NTPC Limited

(A Government of India Enterprise)

EPC PACKAGE FOR SETTING UP 700 TPD (2 X 350 TPD) WASTE TO ENERGY PROJECT AT KAWAS, SURAT

TECHNICAL SPECIFICATION

FOR

EPC PACKAGE

PART – A

SECTION - VI

BID DOC. NO.: CS-2600-001-9

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SUB-SECTION – I

INTENT OF SPECIFICATION

1.00.0 INTENT OF SPECIFICATION

NTPC intends to install a Waste to energy plant (WtE Plant) having waste disposal (incineration) capacity of 700 tonnes per day (TPD). The plant shall be installed at NTPC plant premises at Kawas, Surat and shall be disposing the waste i.e. segregated combustible fraction (SCF)/ Refuse Derived Fuel (RDF) obtained from Surat Municipal Corporation. SCF/RDF consists largely of combustible components of waste such as non- recyclable plastics (not including PVC), wood, pulp or organic waste in the form of fluff.

The WtE Plant shall be of global standard and shall use state of the art technology, proven across globe, employing grate firing system and flue gas cleaning system. The WtE plant shall be completely indoor, odorless and emission norm complaint. The plant shall have a clean, aesthetic environment as well as noise within permissible limit. The plant shall involve enough automation to prevent human exposure to messy areas during operation and maintenance (O&M) of plant. The plant shall have leachate and effluent treatment system to prevent discharge of harmful substance. The waste reception hall. Waste bunker and the furnace shall remain under negative pressure so that foul smell shall not escape from waste dumping area to the surroundings.

1.01.0 Waste Disposal quantity, quality and Plant Output Ratings:

The peak capacity of the plant shall be designed to incinerate up to 265000 metric tons annually of RDF/ combustible fraction having GCV of 2500 kcal/kg to convert it efficiently into Power, assuming 330 days of plant operation.

The average incineration capacity of the plant shall be 750 tonnes per day with average GCV of 2500 kcal/kg. However, generator name plate rating shall be corresponding to the incineration capacity of 600 tonnes per day with GCV of 2500 kcal/kg as this corresponds to the minimum guaranteed waste disposal capacity of 200000 tonnes annually assuming 330 days of plant operation in a year.

Typical analysis of RDF has been provided elsewhere in the specification, however the plant shall be cpable of handling usual variations if RDF due to change is waste input during a course of time.

The peak capacity of the plant should take care of seasonal surge in waste supply and calorific value, for example is spring and autumn when lots of dry leaves may be the part of the waste.

The plant name plate rating shall not be less than 14.9 MW and plant overload capacity shall be at least 15% higher than the name plate rating to take care of grid frequency response and sudden surge in waste quantity and calorific value. The plant should be able to operate at its peak capacity continuously when the need arises.

Plant shall also be capable to supply steam for generating hot water or chilled water or for industrial use. The extraction quantity shall be up to 60% of the steam flowing upstream of the extraction point through inernally controlled extraction