/FAG/NTN/TATA/NORMA
16.	Paints	:	BERGER/ASIAN/SHALIMAR/ J&N
17.	Blowers	:	KAY (CALIFORNIA SERIES) / SLM MANKATALA / SWAM

PART-B ELECTRICAL

1.	LT Motors	:	NGEF/CROMPTON/KIRLOSKAR/ABB/BHARAT BUJILEE
2.	HT Motors	:	BHED/NGEF/KIRLOSKAR/CROMPTON/ABB/BHARAT BIJILEE
3.	Control Desk-Mimic, MCC, Relay panel	:	L&T /CONTROL & SWITCHGEAR /SIEMENS/BHEL GEC-ALSTHOM
4.	LDB’s	:	BCH/CONTROL & SWITCHGEAR/STAR ENGINEERS
5.	Lighting Panels	:	MDS/INDO ASIAN/HAVELL’S SIEMENS/L&T
6.	LT cables	:	IND CABLES/NICCO/ICL UNIVERSAL/KALINGA/FORT CLOSTER/FINLOLEX/PRIMER/KRISHNA/NOTE/OMEGA
7.	HT cables	:	IND CABLES/NICCO/ICL UNIVERSAL/FORT GLOSTER/CCI/FINOLEX/

			ASIAN/PRIMER/ORIENTAL/TORRENT
8.	Control cables	:	INDUSTRIAL /NICCO/UNIVERSAL/CMI/ FORT CLOSTER/DELTON/FINOLEX/ASIAN/KRISHNA/PREMIER/MOTE & OMEGA
9.	Lighting Fittings	:	CROMPTON / BAJAJ/ GLOLITE / PHILIPS
10.	Conduit	:	BEC/AKG/STEEL CRAFT/MST/NATIOAL ENGG/SHARMA SALES CORP.
11.	PVC wires	:	KALINGA/DELTRON/ECKE/PLAZA /FINOLEX/NATIONAL/KRISHANA/ MOTE & OMEGA
12.	Cable Trays	:	INDIA ELECTRICALS SYNDICATE/INDIANA / PILCO / ESSAR ENGG/VIKARAM CARL & ASSOCIATE /POWER PRODUCTS TECHNI ENGINEERS & CO CHANDIGARH
13.	Cable jointing fits	:	RAYCHEM/MAHINDRA (Slip on Type) XICON

PART-C AUX. ELECT. ITEMS

1.	DC Motors	:	KEC/BHEL/NGEF/CGL/BHARAT BIJLEE
2.	Thyristor Convertor	:	SIEMENS / BHEL / NGEF / NELCO ASEA / L&T
3.	Isolators	:	SIEMENS/L&T/STANDARD/ DSC STROMBERS
4.	HRC Fuses	:	SIEMENS /INDO/ASIAN/EE/L&T/STANDARD
5.	A.C Power Contactor	:	SIEMENS/BCH/L&T/TELE MECHANICAL & CONTROL
6.	Crane Duty Power Contactor	:	SIEMENS/BCH/L&T/TELE MECHANICAL & CONTROL
7.	D.C Power Contactor	:	BCH/ BHEL
8.	Bimetallic Relays	:	Same as Contactors
9.	Electromagnetic overload Relay	:	BCH/KILBURN
10.	Single Phase Preventor	:	L&T / BCH
11.	Control Switch	:	SIEMENS / L&T/BCH/EE/KAYEE/CSC
12.	Push Button	:	SIEMENS/L&T/BCH/VAISHNU/CSE/ EE
13.	Limit Switch	:	SIEMENS/BCH/AG SYSTEM/ASEA/CONCORD
14.	Indicating Lamps	:	CSC/L&T/SIEMENS/BCH/CSC
15.	Temperature Scanner	:	PROCON/I.L SKOTA

16.	Control Transformer	:	SIEMENS/LOGIC/BCH
17.	Timer / Time Delay Relay	:	L&T/SIEMENS/TELE MECHANIQU
18.	Hoster / Buzzer / Bell	:	UNICON/EDISON/KHERAJ/GETCO
19.	Terminal Blocks	:	ELEMEX/CSC/ESSEN/TOSHA/CONNECT WEL
20.	Cable Lugs	:	DOWEL/FORWARD/LUPCO/JAINCO
21.	Diode	:	BHEL/NGEC/RUTTON SHAH/USHA RECT./HIND
22.	D.C.E.M. Brake	:	BCH/ELECTROMAS/ELECTROMIC POWER & CONTROL/STROMKARAFT/SPEED-O-CONTROL
23.	Thrustor Brake	:	IND.SYNDICATE/STROM-KRAFT/ELECTROMAG / SPEED-O-CONTROL
24.	RTDS/Thermocouple	:	NAGMAN / GEN INSTRUMENTS
25.	Sol. Valves	:	AVACON / ROTEX / ASCO
26.	Ammeter / Voltmeter / WH meter	:	AC / MECO / IMP
27.	Motor Prot. Relay	:	EE / ABB
28.	Solid State Annunciator	:	PROCON / KELTRON VERSAWAS / ILK
29.	Press & Temp. Switch	:	DANFOSS / SWITZER / BELLS
30.	Control Contactors	:	SIEMENS / BCH / L&T / TELEMECHANIQUE
31.	Cable Glands	:	BRACO / COMET / CAINCO
32.	GT’s	:	KAPPA / GKBERT MAXWEL /

			INDOCOIL
33.	Pressure / Temperature gauges	:	AN INSTRUMENTS / BELLS / H.GURU / GEN. INSTRUMENT
34.	Level gauge	:	LEVACON / BLISSANAND
35.	Level switch	:	LEVCON/ LEVEL TECH / BLISSANAND

Note : If the Bidder wants to add other names of sub vendors, the Bidder shall submit credentials of those sub vendors such as the sub vendor's experience list, the details of the product etc. Acceptance of these makes will be given by, BHEL after scrutiny of the credentials.

LIST OF MAINTENANCE TOOLS AND TACKLES

The list of maintenance tools and tackles required for the Ash & Bed Material handling & accessories are indicated below. In the event BIDDER recommends additional quantities, he shall furnish the same under schedule of maintenance tools and tackles in section-F along with unit rates.

SL.NO.	Particulars	Qty.
A	**MECHANICAL**	
1.	Spanners	
	(a) Open end spanners BS/Metric	1 set each
	(b) Adjustable spanners 10 inch	1 set
	(c) Tubular box spanners	1 set
	(d) Ring spanners BS/metric	1 set each
	(e) Socket head spanner with universal drive	1 set
2	Vice grips 6” & 8”	1 no. each
3	Dial indicators	1 set
4.	Torque wrenches	2 Nos.
5.	Hammer	
	(a) 2 lbs	2 Nos
	(b) 4 lbs	2 Nos
6	Nylon faced hammers	2 Nos.
7	Ball bearing extractor	1 set
8	Oil seal extractor	1 set
9	Pliers	1 set
10	Flange puller bearing puller	1 set
11	Screw drives 18”, 12”, 8” & 6”	2 Nos.
12	Spirit level 12”	2 Nos.

SL.NO.	Particulars	Qty.
13	Plumb bob	2 Nos.
14	Hyd. Jack 15 T	2 Nos.
15	4” dia portable motor operated grinding machine with flexible grinder	1 No.
16	Extendable ladder with max. 6 m height self supporting aluminium ladder	2 Nos.
17	Circlip, bearing and oil seal extractor	2 Nos.
18	Grease gun	1 No.
19	5 Lt. Bucket grease gun	1 No.
B	**ELECTRICAL**	
20	Insulation resistance test set (meggers)	
	(a) 500V	1 No.
	(b) 1000V	1 No.
21	Multimeter with necessary testing leads	1 No.
22	Earth meggar	1 No.
23	Clip on tong tester 0-10-100-300-1000 Amp 600V	1 No.
24	Milliometer	1 No.
25	Adjustable spanner	2 Nos.
26	Combination plier	2 Nos.
27	Nose plier	2 Nos.
28	Screw drivers	4 Nos.

SL.NO.	Particulars	Qty.
29	Hand-drills (piston)	2 Nos.
30	Allen key	2 sets
31	Insulation tester lamp type	3 Nos.
32	Cable knife	1 No.
33	Line tester	1 No.
34	Soldering iron – electric 65 W	1 No.
35	Soldering wire (flux coated)	1 Mtr.
36	Flux soldering	100 gms
37	Brush soldering – big	1 No.
38	Brush soldering – small	1 No.
39	Phase sequence indicator with leads 0-500V	1 No.

DRAWINGS, LITERATURE AND WRITE-UP TO BE SUBMITTED WITH THE PROPOSAL

1.0 GENERAL

1.1 The information sought in Data sheets-B of section-D and various schedules in section –F shall be furnished by the Bidder in the format specified, failing which his quotation may not be considered.

1.2 The Bidder shall enclose with his proposal, particulars of the drive motors offered by him, in proforma as specified in section-F with ratings. He shall also indicate the total auxiliary power requirement at motor shaft for driving all equipment offered by him under this specification.

1.3 The Bidder shall also enclose with his proposal the following drawings, literature, write-up and information related to the mechanical, electrical and civil & structural works to be executed under this contract.

1.4 MECHANICAL

Manufacturer's catalogues/general arrangement/detailed component drawings/write-up covering the items as listed below:

a) General plan, showing layout of the proposed Ash & Bed Material Handling system under his scope of supply.
b) Flow diagram of Ash & Bed Material Handling system, which are under his scope of supply.
c) Layout drawings for Ash & Bed Material Handling system, proposed stock pile area for fresh bed material etc.
d) Layout of proposed maintenance area and its requirements etc
e) Layout of room for Ash & Bed Material Handling system, panel location etc which is part of Material Handling Control room
f) Write-up on controls of Ash & Bed Material Handling system & accessories.

1.5 ELECTRICAL & INSTRUMENTATION & CONTROL

a) Motor data sheet giving details of motor in the required format.
b) Write up on Ash & Bed Material Handling system safety & Interlock system
c) Details on Control panel
d) Bidder has to provide information as per the data provided in EPCC /Vendor interface.

1.6 Bar Chart /PERT Network schedule incorporating the following major activities :

i) Design and Engineering.

ii) Supply of equipment and accessories

iii) Erection schedule.

iv) Testing and commissioning schedule

INFORMATION TO BE FURNISHED ALONG WITH THE BID

1.0 **General**

1.1 The information sought out in this system Data Sheet-B, Data Sheet-B of section-D and various schedules in section-F shall be furnished by the BIDDER in the format specified, failing which his quotation may not be considered.

1.2 The BIDDER shall enclose with his proposal particulars of all drive motors offered by him in specifications proforma with ratings. He shall also indicate the total auxiliary power requirement at motor shaft for driving all equipment offered by him under this specification.

1.3 The BIDDER shall also enclose with his proposal the following drawings, literature, write-up and information related to the mechanical, electrical and civil & structural works to be executed under this contract.

2.0 MECHANICAL

Manufacturer's catalogues/general arrangement drawings/ write-up covering the items as listed below:

a) Flow diagram of ash handling system.

b) General plan, showing layout of the proposed ash handling system.

c) Sectional elevation drawings for silos, pipe racks, etc.

d) Detailed general arrangement drawings for fly ash transmitters, pumps, compressors, etc.

e) Write-up on controls of ash handling system

3.0 ELECTRICAL

a) HT and LT load.

b) Detailed write-up/catalogues/drawings of lighting fixtures.

c) Typical lighting calculations for all areas.

d) Typical Earthing calculations.

4.0 CIVIL

a) Quantities of reinforcement steel and cement required for the scope of work covered in BIDDER scope.

b) All assumptions made and loading taken for the design shall be clearly indicated.

c) The cost of major items of civil works preferably with a break up of various units of ash handling plant.

d) A broad outline of steel erection scheme.

e) Name of manufacturers for all bought out items like doors, windows, louvers, fixers and fittings, etc., manufacturer's catalogues for all hardware and fixtures shall be supplied.

5.0 Actual user's performance certificates in respect of equipment of this ash handling plant such as fly ash transmitters, pumps, compressors, etc.

6.0 Sub-vendor list for bought out items

7.0 PERT chart for the complete activities from design engineering, manufacturing, supply, erection, testing and commissioning.

8.0 **DATA TO BE FURNISHED WITH THE BID**

8.1 CONSUMPTION OF WATER

8.1.1 HIGH/LOW PRESSURE WATER

Description	Qty M3/hr	Remarks No.of hrs of requirement
a) Bed ash hopper flushing		
b) Agitating nozzles in ash Slurry sump		

c) Ash slurry sump make up

d) Ash slurry pipe line flushing

e) Ash slurry sump flushing

f) Bed ash hopper filling

g) Jet pump below fly ash silos

8.1.2 Ratio of ash slurry to ash considered

8.1.3 Total length of Ash slurry disposal pipeline considered M

8.1.4 Slurry pipe diameter and velocity of slurry in pipeline considered

8.1.5 Type of slurry pipes and fly ash pipes and pipe fittings such as bends, laterals etc. included.

8.1.6 Total quantity of conveying air required and its pressure M^3/hr
kg/cm^2 (g)

9.0 SCHEDULE OF MOTORS

Sl.No.	Equipment	Qty	Power requirement at motor input terminals(in kW)	Installed motor rating (in kW)
9.1	Water pumps			
9.2	Ash slurry pumps			
9.3	Sump pumps			
9.4	Air compressors for fly ash transport			

9.5 Air compressor for Instrumentation & control of AHS

9.6 Blowers for air driers

9.7 Heaters for air driers

9.8 Silo aeration blower – FA

9.9 Silo aeration heater - FA

9.10 Feeder below fly ash storage silo

9.11 Fluidising air blower for fly ash hopper

9.12 Motor operated valves

9.13 Exhaust fan at bag filter outlet

10 .0 CAPACITY OF SYSTEM OFFERED

		Rated (TPH)	Design (TPH)
10.1	Bed ash handling system /boiler		
10.2	Fly ash handling system /boiler		
10.3	Bed ash unloading system from BA silo		
10.4	Fly ash unloading system from FA silo		
10.5	Ash slurry system (FA+BA)		
10.6	Bed Material handling system		

11.0 FLY ASH HANDLING SYSTEM

11.1 GENERAL

a) Type of System offered

b) Ash to air ratio

11.2 Operating time per shift

12.0 FLY ASH VALVES Fly Ash Inlet Valves Branch Isolation valves/ diversion valves

12.1 Manufacturer

12.2 Type

12.3 No. of valves

12.4 Size, mm

12.5 Capacity, TPH

12.6 Type of pneumatic operating device

12.7 Material of construction of components of valve which come in contact with fly ash such as valve body, valve disc/dome, valve seat, seal

12.8 Life of valve seals in No. of operating hours.

12.9 Any other data that the BIDDER may wish to furnish, to bring out special features to the valves being offered.

13.0 ASH/ASH SLURRY TRANSPORT PIPING & FITTINGS

13.1 Manufacturer of piping _____

13.2 Manufacturer of fittings _____

13.3 Whether No.of lines as per specification included in the offer _____ Yes/No

13.4 Details of piping such as size, material, length, type of joint and gasket material etc., for _____

a) Fly ash piping below fly ash hoppers upto flyash storage silos _____

b) Jet pump to ash slurry sump (bed ash) _____

c) Jet pump to ash slurry sump (fly ash) _____

d) Ash slurry sump to disposal area _____

e) Sump pump discharge to slurry sump _____

13.5 Maximum air ash mixture velocity in fly ash lines, M/sec _____

13.6 Friction factor for air ash mixture considered _____

13.7 Velocity of slurry in slurry pipe line, M/sec _____

a) From jet pump to slurry sump _____

b) From ash slurry pumps to ash slurry disposal area _____

14.0 ASH SLURRY LINE VALVES

14.1 Manufacturer _____

14.2 Number of valves _____

14.3 Line size, mm _____

14.4 Ash slurry flow-rate through valve, M3/hr _____

14.5 Type of actuation (Motor/Cylinder) _____

15.0 VALVES AND SPECIALITIES

15.1 Type of valves used for water services

- Isolation

- Flow Regulation

15.2 Type of valves used for compressed air services

- Isolation

- Flow Regulation

15.3 Guaranteed life of fly ash discharge valve (if offered by bidder) yrs.

16.0 ROTARY FEEDER (Air Lock Type)

16.1 Quantity _____

16.2 Fly ash handling capacity (T/hr) _____

16.3 RPM of feeder _____

16.4 Type of drive transmission _____

16.5 Material of construction

a) Body _____

b) Rotor _____

17.0 CENTRIFUGAL PUMPS

17.1	Type					
17.2	No. of pumps offered					
17.3	Design capacity, (M3/hr)					
17.4	Total head @ design capacity, (MLC)					
17.5	Maximum total head developed, (MLC)					
17.6	Shut-off head, (MLC)					
17.7	N.P.S.H required at design capacity					
17.8	Efficiency of pump at design capacity %					
17.9	Power requirement of pump at design capacity, (KW)					
17.10	Transmission losses, (KW)					
17.11	Minimum flow recommended, (M3/hr)					
17.12	Casing test pressure, (Kg/cm2)					
17.13	Liquid handled					
17.14	Specific Gravity					
17.15	Sealing water quantity Required (M^3/HR ; MLC)					

17.16 CONSTRUCTION FEATURES

a) Manufacturer					
b) Type of pump					

c) Type of impeller ____ _____ ____ ____ _____

d) Type of drive transmission offered ____ _____ ____ ____ _____

18.0 BLOWERS

		For Fly ash Hopper Fluidisation	For silo aeration
		---	---
18.1	Manufacturers	_____	_____
18.2	Type	_____	_____
18.3	Capacity, M3/hr (FAD)	_____	_____
18.4	Discharge pressure, Kg/cm2 (g)	_____	_____
18.5	BHP at rated capacity and discharge pressure	_____	_____
18.6	Maximum BHP in operating range	_____	_____
18.7	Weight of air blower (kg)	_____	_____

19. FLY ASH STORAGE SILOS Silo-I Silo-II

19.1 Volumetric capacity of the silo, M3 _____

19.2 Over all dimensions of the silo _____

19.3 Are all the fittings and accessories provided as per specification? _____Yes/No

19.4 Material of silo RCC

20.0 AIR COMPRESSORS/BLOWERS Conveying Air

20.1 Number provided :

20.2 Manufacturer :

20.3 Capacity :

20.4 Discharge pressure :

20.5 Type :

20.6 Number of stages :

20.7 Number of cylinders per stage :

20.8 Type of cylinder :

20.9 Discharge pressure at max. speed, kg/cm2(g) :

20.10 Capacity at maximum speed, m3/hr :

20.11 Volumetric efficiency :

20.12 BHP required at the compressor shaft :

20.13 Are the standard accessories for air compressor included? :

20.14 Type of after cooler with moisture separator provided :

20.15 Type of intercooler provided :

20.16 Air Receivers

a) Type and capacity :

b) Number :

c) Design pressure :

d) Code of construction :

e) Are the following accessories included?

i. Auto drain trap :

ii. Pressure gauge with isolating valve :

iii. Safety valve :

iv. Man hole :

v. Test connection :

20.17 Oil filters

a) Make :

b) Mesh size :

c) Efficiency

d) Filter element life (in operating hrs.)

20.18 Air Dryer

a) Manufacturers :

b) Type :

c) Capacity

d) Regeneration Time

e) Dew point of air at 7 kg/cm^2 (g) pressure

f) Reactivating Blower capacity

g) Heater Rating

21.0 <u>BAG FILTER</u>

21.1 Type and number of bag filters :

21.2	Volume of dust laden air handled (m3/hr)	:	
21.3	Air to cloth ratio (m/min)	:	
21.4	Dust concentration of air let out to atmosphere (mg/Nm3)	:	
21.5	Type of fan	:	
21.6	Capacity (m3/hr)	:	
21.7	Suction Pressure (MWC)	:	
21.8	Discharge Pressure (MWC)	:	
21.9	Materials of construction is it as specified	:	
21.10	Are all controls for automatic on-line bag cleaning system provided?	:	Yes/No
21.11	Are tests as per Data Sheet-A included?	:	Yes/No

22.0 HYMIXER

22.1 Manufacturer _____

22.2 Flow rate of fly ash (T/hr) _____

22.3 Water requirement

a) Flow rate (m3/hr) _____

b) Pressure (kg/m2) _____

22.4 Air to water ratio _____

22.5 Slurry flow rate at discharge (m3/hr) _____

23.0 Transmitter Vessel

a) Make & Type

b) Capacity of ash transmitter vessel M^3

c) Diameter of Fly Ash Conveying Pipes from Various Hoppers m

d) Velocity of Air-Ash-Mixture in the Pipeline m/s

e) Type of Ash Inlet Valves

f) Time Required for Emptying the Ash Transmitter Vessel secs

g) Average Ash Conveying Rate from Transmitter to Silo/Buffer Hopper

i) ESP ash transmitter vessel t/hr

ii) Stack hopper ash transmitter vessel t/hr

h) Compressed Air Requirement for the Specified

Fly Ash Conveying Rate of Various Ash Transmitter Vessels

- Flow rate Nm3/s
- Pressure (kg/cm2)

i) Type discharge valve (if offered)

Ash slurry sump

24.0 COMMON SUMP / TANKS

24.1 Capacity (m^3)

24.2 Dimensions

a) Length (m)

b) Breath (m)

c) Depth (m)

Accumulated operating life of liner plates in ash slurry sump ------ hrs.

25.0 The VENDOR should submit every month the drawing schedule to the EPCC/CEPCC furnishing the status of drawings and calculations submitted/approved giving the following minimum information. It is preferable to furnish the drawing schedule in computerised form by the VENDOR.

a) Serial No
b) VENDOR's drawing No
c) EPCC's reference No
d) Title of the drawing
e) Latest revision of the drawing
f) Earliest/Latest scheduled date of first submission by VENDOR.
g) Actual date of first submission by VENDOR & their letter reference.
h) Date of receipt of comments/approval from EPCC/CEPCC & their letter reference.
i) Latest approval status of the drawing (Refer clause 7.2 below)
j) Scheduled date of submission of latest issue and their letter issue.
k) Actual date of submission of latest issue and their letter reference.

For giving approval status of the drawing, the following abbreviations (codes) shall be used.

CODE

A Drawing returned approved as submitted proceed with fabrication / construction.
B Drawing approved subject to comments noted; proceed with fabrication / construction considering our comments.
C Our comments are noted on the enclosed marked-up print.
D See attached memo
E Correct the original of this drawing to reflect our comments and resubmit for approval
F Correct the original of this drawing to reflect our comments and resubmit for records.
G Drawing of this category are for information only and not for approval. Information furnished on the drawing is noted.
H Drawing reviewed only against our previous comments.
I Drawing returned without review.

26.0 CALCULATIONS/TECHNICAL DATA TO BE FURNISHED BY THE VENDOR AFTER AWARD OF CONTRACT FOR REVIEW/APPROVAL OF PURCHASER/CONSULTING ENGINEERS

26.1 VENDOR shall furnish the exact power requirements of each pump, rotary feeder, blower, motorised gates & valves, compressor, etc., within 4 weeks from the date of letter of intent to enable procurement of switchgears.

26.2 Within four (4) weeks from the date of intent, the VENDOR shall start furnishing progressively to the EPCC, all general arrangement and detailed drawing, showing all design particulars such as loading (dead load, live load, dynamic load, wind load, seismic load separately), levels, elevations, base plates details, anchorage details such as anchor bolts, pipe sleeves, anchor channels, etc, details of pockets and all inserts to be embedded.

26.3 Design calculations for the following shall be submitted for review/approval of EPCC/CEPCC.

a) Sizing of compressed air piping and sizing of air compressor flow rate and discharge pressure.

b) Sizing of piping and pumps for ash slurry disposal system.

c) Sizing of ducting and fan for pressurized ventilation system of the AHEH room.

d) Friction drop calculations for fly ash piping and slurry disposal piping.

e) Water balance for ash water recovery system.

f) Sizing of piping for drain tipes.

26.4 VENDOR shall furnish the exact water requirements for various services.

26.5 Technical data sheet of all equipment including characteristic curves, if any.

26.6 Flow diagram of the system giving complete scope of equipment, piping (with line sizes), instrumentation, valves and major parameters of the

equipment for bed ash handling system, fly ash handling system, ash slurry disposal system.

26.7 General arrangement - Plan of the following subsystems:

(a) Bed ash handling system

(b) Fly ash handling system

(c) Ash slurry disposal system

(d) Fly ash silo unloading system

(e) Fluidising system for flyash hoppers and silos

(f) Pressurized ventilation system for AHEH room

26.8 General arrangement - Plan and Sections of the following:

(a) Ash Slurry Sump

(b) AHEH

(c) Bed Ash Hopper

(d) Fly ash silos

(e) Pipe racks

(f) Under ground trenches, drains & drain sump

(g) Control room & switchgear room layout

26.9 Following piping arrangement drawings:

(a) Fly ash piping layout near fly ash hoppers to slurry sump/flyash silo.

(d) Compressed air piping and Instrument air piping

(c) Bed ash slurry piping

(d) Ash slurry disposal piping from slurry pump house to disposal area.

26.10 Detailed dimensional GA drawings showing supporting details, cross sectional details, loading details, foundation /insert details along with parts list major parameters and test certifications for material of construction; detail drawings for various components; operation and maintenance instruction manuals for the following equipments / items :

(a) All pumps
(b) Transmitter vessel
(c) Slurry line valves
(d) Fly ash valves
(e) Pipe fittings
(f) Dust conditioner
(g) Rotary feeder
(h) Jet pumps
(i) Blowers
(j) Air Compressors
(k) Mechanical Exhausters
(l) Flyash storage silo
(m) Bed ash hopper
(n) Bed ash silos

26.11 Hydrostatic test certificates for :

a) Ash slurry line valves;
c) Fly ash piping, fittings
d) Ash slurry piping, fittings
e) Water piping, fittings
f) Pump casings
g) Air receivers

26.12 Characteristic curves for :

a) Jet pumps
b) All horizontal centrifugal pumps.
c) Sump pumps.
d) Vertical turbine pumps if any
e) Motors
f) Fluid couplings, if required.

26.13 Certificates for tests carried out at works for :

a) Piping
b) All electric motors
c) Pumps - running performance tests
d) Compressors & blowers
e) EOT cranes overload test, deflection test.
f) Radiography tests of welds, pump castings.

26.14 Detailed drawings showing the layout of electrical equipment, components mounted on panels, the corresponding schematics, detailed wiring diagrams and interconnections, wiring diagrams. Motor data including curves, starting time with driven equipment coupled at 100% and80% rated voltage, withstand time at 100% and 110% voltage and withstand characteristics.

26.15 Data / Design calculations :-

a) Characteristic curves of the following pumps

i) Ash water pumps
ii) Ash slurry pumps
iii) Sumps pumps

b) Calculations for the T.D.H at various disposal distances and B.H.P of slurry pumps.

c) Detailed write-up for ash handling system and equipment performance testing.

d) Test certificates giving chemical composition for all the equipment supplied.

e) Design calculation for sizing of pipes of various water and compressed air services.

f) Design calculations to arrive at the discharge pressure of various water pumps.

26.16 All the drawings as listed in the data sheet-C of various specification in Section-D.

26.17 Calculations for :

- Lighting design

- Cable sizing
- Earthing

26.18 Cable layout drawings for entire scope covered in this specification. These drawings should give details of cable trays, conduits, embedded parts, etc. cable schedules and interconection schedules.

26.19 Earthing and lightning protection drawings.

26.20 Lighting layout drawings.

26.21 6.6 kV and 415V one line diagrams including all protection, metering, etc.

26.22 General arrangement drawings of local starters/control cabinets, etc.

26.23 Control schematic diagrams for Ash handling plant

26.24 Control wiring diagrams for various drives/equipment complete with the internal details of the switchgear modules.

26.25 Relay setting charts, calculations and the coordinated characteristics/curves.

26.26 Cable schedules for power, control cables.

26.27 Interconnection cable schedule (ICS) for control cables.

26.28 Write-up giving the permissive conditions for starting the ash handling equipments, annunciation conditions, etc. Also, details of PLC operation for fly ash removal system.

26.29 Block interlock diagram for safety and sequential interlocks of complete ash handling system.

26.30 General arrangement drawing of mimic-cum control panel to scale.

26.31 Duly filled manufacturer’s data sheets along with catalogues.

26.32 Control panel, junction box, marshalling cabinet, terminal block details.

26.33 I/O list to PLC system listing out all the inputs and outputs to the PLC.

26.34 Configuration diagrams.

26.35 Termination details of all input/output signals and power supplies on control panel, marshalling cabinet, junction boxes, etc.

26.36 Cable list for all the cables. The format of cable list will be given during detailed engineering.

26.37 Interconnection schedule, GA drawing for control panels.

26.38 Panel internal wiring diagram.

26.39 Instrument / JB schedules.

26.40 VENDOR shall furnish design calculations for all building works, one silo and pipe rack, pipe supports etc., (to be identified by the PURCHASER/ CONSULTANT after award of contract) as per requirement of Section C8. However, the PURCHASER reserves the right to ask for any other design calculations in addition to the typical one identified by them.

26.41 As built drawings for the ash handling plant.

26.42 Quality Assurance Procedures

The Contractor shall submit Quality Assurance procedures (QAP) for the complete ash handling equipments for CONSULTANT/PURCHASER's review and approval.

26.43 **Production schedule and Progress Reports**

Schedule submitted to the purchaser.

26.43.1 The VENDOR shall furnish detailed production schedule for all major components of the ash handling system supplied by him. The schedule shall include dates for completing.

1. Engineering work
2. Different phases of material procurement, manufacture and fabrication.
3. Delivery, erection and trial testing.

26.43.2 Similarly the VENDOR shall furnish PERT chart indicating dates for start and completion of engineering, construction of civil works construction of slurry pump house, ash water pump house, sumps, switchgear and control room, bottom ash hopper etc., supply of equipment, erection trial testing and commissioning. PERT chart shall be revised every quarter to show the actual progress with respect to the planned.

A report on actual progress (in percentage) and dates of completion of each of above items shall be sent to the PURCHASER every month, starting second month from the date of letter of intent, or date of Purchase Order whichever is earlier.

26.43.3 All design drawings and calculations shall be submitted and got approved with in five (5) months from the date of letter of intent, to meet commissioning schedule specified.

15.0 PROCEDURE FOR PERFORMANCE TESTING

15.1 REFERENCE DOCUMENTS

15.1.1 CEPCC's specification for the **Ash & Bed Material Handling System** with final approved documents and guarantee requirements specified in each equipment data sheets and write ups.

15.1.2 EPCC's Instruction to Tenderers and Purchase Order.

15.1.3 Proformas for P.G. test of equipment given in this document.

15.2 GENERAL INSTRUCTIONS

15.2.1 After the **Ash & Bed Material Handling System** & Accessories is erected, successfully commissioned and completed in all respects, the system shall be tested.

15.2.2 The parameters to be guaranteed for different equipment/system are furnished in Section-C10 of this specification.

15.2.3 In the event of non-fulfilment of any of the guarantee requirements, the vendor shall at his own cost replace/rectify the concerned equipment/system to improve the performance to the level of the guaranteed performance.

15.2.4 The CONTRACTOR may check the **Ash & Bed Material Handling System** during the normal operation of the system before P.G. test for mock trial purpose.

15.2.5 Endurance test as specified shall be conducted by the CONTRACTOR for the specified period before or during the performance testing. The endurance test shall be conducted at rated load when ash is available and when ash is not available for part of the period, the endurance test shall be continued on no load.

15.3 RESPONSIBILITIES/ FACILITIES BY EPCC

15.3.1 Power supply with voltage and frequency as stipulated in the contract.

15.3.2 Supply of water at required pressure and quantity as stipulated in the contract.

15.4 RESPONSIBILITIES/FACILITIES BY THE CONTRACTOR

15.4.1 All necessary instruments including walkie-talkies for carrying out performance testing of **Ash & Bed Material Handling System** & Accessories equipment at site shall be supplied by the CONTRACTOR on loan basis. All measuring instruments shall be recently calibrated with calibration certificates.

14.4.2 Sufficient stock of consumable spares required for P.G. test.

15.4.3 Instruments shall be calibrated independently before commencement of P.G. test.

15.4.4 Adequate number of personnel for starting the system and for taking readings.

15.5 RESPONSIBILITIES/FACILITIES JOINTLY BY EPCC/CONTRACTOR

15.5.1 All protection relays/fuses for protection of the electrical equipment should be properly set and malfunction, if any, should be set right one week before the date fixed for conducting P.G. test.

15.5.2 One month prior to the date fixed for conducting P.G. test, the Contractor shall check the operation of all the equipment and whenever replacement of worn out parts are required, the same shall be advised to the EPCC and the EPCC will attend all the equipment jointly with Contractor.

15.5.3 Controls/Sequential interlocks shall be tested on no load prior to commencement of load tests.

15.6 PROCEDURE TO BE FOLLOWED :

For conducting P.G. tests the following procedure shall be followed :

15.6.1 The EPCC and the CONTRACTOR shall ensure and verify that all the pre-requisites for starting the performance guarantee tests are taken care of as per details given in this document.

15.6.2 The 12 hours/6 hours run on load shall be provided within a maximum of 4 days in case there are no trips due to equipment fault. However, if the trip of any equipment in the selected path is due to **Ash & Bed Material Handling System** fault the complete 12/6 hour load test shall be repeated. All efforts are to be put by the EPCC and the CONTRACTOR to complete P.G. tests within 15 days, provided there are no

equipment faults, except for unforseen reasons in which case the above period shall be extended to 30 days.

15.6.3 Final test results shall be recorded in proforma as applicable and jointly signed by representatives of EPCC and CONTRACTOR. The final results shall be supported by the detailed observation sheets recording the detail of interruptions, adjustments made, time of starting and finishing of test, vibrometer, voltmeter, Ammeter, Power factor meter readings etc. where applicable.

15.6.4 The readings shall be taken after a minimum period of 1 hour or after the stable conditions are reached whichever is earlier.

15.6.5 If auxiliary equipment connected to the equipment fails during the test period, the system shall be considered as tripped and the test shall be conducted only after restarting the auxiliary equipment.

15.6.6 Abnormal noise and vibration, if observed during the test, the equipment will be allowed to run only on advice from EPCC.

15.6.7 Sequential interlocks and protection will be checked on no load run.

15.6.8 The readings shall be taken after a minimum period of 1 hour or after the stable conditions are reached whichever is earlier.

15.6.9 If auxiliary equipment connected to the equipment fails during the test period, the system shall be considered as tripped and the test shall be conducted only after restarting the auxiliary equipment.

15.6.10 Abnormal noise and vibration, if observed during the test, the equipment will be allowed to run only on advice from EPCC.

14.6.11 Earthing resistance shall be measured after isolating Vendors earthing grid from EPCC's earthing grid.

15.6.12 Vendor shall comply with Consultants (EIL) Performance Guarantee Proforma attached along with this specification.

PROFORMA NO. 1

Ash & Bed Material Handling System

Capacity rating for the following

Fly ash from hoppers to unloading silo
- Normal condition
- Emergency condition

Fly ash unloading into closed trucks
Fly ash slurry to slurry sumps

Bed ash from hoppers to unloading silo
- Normal condition
- Emergency condition

Bed ash unloading into closed trucks
Bed ash slurry to slurry sumps

Fresh Bed material from silo to boiler bunkers

Transfer from Bed ash system to Fly ash silo

Transfer from Fly ash system to bed ash silo

Ash disposal from Slurry sump to Ash Pond

Capacity of individual equipment in System

:

Signature :

for EPCC forCONTRACTOR

PROFORMA NO.2

CAPACITY, FLOW & POWER PARAMETERS TO BE RECORDED DURING PERFORMANCE TEST

1.0 Date and time of starting test :

2.0 Date and time of completion of test :

3.0 Equipment :

4.0 Location :

5.0 kW rating of motor :

6.0 Path and stream being tested :

7.0 Measurements :

	Volts	Amps	kW		Volts	Amps	kW

Note : The above readings shall be recorded for no load and full load reading shall be taken at an interval of five minutes.

Average recorded (computed from above observation)

Signature :

for EPCC for CONTRACTOR

PROFORMA NO.3
VIBRATION & NOISE MEASUREMENT

1.0 Designation :

2.0 Date & time of measurement :

3.0 Measurement :

Note :

1) The vibration shall be measured at two locations

2) Vibrations shall be measured when the equipment is operating.

Signature :

for EPCC for CONTRACTOR

PROFORMA NO.4

PLANT STOPPAGE RECORD

			Remarks
1.0	Date and time of starting test	:	
2.0	Date & time of trip	:	
3.0	Designation of equipment responsible for Plant(*) stoppage	:	
4.0	Reason for equipment trip/stop prior to completion of test	:	
5.0	Date & time of restarting the plant	:	
6.0	Plant stoppage shall be considered as equipment/system fault	:	YES/NO
7.0	Breakdown time for this plant stoppage (item 6.0 - item 3.0)	:	Hrs.
8.0	Date and time of stopping the Plant		
9.0	Time period of operation of the Plant (Item 9.0 - item 1.0)	:	
10.0	Cumulative time period of operation during the test considering earlier time period operated	:	

Signature :

for EPCC for CONTRACTOR

"Plant " here denotes Ash & Bed Material Handling Systems and items of equipment supplied by the CONTRACTOR

PROFORMA NO.5

CONTROL & SEQUENTIAL INTERLOCKS

1.0 Date and time of starting test :

2.0 Date and time of completion of test :

3.0 Path and stream being tested :

4.0 Observations :

Control/sequential itnerlocks are checked on no load and found — Working satisfactorily / Not working satisfactorily_____

If found not working satisfactorily list the defects observed : _____

_____

_____

_____

_____

5.0 Workmanship of control-cum-mimic panel is satisfactory : YES/NO

Signature :

for EPCC

for CONTRACTOR

SCHEDULE OF GENERAL PARTICULARS

1.0	Name of BIDDER	:	
2.0	Address of BIDDER	:	
3.0	Telegraphic/ telex address of BIDDER/ Manufacturer	:	
4.0	Name and designation of the officer of the BIDDER to whom all the reference shall be made for expeditious technical co-ordination	:	
5.0	Place of manufacture	:	
6.0	Service facilities available	:	
7.0	Availability of spare parts	:	
8.0	BIDDER's proposal number and date	:	
9.0	Proposal validity period (not less than 120 days)	:	
10.0	Earnest money as desired submitted	:	Yes / No
11.0	Terms of payment as laid down in general conditions of contract acceptable?	:	Yes / No
12..0	Penalty for delay in delivery acceptable as per General Conditions of Contract	:	Yes / No
13.0	Are all technical particulars called for in Data Sheet-B and as called for in Schedule of Prices and Delivery filled-up	:	Yes / No
14.0	Are all deviations pointed out in Schedule of Deviations>	:	Yes / No
15.0	Is BIDDER agreeable to supply the equipment as per specification in case the deviations stipulated by him are not acceptable to the Board	:	Yes / No
16.0	Manufacturing facilities	:	

17.0	Whether the BIDDER has got any associates for manufacture/ consultants/civil works	:	Yes / No
17.1	If yes, furnish the following:		
17.1.1	Experience of the associates with details of experience in the specified field	:	
17.1.2	Letter from the associates conforming the following:		
	i. They are willing to associate with BIDDER for Ash & Bed Material Handling System & Accessories Plant at Bharat Oman Refineries Ltd'd CPP	:	
	ii. All the major designs & drawing shall be prepared by whom	:	
	iii. They are agreeable to guarantee along with BIDDER the performance of equipment/ design/ civil works	:	
	iv. They are agreeable to furnish the performance bond equivalent to	:	
	v. Whether evidence regarding associates experience is enclosed	:	
17.2	If the BIDDER is not having any associates then furnish the following:		
17.2.1	No. of design engineers	:	
17.2.2	Experience of Design engineers with brief bio-data who will be involved in the design of this project	:	
17.2.3	No. of Draftspersons	:	
18.0	Total fixed assets	:	
19.0	Annual turnover for the last 3 years	:	

20.0	Balance sheet for the last 3 years enclosed	:	Yes / No
21.0	The facilities available for manufacturing the equipment being offered	:	
22.0	Experience list of the BIDDER in the Schedule-F as per the format enclosed?	:	Yes / No
23.0	Validity of tender from the date of opening of the Tender	:	
24.0	Delivery/completion period as per specification	:	Yes / No
25.0	Warrantee period from the date of commissioning	:	_____ months
26.0	Is BIDDER agreeable to furnish the following as per General Conditions of Contract (GCC):		
26.1	Security Deposit	:	Yes / No
26.2	Performance Guarantee	:	Yes / No

Note : All the above details are required to be furnished by the BIDDER, failing which the tender will be considered incomplete

SIGNATURE ----------

NAME ----------

SEAL OF THE COMPANY DESIGNATION ----------

COMPANY ADDRESS ----------

DATE ----------

SCHEDULE OF PRICES

1.0 All supply prices shall be Ex-works excluding all taxes and duties. Lump sum price for packing, forwarding, loading, freight upto Bharat Oman Refineries Ltd (BORL) site including transit insurance charges shall be indicated separately. All erection prices shall include, unloading at site, transportation to storage site, storage and erection insurance including third party risk, storage and handling at site, labour, tools, tackles, supervision, etc. all taxes and duties including Excise Duty on bought out items like electricals etc. (and not on bought – outs which will be used as inputs for equipment i.e., for input items like steel, tubes, bearings, seals, etc. gear boxes, etc. the taxes and duties on these input items shall be included in the cost of finished / main equipment and this will not be reimbursed by the EPCC) shall be indicated separately.

EPCC reserves the right to add or delete any of the unit price items mentioned below and when added together everything, the complete Bidder shall furnish separately the lump sum prices of essential spare parts listed in system Data Sheet-A2 of Section – C13..

1.0	Complete Ash & Bed Material Handling System inclusive of all till smooth functioning of the equipment.	
1.1	Lump sum price for design engineering	
1.2	Lump sum price for manufacture and supply, ex-works excluding all taxes and duties (for Civil, Mechanical & Electrical& Control Works)	
1.3	Lump sum price for packing, forwarding, loading into carriers, freight charges upto site including transit insurance	
1.4	Lump sum price for unloading at site, handling at site, storage at site, intrasite transportation and storage insurance charges	
1.5	Lump sum price for erection, testing and commissioning including erection insurance	
1.6	Sum of items 1.1 to 1.5 above	
1.7	Lump sum binding amount of	

a) Sales tax
b) Other local taxes, if any

1.8 Lump sum binding amount of excise Duty (ED) on BIDDER'S manufactured items

1.9 Lump sum binding amount of excise Duty on all finished bought out items

Note : Sales tax and other taxes as shown in item 1.10 and Excise Duty as shown in item 1.11 and 1.12 shall be reimbursed by EPCC at actuals against documentary evidence upto the ceiling amounts indicated against above items 1.10,1.11 & 1.12. in case there is any statutory increase in the taxes and duties the same shall be reimbursed by the EPCC. The rates of taxes and duties (including taxes and duties for site fabrication, erection, etc. if applicable) prevailing at the time of submission of Bids shall be indicated in the Bid for different items.

2.0 Price split up

2.1
a) Fly ash silo
b) Bed ash silo
c) Slurry sump
d) Bed Material Hopper
e) Unloading system in dry form
f) Unloading system in slurry form
g) Piping interconnection between fly ash to bed silo and vice versa
h) Unit rates of denseveyors
i) Unit rates of divertor valves

(Price to cover supply, erection & commissioning)

3.0 <u>BREAK-UP PRICES, EX-WORKS FOR MAJOR EQUIPMENTS</u>

3.1a Complete Fly Ash Handling System & Accessories for proper and smooth functioning
3.1b Complete Bed Ash Handling System & Accessories for proper and smooth functioning
3.1c Complete Bed Material Handling System & Accessories for proper and smooth functioning.
3.1d Complete AHEH room excluding equipment
3.2 Complete Air compressor & blower system
3.3 Painting for equipments and electrical items as specified.

3.6 One (1) no. CRT, control cabinet & marshalling cabinet

3.7 Electrical items as per interface details

3.8 All other items and works required to make the Ash & Bed Material Handling System & Accessories in all respects as per specification (indicate the details)

4.0 SCHEDULE OF UNIT RATES

4.1 GENERAL NOTES

4.1.1 The CONTRACTOR shall quote unit item rates for the items furnished herein. These unit rates shall be applicable for any extra/rebates only.

4.1.2 Description of items given in this section shall be read along with tender notification, general conditions of contract, general conditions relating to works, sections A,B,C,D,E&F, detailed specifications and all other component parts of the tender document.

4.1.3 The quoted rates shall include cost and conveyance of all materials, labour charges, equipment and drainage, lighting and providing and maintaining communication facilities, all leads, and lifts including roads, cross drainage works, etc. No extra payment for these items shall be made on any account.

4.1.4 All items shall be executed to the approved designs and pattern and shall comply with the specifications and general conditions relating to and all terms and conditions enclosed with the tender and orders conveyed by competent authority from time to time during the course of execution.

SCHEDULE OF REVISION OF PRICES

Against each and every deviation from the specification conditions as enumerated in the technical deviation sheet the amount of which the tender price will thereby be increased or decreased be intimated clause by clause in this schedule. In case the amount is not mentioned in this schedule against any of the deviation mentioned in deviation sheet, it will be taken for granted that the same does not involve any change in the tender price.

Clause No.	Deviation if any	Amount by which the tender will change	
		Increase Rs.	Decrease Rs.

COMPANY SEAL

SIGNATURE _____

NAME _____

DESIGNATION _____

COMPANY _____

DATE _____

SCHEDULE OF DELIVERY AND ERECTION

1.0 The BIDDER shall furnish a bar chart indicating all phases of drawings submission, design, completion of civil and structural works, delivery of the equipment, erection, testing and commissioning of Ash & Bed Material Handling System & Accessories equipment covered under this contract.

Months

2.0 Guaranteed delivery, erection, testing and commissioning completion period from the date of letter of intent for Ash & Bed Material Handling System & Accessories. :

3.0 Drawing submission schedule / submission of drawings for approval in weeks from the date of issue of letter of intent. :

4.0 Production Schedule

The schedule should indicate the dates of completion of the following activities for all major components of Ash & Bed Material Handling System & Accessories equipment supplied under this specification taking the date of letter of intent, as datum. :

4.1 Design / engineering Work

4.2 Different phases of materials procurement, manufacture and fabrication of components, equipment and associated accessories :

4.3 Delivery :

COMPANY SEAL

SIGNATURE _____

NAME _____

DESIGNATION _____

COMPANY _____

DATE _____

SCHEDULE OF DRAWINGS ENCLOSED WITH THE BID

Sl, No.	Drawing No.	Title

SIGNATURE _____

NAME _____

DESIGNATION _____

COMPANY SEAL

COMPANY _____

DATE _____

SCHEDULE OF REQUIREMENTS OF STRUCTURAL STEEL

The BIDDER shall indicate herein the requirements of steel for the ash handling system. However, the structural steel required for this project has to be arranged and supplied by the CONTRACTOR. Requirements furnished here are for PURCHASER's information only and no claim based on this data will be entertained at a later date. Any variation in section and/or quantity and any sections not indicated but required to complete the system shall be in BIDDER's scope:

			Requirement (in tonnes) At Works	At Site
1.0	Structural steel section wise	:		
1.1		:		
1.2		:		
1.3		:		
1.4		:		
1.5		:		
2.0	Plates	:		
3.0	Chequred plates	:		
4.0	Round bars	:		
5.0	Stainless steel plates	:		
6.0	Any other (fully specify)	:		
	TOTAL			

SIGNATURE _____

NAME _____

SEAL OF THE COMPANY DESIGNATION _____

DATE _____

SCHEDULE OF REQUIREMENT OF CEMENT AND REINFORCEMENT STEEL

The BIDDER shall indicate herein the requirements of ordinary portland cement Reinforcement Steel for the civil work of ash Handling System. It may benoted that requirements furnished here are for PURCHASER's information only and no claims based on this data will be entertained at a later date.

SL.NO.	DESCRIPTION	REQUIREMENT IN TONNES
1.	Ordinary Portland Cement	
2.	Reinforcement steel	
2 (a)	High yield strength deformed bars	
	Diameter 36 mm	
	32 mm	
	28 mm	
	25 mm	
	22 mm	
	20 mm	
	16 mm	
	12 mm	
	10 mm	
	8 mm	

Sl. No.	Description	Requirements in tonnes
2 (b)	Plain Mild Steel Round Bars	
	Diameter 36 mm	
	32 mm	
	28 mm	
	25 mm	
	22 mm	
	20 mm	
	16 mm	
	12 mm	
	10 mm	
	8 mm	
	6 mm	

SIGNATURE _____

DESIGNATION _____

SEAL OF THE COMPANY COMPANY

DATE _____

SCHEDULE OF MAKES OF EQUIPMENT

The makes of all bought-out items shall be as indicated in system data sheet-4 in section-C of this specification. In case BIDDER wants to offer any other equivalent or superior makes for consideration for some of the equipment the same can be listed below. However, these makes are subject to written approval by EPCC/CEPCC.

SL. NO.	EQUIPMENT	MAKE

SIGNATURE _____

DESIGNATION _____

NAME _____

DATE _____

SCHEDULE OF DRIVE MOTORS AND OTHER ELECTRICAL EQUIPMENT

BIDDER shall furnish the information called for in this schedule which shall company the Bid :

Sl.No.	Equipment	Qty.	Voltage	RPM	KW

SIGNATURE _____

DESIGNATION _____

COMPANY _____

DATE _____

SCHEDULE OF DEVIATIONS FROM TECHNICAL SPECIFICATIONS

All deviations from the Technical specification shall be filled in by the BIDDER clause by clause in this schedule.

SECTION	SPECIFICATION NO.	CLAUSE NO.	DEVIATION

The BIDDER hereby certifies that the above mentioned are the only deviations from the Client's technical specifications for this enquiry. The BIDDER further confirms that in the event of any other data and information presented in the Bidder's proposal and accompanying documents including drawings, catalogues, etc., are at variance with the specific requirements laid out in the Client's technical specifications, then the latter shall govern and will be binding on the BIDDER for the quoted price.

SIGNATURE _____

DESIGNATION _____

COMPANY _____

DATE _____

SCHEDULE OF DEVIATIONS FROM GENERAL CONDITIONS

All deviations from the General Conditions shall be filled in by the BIDDER clause by clause in this schedule.

SECTION	SPECIFICATION NO.	CLAUSE NO.	DEVIATION

The BIDDER hereby certifies that the above mentioned are the only deviations from the Client's General Conditions of Contract. The BIDDER further confirms that in the event of any other information presented in the bidder's proposal and accompanying documents are at variance with the specific requirements laid out in the Client's General Conditions of Contract, then the latter shall govern and will be binding on the BIDDER for the quoted price.

SIGNATURE ----------

DESIGNATION ----------

COMPANY ----------

DATE ----------

SCHEDULE OF PRICES FOR RECOMMENDED SPARES PARTS

BIDDER shall indicate below the break-up of recommended spare parts duly indicating the delivery period for the Ash & Bed Material Handling System & Accessories covered in this specification apart from essential spares already covered in Schedule F16. (System Data Sheet-A2 of Section-C13)

Sl. No.	Equipment	Particulars of items & part No.	Quantity Recommended Per Unit	Quantity Recommended Total	Unit Price Rs.	Total Price Rs.	Delivery Period	Remarks

SIGNATURE _____

NAME _____

SEAL OF THE COMPANY DESIGNATION _____

DATE _____

SCHEDULE OF MAINTENANCE TOOLS AND TAKCLES

The BIDDER shall give below the additional maintenance tools and tackles recommended by him apart from that covered in System Data Sheet-A4 of Section-C13 for Ash & Bed Material Handling System covered in this specification.

Sl. No.	Particulars	Quantity	Unit Price Rs.	Total Price Rs.	Remarks

SIGNATURE _____

NAME _____

SEAL OF THE COMPANY DESIGNATION _____

DATE _____

SCHEDULE OF BIDDER' S EXPERIENCE

The BIDDER shall furnish herein list of similar jobs executed by him and details of the same.

Sl. No.	Plant Name & Address	Date of Scheduled Commissioning	Details of Ash & Bed Material Handling System & Accessories	Date of actual commissioning	Contract value (Rupees crores)

SIGNATURE _____

DESIGNATION _____

COMPANY _____

DATE _____

SCHEDULE OF DECLARATION

DECLARATION

I, _____ certify that all the data and information furnished pertaining to this specification are correct and are true representation of the equipment covered by our formal proposal No. _____ dated _____

I hereby certify that I am duly authorised representative of the supplier whose name appears above my signature.

Supplier' s name :

Authorised representative' s name :

Authorised representative' s designation :

Manufacturer' s intent : The manufacturer hereby agrees to fully comply with the requirements and intents of the specification for the price indicated.

Authorised representative' s signature : _____

SIGNATURE ----------

DESIGNATION ----------

SEAL OF THE COMPANY COMPANY ----------

SCHEDULE OF ESSENTIAL SPARES

The BIDDER shall give below the list of Essential Spares (covered in system Data Sheet – A2 of Section - C13), prices and other data required for the equipment covered in this specification.

Item No.	Manufacturer & Part No.	Description	Qty.	If set, Nos. per set	Unit Price	Total Price	Remarks

SIGNATURE _____

DESIGNATION _____

SEAL OF THE COMPANY

COMPANY _____

DATE _____

DOCUMENT DISTRIBUTION SHCEDULE & VENDOR DOCUMENTATION PROCEDURE

Sl. No.	Document Name / Type	To Contain	Required With Offer	Required After P.O	
			Compliances from Vendor & No. of Sets Reqd.	No. of Sets Required – Engg. & Approval/ Review Activities.	No. of Sets Required- For Site & Customer Submission
1	(a) Drgs, , Data Sheets , Catalogues. BOM etc. (b) PIDs , SLDs, Block-Schematics etc. (wherever applicable)	Adequate Information & essential for proper Technical Evaluation of the Offers. Other Information to be furnished as defined in the applicable Tech Specs.	2+2* (Addl. Copies Required - wherever Offer Docs. are subject to Review by Customer . See Spec. Requirement)	–	–
2	Terminal Point (s)	List of Scope Terminal Point (s) & Process Datra etc. - wherever applicable.	2+2* (See also Sl-1 above)	–	–
3	Deviations if any	To be clearly listed, furnishing reasons for non-compliance	2+2* (See also Sl-1 above)	–	–
4	Master Document List (**MDL**)- (***Blank format Attached with this specification)***	**a)** List of all Documents & Drgs., Spares Items etc. which are applicable for the Project . They shall be group wise enlisted in MDL Doc. **b)** Submission of Up-dated MDL Doc.is required at the time of each submission of Drgs./Doc or group of Drgs. / Docs..	-	3+3*	16
5	Project completion activity “Bar-chart” matching with BHEL Project Schedule	Required for packages & for contracts and also for projects where Erection &	Compliance required to meet BHEL Delivery	3+3*	16

Sl. No.	Document Name / Type	To Contain	Required With Offer	Required After P.O	
			Compliances from Vendor & No. of Sets Reqd.	No. of Sets Required – Engg. & Approval/ Review Activities.	No. of Sets Required- For Site & Customer Submission
		Commissioning activities are in vendor scope.	Sch.		
6	(a) Drgs, , Data Sheets , Catalogues. BOM etc. (b) PIDs , SLDs, Block-Schematics etc. (wherever applicable)	While carrying out Detailed Engg. during Post-Ordering Stage.	-	10+4*	16
7	Information Reg. "INITIAL - FILL" Items & Consumable Items – List - As Required (for each applicable systems)	**a**) Confirmation from Vendor Required. The Items shall be considered as Part of main scope of supply. **b**) A Separate Doc. to be furnished with Detail List & Quantity. (Applicable Items & Qty subject to Review during detail Engg.)	**a**) Supply Confirmation Required from Vendor **b**) Doc. to be Enlisted in MDL.	10+4*	16
8	SPARES for Erection / Commissioning	**a**) Informative List required with Technical & Commercial bids. **a.1**) To consider as Part of main scope of Supply. **b**)Such Spares List is subject to Review during Detail Engg.	Vendor to Confirm Supply in their Offer.	6+4*	16
9	"Operation and Maintenance Spares" / "Mandatory Spares" List	**a**)Recommended List by Vendor **b**) List with Other Data – if Specified in Tech. Spec.	**1**) To Enclose with Offer. **2**)To indicate price for the listed items in commercial offer	6+4*	16

Sl. No.	Document Name / Type	To Contain	Required With Offer	Required After P.O	
			Compliances from Vendor & No. of Sets Reqd.	No. of Sets Required – Engg. & Approval/ Review Activities.	No. of Sets Required- For Site & Customer Submission
			& with extended validity		
10	Vendor's "Bill of Material" Doc. (**BOM**) ***-Blank format attached with this specification)*** This Doc. shall be Enlisted in MDL Doc.	1) The Engg. Part of Information in this Doc. shall be approved by BHEL 2) Submission of this Document is essential during initial Submission stage of Engg. Docs. & the same be progressively Updated as the Detail Engg. progresses. 3) All Dispatchable Units shall be identified in this Doc with "Dispatch Tag-No." (5 Chr. BHEL Des. No. with 3 Chr. Running Item Sl No. - e.g. "Jxxxx / 001" , max. upto 999) . 4)The Despatch Tag no. shall be written on an 'Al- Strip' and tied to the dispatchable Unit or be prominently painted on each Item with washable paint. **PL. NOTE** – This Standard Unified System shall be followed being an essential part of Field Qualitry Assuannce Practices & for proper Identification of Items	-	6+4*	16

Sl. No.	Document Name / Type	To Contain	Required With Offer	Required After P.O	
			Compliances from Vendor & No. of Sets Reqd.	No. of Sets Required – Engg. & Approval/ Review Activities.	No. of Sets Required- For Site & Customer Submission
		at Site.			
11	Quality Assurance Plan (QAP) & Factory Testing Procedure Documents	1) Approval from BHEL required. 2) Submission along with the Engg. Docs.	**A**) Submission -if already standardized with BHEL / Draft proposal & it may be finalized after Review. **B**) Submission compliance from Vendor required	6+4*	4
12	FQAP (Field Quality Assurance Plan) & Site Erection, Testing & Commissioning Procedure documents	1) Approval from BHEL required 2) Submission along with the Engg. Docs.	same as for Sl-11 above	6+4*	4
13	Erection Documents & Drawings:-	1) To contain final MDL, BOM, Handling & Storage Instructions Doc., Initial-Fill & Consumables Items list, Erection & Commissioning Spares List , Operation & Maintenance spares list / Mandatory Spares List etc. 2) Submission minimum 6 –	-		16

Sl. No.	Document Name / Type	To Contain	Required With Offer	Required After P.O	
			Compliances from Vendor & No. of Sets Reqd.	No. of Sets Required – Engg. & Approval/ Review Activities.	No. of Sets Required- For Site & Customer Submission
		weeks before eqpt. schedule dispatch. 3) The drgs. shall be kept in plastic pouches and neatly arranged, submitted in an aesthetic, appropriate & durable folder(s). Documents filed appropriately in Folder in – seriatim of MDL.			

Sl. No.	Document Name / Type	To Contain	Required With Offer	Required After P.O	
			Compliances from Vendor & No. of Sets Reqd.	No. of Sets Required – Engg. & Approval/ Review Activities.	No. of Sets Required- For Site & Customer Submission
14	O&M Manual Document Folder(s)	1) Submission 1-month before schedule eqpt. dispatch (Draft copy shall be submitted beforehand for review by BHEL) 2) The manual shall be submitted in an aesthetic, appropriate & durable folder(s). Each vol. shall be marked with its Vol. No. 3)**<u>This Manual shall include</u> primarily following information: -** **i)** Operational & safety instructions. **ii)** Environmental Safety instructions & indicating compliances of the Regulations in-force. **iii**) Guidelines incorporating requirements for Operation of the Equipment in Hazardous Environment- wherever applicable. **iv)** Master document List (MDL) doc. **v)** Bill of material (BOM) doc. **vi)** Erection Instructions.	-	Adv. Copy 2 sets- for review by BHEL	Final Copies –16 sets

Sl. No.	Document Name / Type	To Contain	Required With Offer	Required After P.O	
			Compliances from Vendor & No. of Sets Reqd.	**No. of Sets Required – Engg. & Approval/ Review Activities.**	**No. of Sets Required- For Site & Customer Submission**
		vii) Operational & s for all Systems / Items with nd sketches etc., Catalogue nd applicable Model no. ul schedules etc. viii) Lubrication Schedule **viii**) Initial-Fill Items List **ix**) Approved QAP's Shop Tests & Calibration Reports. **x**) Approved FQAP - along with related docs. , with site testing & commissioning Protocols etc.			
15	"As –Built" Drawings & Documents	Submission within three weeks -after commissioning at site	-	1*	16
16	Compact Disc (CD)	1) MDL, All drawings, Documents, Data sheets – as Listed in Approved MDL Doc. , all applicable Catalogues (Scanned), BOM & all items covered in the O&M Manuals & the "As-built" Drgs. 2) To submit along with the submission of "As-built" drgs. & docs.	-	1*	3

1.0.0. Notes :

1.1.1. BHEL will furnish their approvals / comments within 15 days after submission of drawings/ documents.

1.1.2. The O&M manuals shall contain the following details as minimum in addition to those indicated in the above table:-

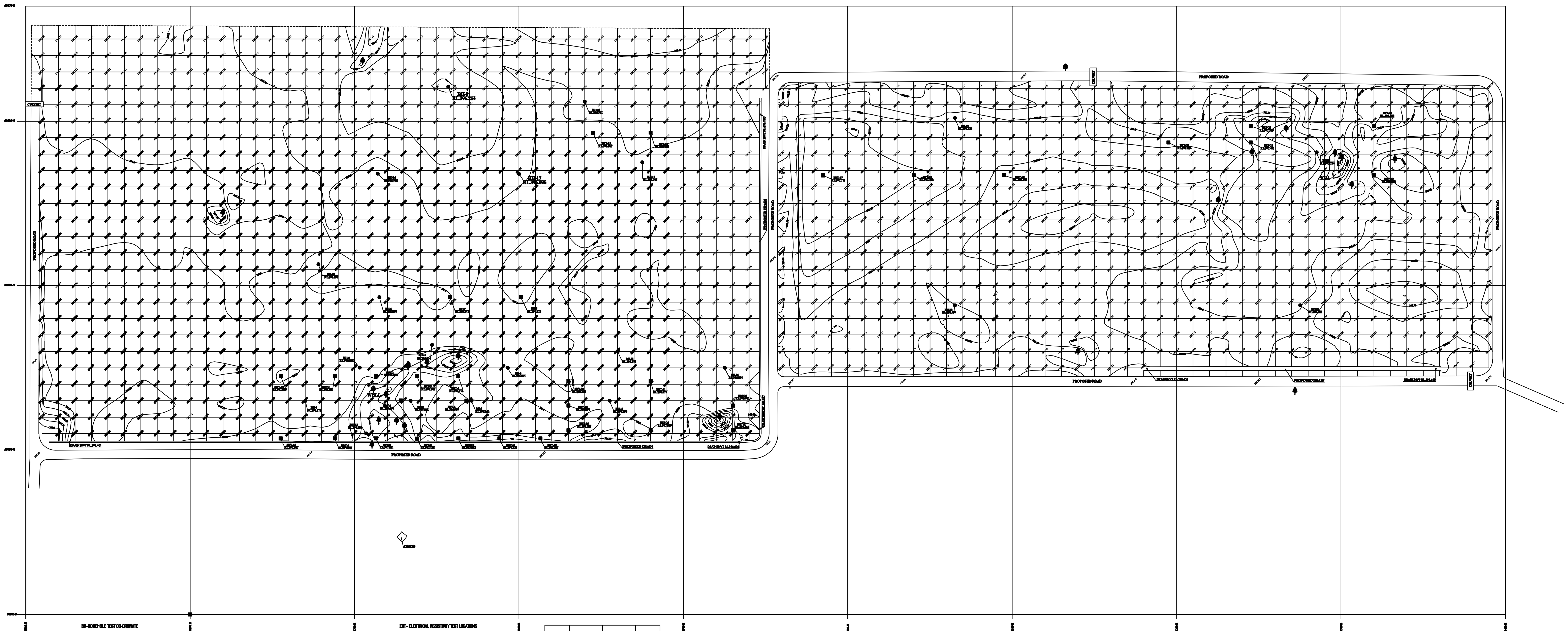
- Identification details of the equipment like BHEL PO NO., Vendor's Sl. No., Vendors contact address with tel., fax details.
- Description of the equipment.
- Final Data sheets and Drawings of the equipment as per the list mentioned in this specification.
- O&M Manuals of the equipment.
- Recommended 2 years operational spares.
- Test reports.

1.1.3. The erection documentation shall consist of

- All drawings/documents,
- O&M instructions of pump, motor, instruments, ARC valve, etc.
- All such drawings/documents, not submitted for review, but essential for erection/commissioning, e.g. cooling plan, flushing plan, assembly drawings, etc.
- Master document list
- Site dispatchable B.O.M.
- Any special safety/erection/commissioning requirements, vendor would like to specify.

1.1.4. For drawings, data, sheets and all graphic works Auto Cad release 2006 or later versions and for all texts, MS Word 2000 shall only be used.

1.1.5. No. of sets indicated with "*" are to be forwarded to "CEPCC".



BH-BOREHOLE TEST CO-ORDINATE

S.NO	EASTING	NORTHING	RL
BH1	[illegible]	[illegible]	396.772
BH2	46734.00	[illegible]	[illegible]
BH3	46771.00	[illegible]	[illegible]
BH4	[illegible]	[illegible]	[illegible]
BH5	[illegible]	[illegible]	[illegible]
BH6	[illegible]	[illegible]	[illegible]
BH7	[illegible]	[illegible]	[illegible]
BH8	[illegible]	[illegible]	[illegible]
BH9	[illegible]	56621.00	396.214
BH10	[illegible]	[illegible]	[illegible]
BH11	46747.00	[illegible]	[illegible]
BH12	[illegible]	[illegible]	[illegible]
BH13	[illegible]	[illegible]	[illegible]
BH14	[illegible]	[illegible]	[illegible]
BH15	[illegible]	[illegible]	[illegible]

S.NO	EASTING	NORTHING	RL
BH16	46714.00	[illegible]	[illegible]
BH17	[illegible]	[illegible]	[illegible]
BH18	[illegible]	56612.00	396.741
BH19	[illegible]	[illegible]	[illegible]
BH20	[illegible]	[illegible]	[illegible]
BH21	[illegible]	[illegible]	397.321
BH22	[illegible]	56601.00	397.764
BH23	[illegible]	56602.00	396.130

ERT- ELECTRICAL RESISTIVITY TEST LOCATIONS

S.NO	EASTING	NORTHING	RL
ERT 1	[illegible]	[illegible]	[illegible]
ERT 2	46713.00	[illegible]	[illegible]
ERT 3	[illegible]	[illegible]	[illegible]
ERT 4	[illegible]	[illegible]	397.116
ERT 5	[illegible]	[illegible]	397.160
ERT 6	[illegible]	[illegible]	[illegible]
ERT 7	[illegible]	[illegible]	[illegible]
ERT 8	46713.00	[illegible]	397.011
ERT 9	[illegible]	[illegible]	397.104
ERT 10	[illegible]	[illegible]	397.412
ERT 11	[illegible]	[illegible]	397.420
ERT 12	46813.00	[illegible]	[illegible]
ERT 13	[illegible]	[illegible]	397.046
ERT 14	[illegible]	[illegible]	[illegible]
ERT 15	[illegible]	[illegible]	396.017

S.NO	EASTING	NORTHING	RL
ERT 16	[illegible]	[illegible]	396.760
ERT 17	[illegible]	[illegible]	397.711
ERT 18	[illegible]	[illegible]	397.760
ERT 19	[illegible]	[illegible]	396.346
ERT 20	49108.00	[illegible]	[illegible]
ERT 21	[illegible]	[illegible]	397.471
ERT 22	[illegible]	[illegible]	[illegible]
ERT 23	[illegible]	[illegible]	[illegible]
ERT 24	[illegible]	[illegible]	[illegible]
ERT 25	[illegible]	56712.00	[illegible]
ERT 26	[illegible]	56712.00	[illegible]
ERT 27	[illegible]	56712.00	[illegible]
ERT 28	[illegible]	56727.00	[illegible]
ERT 29	[illegible]	56727.00	[illegible]
ERT 30	[illegible]	56742.00	[illegible]
ERT 31	[illegible]	56742.00	396.077

Magnetic North :

PLANT NORTH

Note :

01. All Dimensions are in Metres unless otherwise specified.
02. Do not Scale the Drawing, if in Doubt please ask.

Legend :

TREE	
BH	
ERT	
ROAD	
DRAIN	

Area Detail:

AREA=203369.3760 Sqm.
=50.253 ACRES

S. No.	Date	Particulars
05		
04		
03		
02		
01		

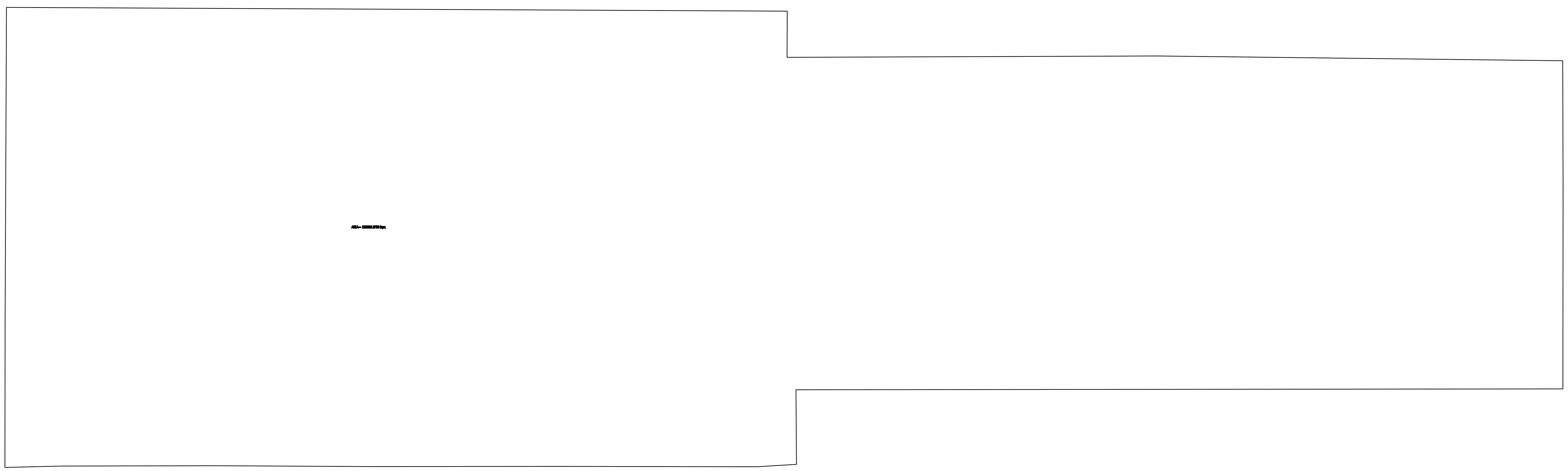
Revisions

Project : Topographical Survey Plan
AT 3X33 MW. STG, BORL,
BINA (M.P)

Client : BHARAT HEAVY ELECTRICALS LTD.
Power Sector, Western Region
345 Kingsway Nagpur-440001

Surveyed by : Cengrs Geotechnica Pvt. Ltd.
Civil & Geotechnical Engineers B-3/87, Safdarjung Enclave, New Delhi-29
Tel. 011 [illegible] Fax :011 [illegible]
email : [illegible]

Scale: 1 : 500	Srvd: MAHAVIR	Drn.: SURUCHI	Chkd.: R.Jain
Date: DEC 2006	Drg. No.	Rev. No.	

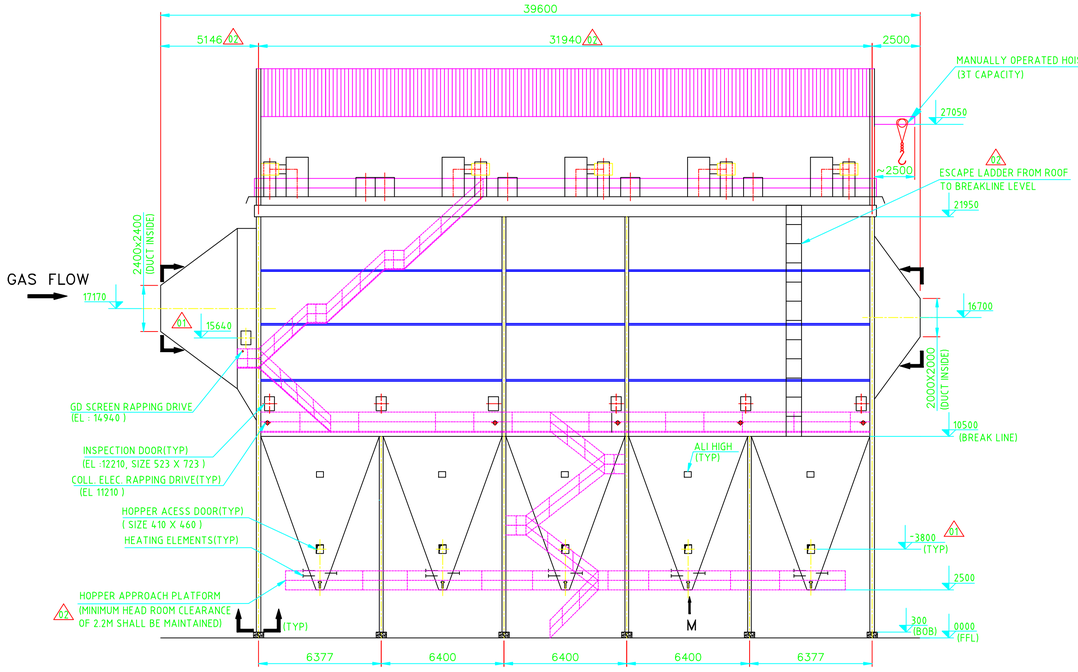


FIRST ANGLE PROJECTION

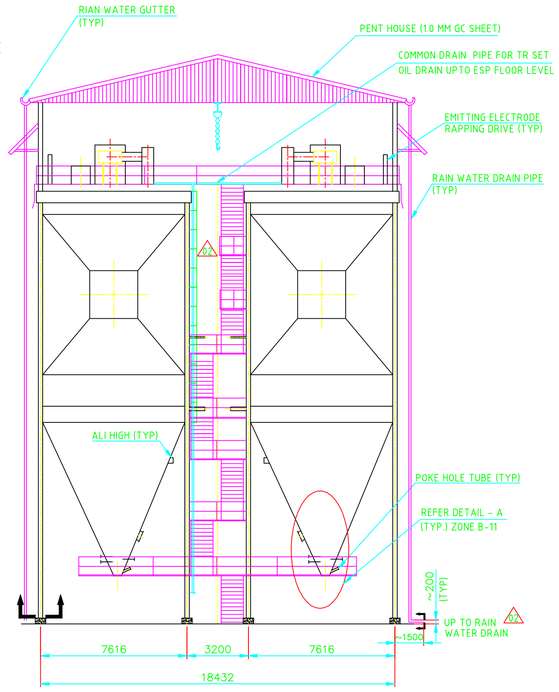
(ALL DIMENSIONS ARE IN mm)

DRG. NO. 1-00-111-28092/02

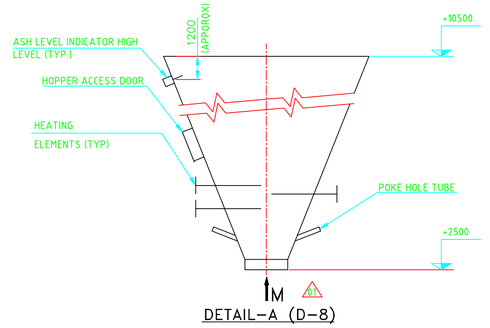
SHT. OF



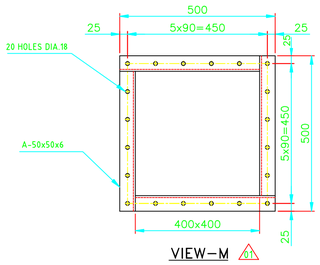
ELEVATION



VIEW–P

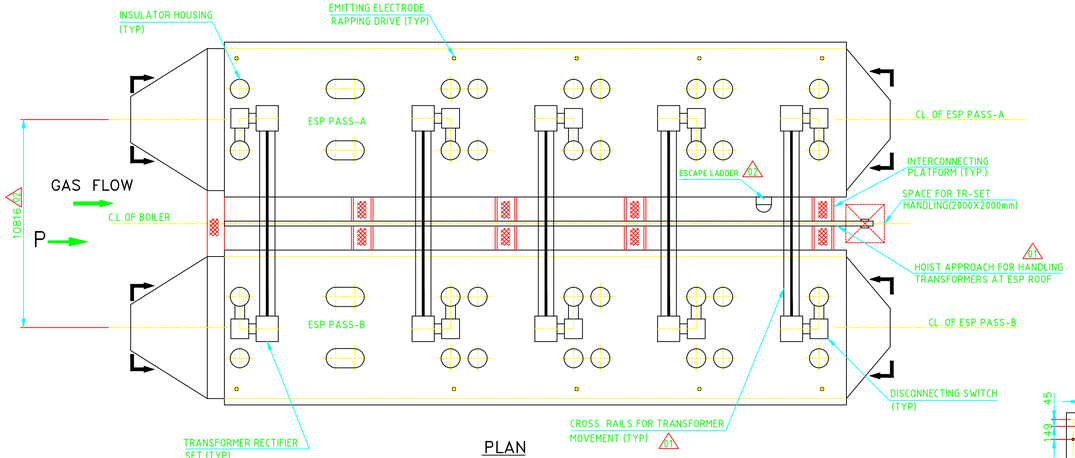


DETAIL–A (D–8)

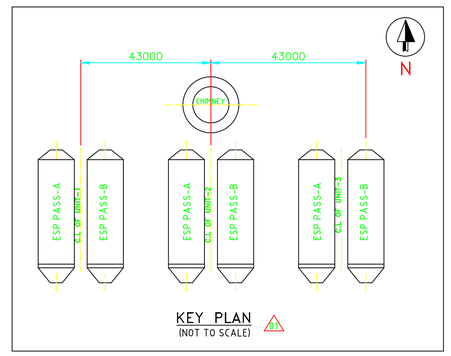


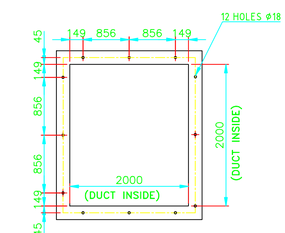
VIEW–M

HOPPER FLANGE DETAILS

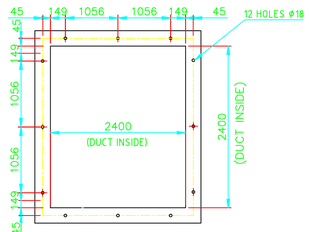


PLAN





OUTLET FUNNEL FLANGE DETAILS



INLET FUNNEL FLANGE DETAILS

NOTE:

1. INDICATES BHEL/RANIPET SCOPE OF SUPPLY.
2. ESP SIZE:FAA-5X45M-72110-2; (400 mm PITCH), NO. OF ESP/BOILER = 2.
3. FOR ESP FOUNDATION PLAN AND LOADING DATA REFER DRAWING NO. 1-00-112-28100.
4. +0.000 MM CORRESPONDS TO FINISHED FLOOR LEVEL (FFL) OF ESP AREA AND + 300 MM CORRESPONDS TO BOTTOM OF BASE PLATE (BOB) OF ESP COLUMNS.
5. EACH HOPPER IS BE PROVIDED WITH ONE NUMBER ASH LEVEL INDICATOR FOR HIGH LEVEL.
6. HOPPER APPROACH PLATFORM PROVIDED FOR MAINTENANCE/ ACCESS TO INSPECTION DOOR, POKE HOLE etc.,
7. RAIN WATER GUTTERS WILL BE PROVIDED WITH RAIN WATER DRAIN PIPE.
8. WEATHER PROOF PENT HOUSE WITH 1.0 MM GC SHEET FOR ROOF.
9. MANNUAL HOIST OF 3 TON CAPACITY IS PROVIDED TO HANDLE TR SETS.
10. THE PERFORMANCE TEST POCKET ADAPTERS WILL BE SUPPLIED IN ESP SCOPE UNDER PGMA 75-661 WHICH ARE TO BE SUITABLY LOCATED IN THE STRAIGHT PORTIONS OF ESP INLET AND OUTLET DUCTS. THE REQUIRED APPROACH PLATFORM FOR THESE TESTPOCKETS WILL BE PROVIDED IN THE DUCTING SYSTEM BY BHEL / TRICHY.
11. BHEL,TRICHY & BHEL HYDERABAD TO TAKE CARE OF THE ELEVATION & LEVELS OF ESP AREA APPROPRIATELY.

BHEL RANIPET WO.NO : R409,410&411

CUSTOMER: BHARAT OMAN REFINERIES LIMITED

CONSULTANT : ENGINEERS INDIA LTD
1, BHIKAIJI CAMA PLACE, NEWDELHI – 110 006
EIL JOB NO.: 6743

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: BINA REFINERY PROJECT CAPTIVE POWER PLANT

BHARAT HEAVY ELECTRICALS LTD.
UNIT: BOILER AUXILIARIES PLANT,
RANIPET – 632 406.

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	J.VELARASAN		24.11.06	
CHD.	G.GUNASEKAR		24.11.06	
APPD.	P.SELVARAJ		24.11.06	

REV.	DATE	ALTERED	ZONE
02	27.01.07	ALTERED J.V.R CHD/APPD G.G	REVISED BASED ON CUSTOMER COMMMENTS. VIDE LETTER DATE 04.01.07
01	14.12.06	ALTERED J.V.A CHD/APPD G.G	REVISED BASED ON CUSTOMER COMMMENTS.

DEPT. PED | CODE 450 | UNTOL DIMS. GR. g/M/ff | SCALE N.T.S | WEIGHT (KG) ---- | REF. TO ASSY. DRG. | ITEM NO. - | NO.OF ITEMS -

TITLE: GENERAL ARRANGEMENT OF ELECTROSTATIC PRECIPITATOR

CARD CODE U 01 | DRAWING NO. 1-00-111-28092 | REV. 02 | SHT. No | NO. OF SHT.

THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY

GENERAL DIMENSIONAL LIMITS,FITS & TOLERANCES AS PER HY0230261

COMPUTER FILE NAME | REF. DRG. NO. | SIGN. AND DATE | INVENTORY NO

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. 3-00-118-35050/00

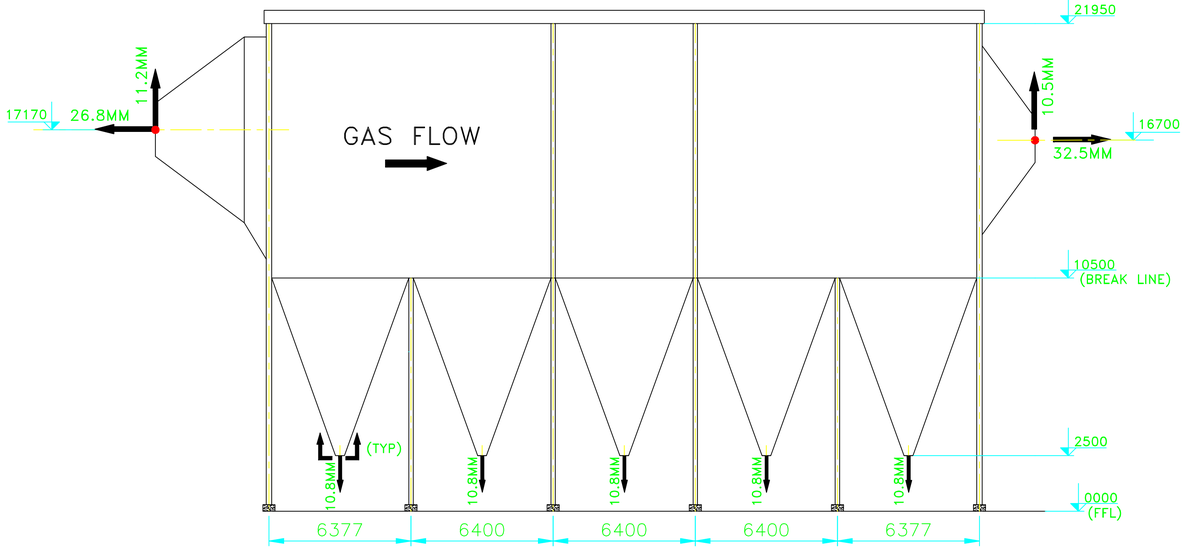
SHT. 01 OF 01

COMPUTER FILE NAME

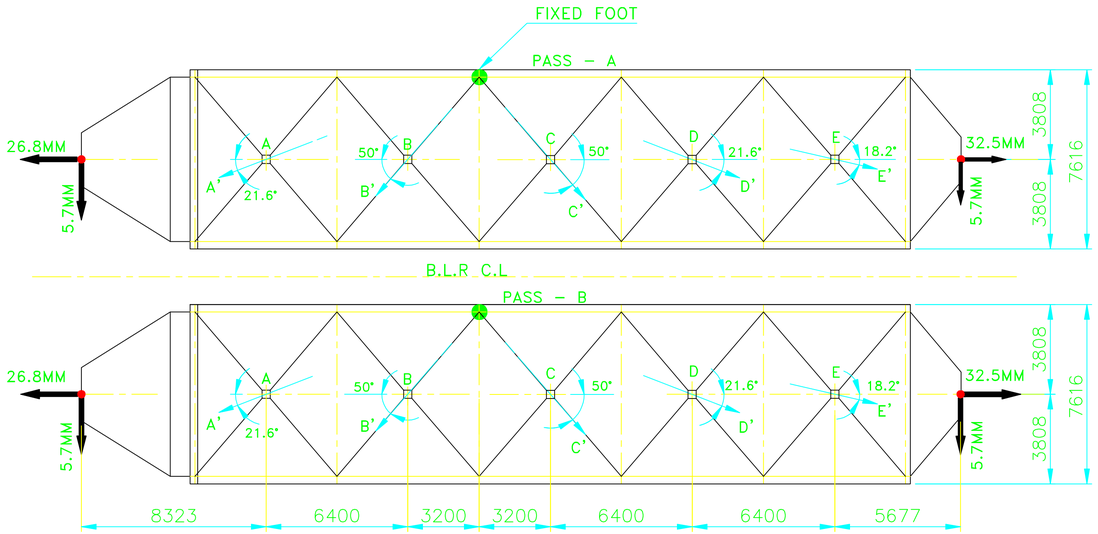
REF. DRG. NO.

SIGN. AND DATE

INVENTORY NO



ELEVATION



PLAN

NOTE:

01. A B C D & E – ARE INITIAL POSITION OF CENTRE OF HOPPER BOTTOM FLANES.

02. THE MAXIMUM THERMAL EXPANSION OF CENTRES OF HOPPER BOTTOM FLANGES IN THE DIRECTION OF
    A' A –D' D --- 15.5MM.
    B' B –C' C ---7.5MM.
    E' E ---24.7MM.

03. DOWNWARD MOVEMENT OF HOPPER IS 10.8 MM

REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHD/APPD			CHD/APPD			CHD/APPD
ZONE			ZONE			ZONE		

CUSTOMER: BHARAT OMAN REFINERIES LIMITED

BHARAT OMAN REFINERIES LIMITED

CONSULTANT : ENGINEERS INDIA LTD

1, BHIKAIJI CAMA PLACE, NEWDELHI – 110 006

EIL JOB NO.: 6743

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: BINA REFINERY PROJECT CAPTIVE POWER PLANT

BHARAT HEAVY ELECTRICALS LTD. HYDERABAD

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	J.VIMALRAJ		23.01.07	
CHD.	G.GUNASEKAR		23.01.07	
APPD.	P.SELVARAJ		23.01.07	

DEPT. / CODE.	UNTOL. DIMS. GR. C/M/F	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
		NTS	---	---	---	

TITLE: THERMAL MOVEMENT DIAGRAM FOR ESP

CARD CODE

DRAWING NO. 3-00-118-35050 REV. 00

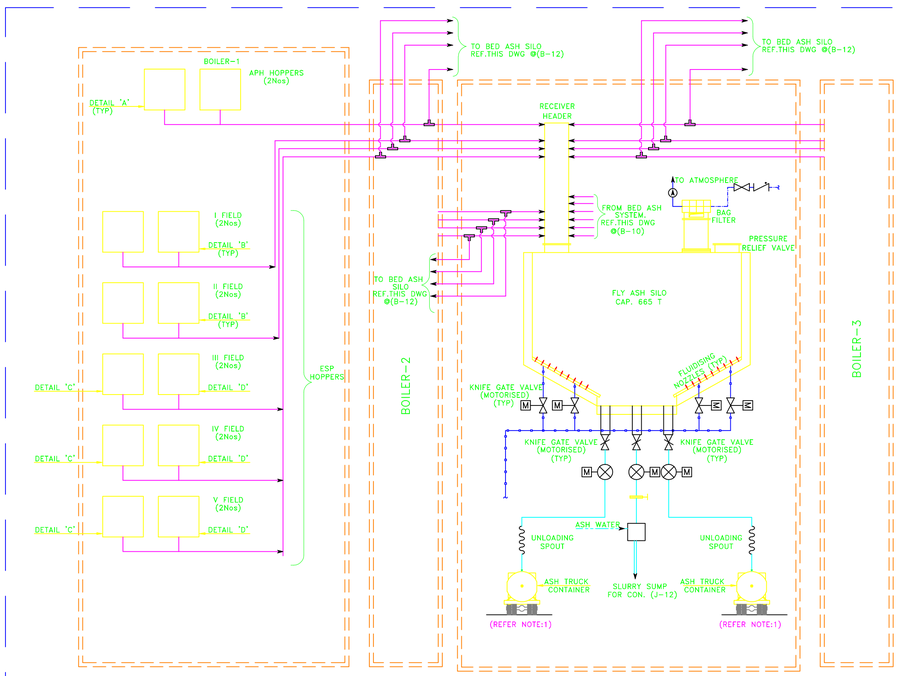
SHT. No 01 NO. OF SHT. 01

FIRST ANGLE PROJECTION

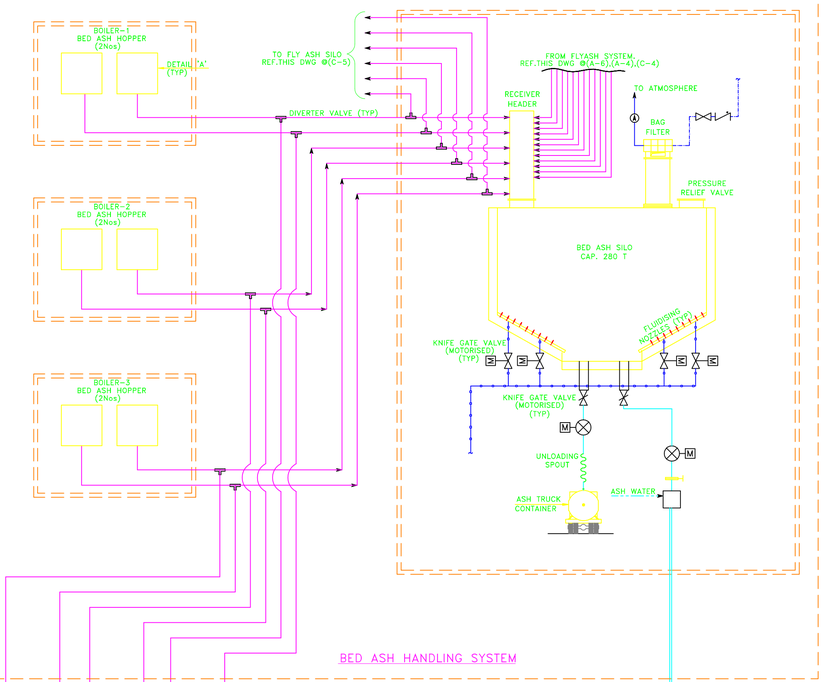
(ALL DIMENSIONS ARE IN mm)

DRG. NO. (BHEL DWG NO. 0-381-01-00814) SHT. 01 OF 01

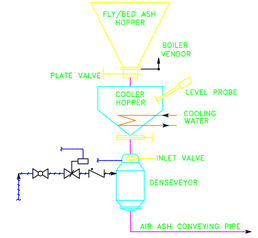
CUS. DWG NO. 00814-31-10-38



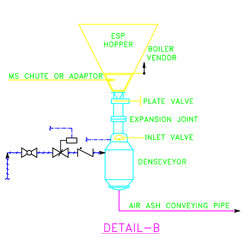
FLY ASH HANDLING SYSTEM



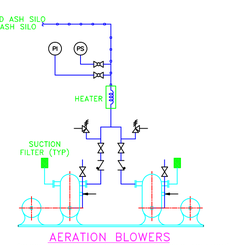
BED ASH HANDLING SYSTEM



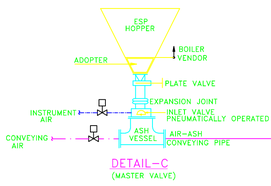
DETAIL-A



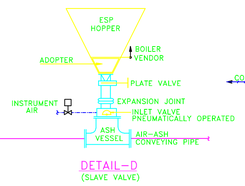
DETAIL-B



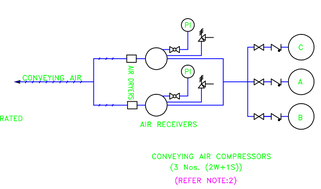
AERATION BLOWERS
(BLOWERS FOR BED ASH & FLY ASH SILO AREATION)
(2 Nos. (1W+1S))



DETAIL-C
(MASTER VALVE)

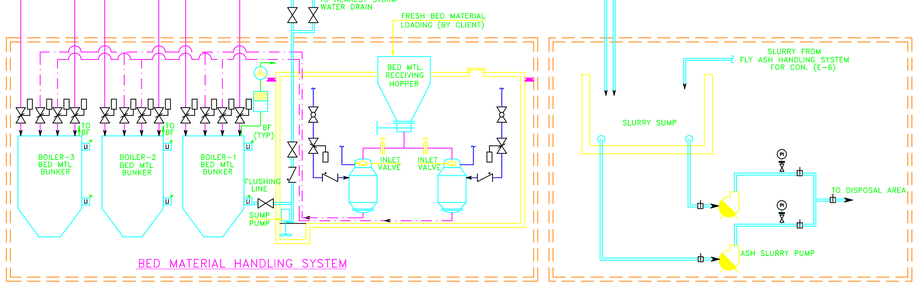


DETAIL-D
(SLAVE VALVE)



CONVEYING AIR COMPRESSORS
(3 Nos. (2W+1S))
(REFER NOTE:2)

DETAIL



BED MATERIAL HANDLING SYSTEM

LEGEND

- ASH-AIR LINE
- CONVEYING AIR
- INSTRUMENT AIR
- ASH SLURRY
- BED MATERIAL
- FLUIDISING AIR
- PNEUMATICALLY OPERATED VALVE
- GATE VALVE
- GLOBE VALVE
- NON RETURN VALVE
- MOTORISED VALVE
- SAFETY VALVE
- PRESSURE INDICATOR
- PRESSURE SWITCH
- ROTARY VALVE
- INLET VALVE
- DIVERTER VALVE (TYP)
- PLATE VALVE
- LEVEL INDICATOR

NOTES:

1: THE SYSTEM SHALL BE DESIGNED FOR OPERATION OF BOTH THE UNLOADING SPOUTS AT THE SAME TIME SUCH THAT 2 TRUCKS CAN BE LOADED SIMULTANEOUSLY FROM THE SILO.

2: DEPENDING ON THE LEAN PHASE/DENCE PHASE SYSTEMS THE BIDDER SHALL DECIDE CAPACITY AND NUMBER OF AIR COMPRESSOR OR AIR BLOWERS REQUIRED FOR THE SYSTEM BY CONSIDERING 100% STANDBY REQUIREMENTS.

3: * LEVEL INDICATOR FOR BOILER BED MATERIAL BUNKERS WITH HI & LOW LEVEL ALARM ARE IN BIDDER'S SCOPE.

REFERENCE DRAWINGS

1: GENERAL ARRANGEMENT OF BOILER OPLAN: 0-00-511-93211-REV01

2: GENERAL ARRANGEMENT OF BOILER ELEVATION: 0-00-511-93210-REV01

COMPUTER FILE NAME | REF. DRG. NO. | SIGN. AND DATE | INVENTORY NO

REV.	DATE	ALTERED	CHD/APPD

CUSTOMER: BHARAT OMAN REFINERIES LIMITED

CONSULTANT: ENGINEERS INDIA LTD
1, BHIKAIJI CAMA PLACE, NEWDELHI – 110 006
EIL JOB NO.: 6743

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: BINA REFINERY PROJECT
CAPTIVE POWER PLANT

BHARAT HEAVY ELECTRICALS LTD. HYDERABAD

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	THE		26.05.08	N.A.
CHD.	KRR		26.05.08	
APPD.	AVDR		26.05.08	

DEPT. PED	UNTOL. DIMS. OR '0'M/F	SCALE N.T.S	WEIGHT (KG) N.A.	REF. TO ASSY. DRG. N.A.	ITEM NO. N.A.	NO.OF ITEMS N.A.

TCE CONSULTING ENGINEERS LIMITED
JOB NO.5178A
DESIGN CONSULTANTS TO M/S. BHEL

	NAME	SIGN.	DATE
DRN.	SK		26.05.08
DESIG.	KS		26.05.08
CHD.	KG		26.05.08
APPD.	KG		26.05.08

TITLE: FLOW DIAGRAM – ASH HANDLING AND BED MATERIAL HANDLING SYSTEMS

CARD CODE | DRAWING NO. BHEL DWG NO. 0-381-01-00814 | CUS. DWG NO. 00814-31-10-38 | REV. 02

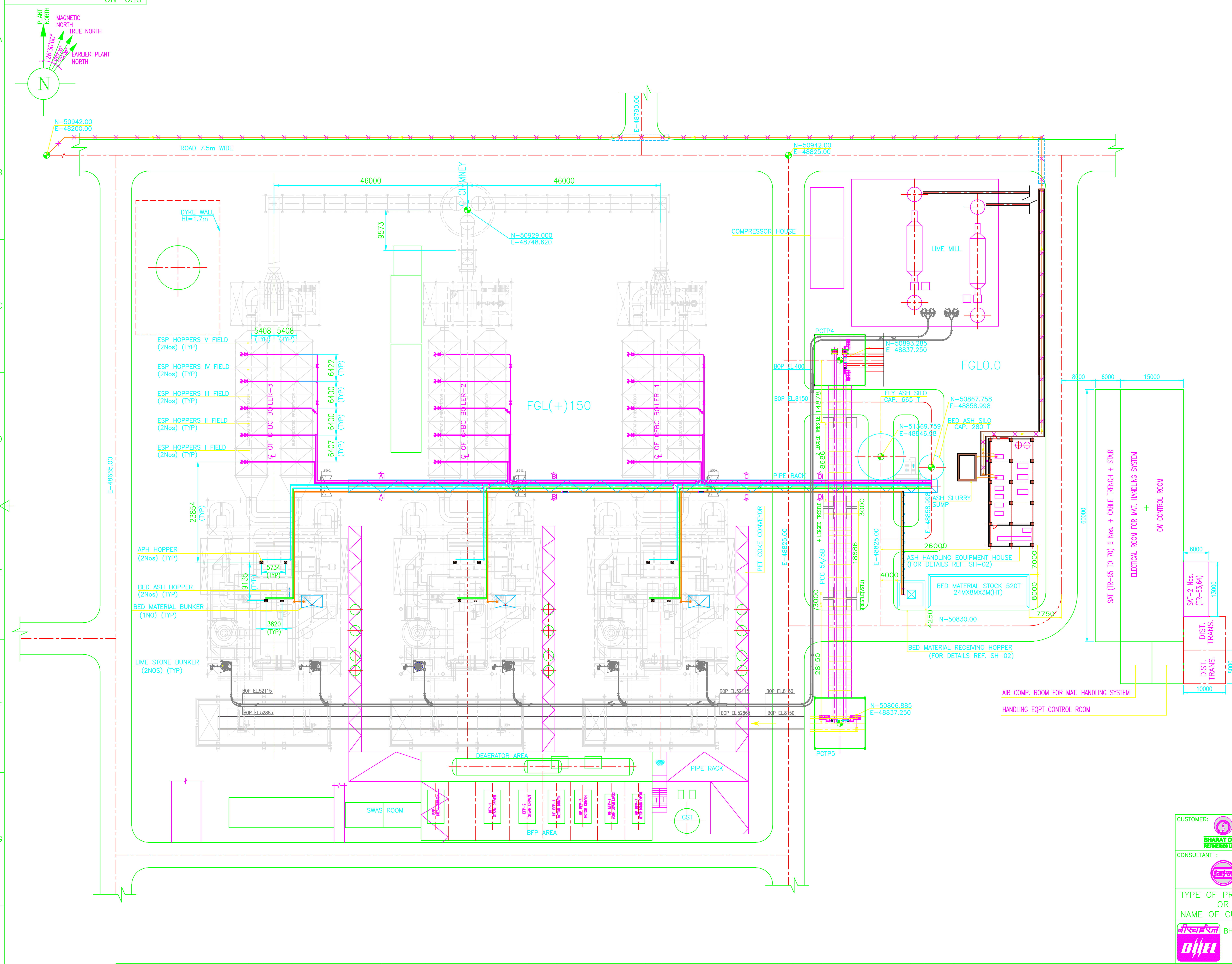
SHT. No. 01 | NO. OF SHT. 01

PAPER SIZE (A0)

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. BHEL DWG NO. 0-381-01-00815 SHT.01 OF 02



PLANT NORTH
MAGNETIC NORTH
TRUE NORTH
EARLIER PLANT NORTH
26°30'00"
N
N-50942.00 E-48200.00
ROAD 7.5m WIDE
E-48790.00
N-50942.00 E-48825.00
46000
46000
CHIMNEY
N-50929.000 E-48748.620
9573
DYKE WALL Ht=1.7m
COMPRESSOR HOUSE
LIME MILL
5408 (TYP) 5408 (TYP)
ESP HOPPERS V FIELD (2Nos) (TYP)
ESP HOPPERS IV FIELD (2Nos) (TYP)
ESP HOPPERS III FIELD (2Nos) (TYP)
ESP HOPPERS II FIELD (2Nos) (TYP)
ESP HOPPERS I FIELD (2Nos) (TYP)
6422 (TYP)
6400 (TYP)
6400 (TYP)
6407 (TYP)
℄ OF CFBC BOILER-3
℄ OF CFBC BOILER-2
℄ OF CFBC BOILER-1
FGL(+)150
FGL0.0
PCTP4
N-50893.285 E-48837.250
BOP EL.400
BOP EL.8150
FLY ASH SILO CAP. 665 T
N-50867.758 E-48858.998
BED ASH SILO CAP. 280 T
N-51369.759 E-48846.98
14878
2 LEGGED TRESTLE
18686
PIPE RACK
ASH SLURRY SUMP
E-48858.998
3000
4 LEGGED TRESTLE
E-48665.00
23854 (TYP)
APH HOPPER (2Nos) (TYP)
5734 (TYP)
9135 (TYP)
BED ASH HOPPER (2Nos) (TYP)
BED MATERIAL BUNKER (1NO) (TYP)
3820 (TYP)
LIME STONE BUNKER (2NOS) (TYP)
PET COKE CONVEYOR
E-48825.00
PCC 5A/5B
18686
TRESTLE(VGTU)
E-48825.00
26000
ASH HANDLING EQUIPMENT HOUSE (FOR DETAILS REF. SH-02)
4000
BED MATERIAL STOCK 520T 24MX8MX3M(HT)
7000
8000
7750
4250
N-50830.00
BED MATERIAL RECEIVING HOPPER (FOR DETAILS REF. SH-02)
28150
BOP EL.52115
BOP EL.52865
BOP EL.8150
BOP EL.8150
N-50806.885 E-48837.250
PCTP5
DEAERATOR AREA
PIPE RACK
SWAS ROOM
BFP DIESEL DRIVEN
BFP-1 STEAM DRIVEN
BFP-2 STEAM DRIVEN
HP BFP-1 MOTOR DRIVEN
HP BFP-2 MOTOR DRIVEN
MP BFP-1 MOTOR DRIVEN EXPORT
MP BFP-2 MOTOR DRIVEN EXPORT
BFP AREA
CST
8000 6000 15000
60000
SAT (TR-65 TO 70) 6 Nos. + CABLE TRENCH + STAIR
ELECTICAL ROOM FOR MAT. HANDLING SYSTEM + CW CONTROL ROOM
6000
SAT-2 Nos. (TR-63,64)
13000
DIST. TRANS.
DIST. TRANS.
8000
10000
AIR COMP. ROOM FOR MAT. HANDLING SYSTEM
HANDLING EQPT CONTROL ROOM

LEGEND

(symbol)	PIPE RACK
(symbol)	PIPE SUPPORT
PCTP	PET COKE TRANSFER POINT
PCC	PET COKE CONVEYOR
FGL	FINISHED GRADE LEVEL

NOTES:

1.IN THIS DRAWING 0.00 CORRESPONDS TO FGL 99.85M (MSL 397.10M)

REFERENCE DRAWING:

1: OVERALL PLOT PLAN : EIL DRG NO.67439916470001
2: GENERAL ARRANGEMENT OF BOILER PLAN: 0-00-511-93211-REV01
3: GENERAL ARRANGEMENT OF BOILER ELEVATION: 0-00-511-93210-REV01
4: CPP PLOT PLAN : 0-381-01-00779

REV.	DATE	ALTERED	CHD/APPD
ZONE			

CUSTOMER: BHARAT OMAN REFINERIES LIMITED

CONSULTANT : ENGINEERS INDIA LTD
1, BHIKAIJI CAMA PLACE, NEWDELHI – 110 006
EIL JOB NO.: 6743

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: BINA REFINERY PROJECT CAPTIVE POWER PLANT

BHARAT HEAVY ELECTRICALS LTD. HYDERABAD

	NAME	SIGN.	DATE
DRN.	TCE		26.05.08
CHD.	KRA		26.05.08
APPD.	AVDR		26.05.08

NO.OF VAR. N.A.

TCE CONSULTING ENGINEERS LIMITED
DESIGN CONSULTANTS TO M/S. B.H.E.L

	NAME	SIGN.	DATE
DRN.	SV		26.05.08
DESD.	KS		26.05.08
CHD.	KG		26.05.08
APPD.	KG		26.05.08

DEPT.	UNTOL. DIMS. GR.	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
PED, CODE 450	g/M/F	1:450	N.A.	N.A.	N.A.	N.A.

TITLE: GENERAL ARRANGEMENT: ASH HANDLING & BED MATERIAL HANDLING SYSTEM: PLAN & SECTIONS.

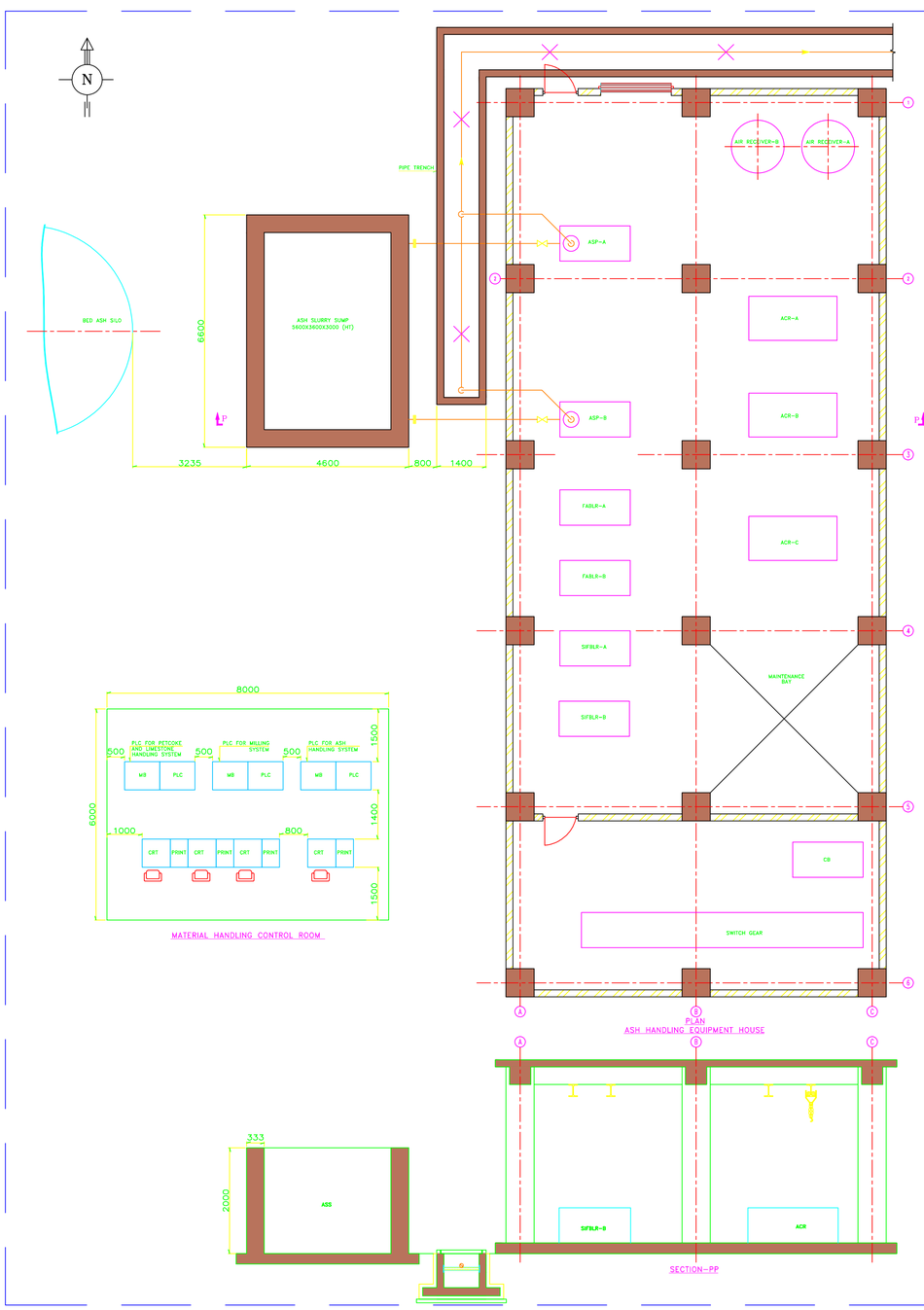
CARD CODE

DRAWING NO. BHEL DWG NO. 0-381-01-00815 REV. 2

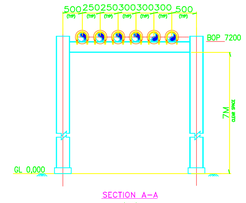
SHT. No 01 NO. OF SHT. 02

COMPUTER FILE NAME | REF. DRG. NO. | SIGN. AND DATE | INVENTORY NO

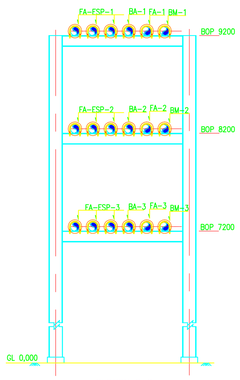
PAPER SIZE: A1



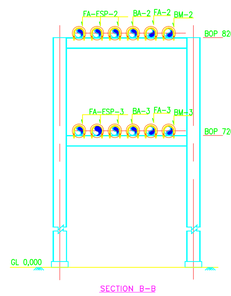
MATERIAL HANDLING CONTROL ROOM



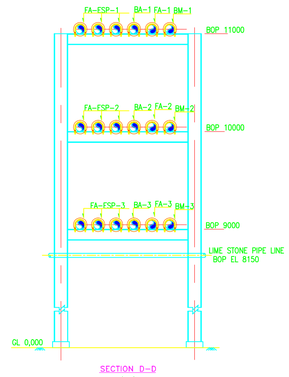
SECTION A-A
(NTS)



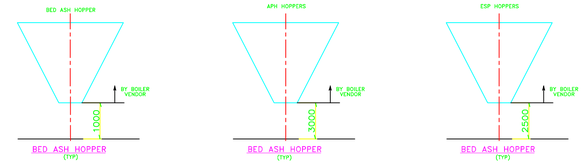
SECTION C-C
(NTS)



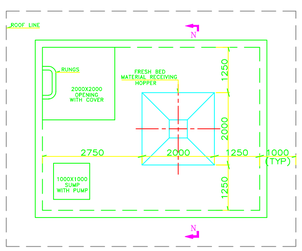
SECTION B-B
(NTS)



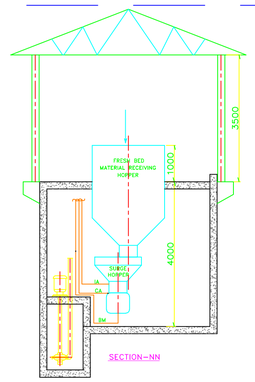
SECTION D-D
(NTS)



BED ASH HOPPER (TYP) | BED ASH HOPPER (TYP) | BED ASH HOPPER (TYP)



PLAN
BED MATERIAL HANDLING ARRANGEMENT



SECTION-NN

LEGEND

BA – BED ASH
FA – FLY ASH
BA1 – BED ASH FROM BOILER-1
BA2 – BED ASH FROM BOILER-2
BA3 – BED ASH FROM BOILER-3
FA1 – FLY ASH FROM BOILER-1
FA2 – FLY ASH FROM BOILER-2
FA3 – FLY ASH FROM BOILER-3
ESP – ELECTRO STATIC PRECIPITATOR HOPPER
APH – AIR PREHEATER HOPPER
BM – BED MATERIAL
IA – INSTRUMENT AIR
CA – CONVEYING AIR
ASS – ASH SLURRY SUMP

NOTE

REFER DWG. NO. 0-381-01-00815 SHEET NO. 1 OF 2

REV.	DATE	ALTERED	CHD/APPD
ZONE			

CUSTOMER: BHARAT OMAN REFINERIES LIMITED

CONSULTANT : ENGINEERS INDIA LTD
1, BHIKAIJI CAMA PLACE, NEWDELHI – 110 006
EIL JOB NO.: 6743

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: BINA REFINERY PROJECT CAPTIVE POWER PLANT

BHARAT HEAVY ELECTRICALS LTD. HYDERABAD

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	TCE		26.05.08	N.A.
CHD.	KRA		26.05.08	
APPD.	AVDR		26.05.08	

TCE CONSULTING ENGINEERS LIMITED
DESIGN CONSULTANTS TO M/S. B.H.E.L

	NAME	SIGN.	DATE
DRN.	SV		26.05.08
DESD.	KS		26.05.08
CHD.	KG		26.05.08
APPD.	KG		26.05.08

DEPT. PED | CODE 450 | UNTOL. DIMS. OR. +/-1/2 | SCALE 1:75 | WEIGHT (KG) N.A. | REF. TO ASSY. DRG. N.A. | ITEM NO. N.A. | NO.OF ITEMS N.A.

TITLE: GENERAL ARRANGEMENT: ASH HANDLING & BED MATERIAL HANDLING SYSTEM: PLAN & SECTIONS.

CARD CODE | DRAWING NO. BHEL DWG NO. 0-381-01-00815 | REV. 2

SHT. No 02 | NO. OF SHT. 02

SIZE-A2

FILE NAME: F042R3.DWG

TCE FORM NO. 042 R3

BHEL

INTERFACE WITH ASH HANDLING & BED MATERIAL (BM) HANDLING SYSTEM (AHS)

a) BHEL ASH HOPPERS (BOILER) -ASH HANDLING SYSTEM INTERFACE :

. ASH LEVEL HIGH INDICATION & ALARM ON AHS PANEL.

b) BHEL BED MATERIAL BUNKERS IN BOILER- BED MATERIAL SYSTEM INTERFACE :

. BM BUNKERS LEVEL (FOR EACH BUNKER) 'HI' AND 'LO' INDICATION ON AHS PANEL.

. BM BUNKERS LEVEL (FOR EACH BUNKER) 'LO' ALARM ON AHS PANEL.

ASH HANDLING & BED MATERIAL (BM) HANDLING SYSTEM (AHS)

VENDOR:

SAFTEY SEQUENTIAL INTERLOCKS WITHIN THE SYSTEM BY VENDOR

INTERFACE WITH CENTRAL PLANT CONTROL ROOM

ASH HANDLING PANEL TO CR

. BED ASH HANDLING SYSTEM IS 'ON'

. FLY ASH HANDLING SYSTEM IS 'ON'

. BED MATERIAL HANDLING SYSTEM IS 'ON'

. FLY ASH UNLOADING FROM FLY ASH SILO TO TRUCKS IS 'ON'

. BED ASH UNLOADING FROM BED ASH SILO TO TRUCKS IS 'ON'

. SLURRY DISPOSAL SYSTEM IS 'ON'

TITLE: SIGNAL EXCHANGE BETWEEN ASH HANDLING & BED MATERIAL (BM) HANDLING SYSTEM (AHS)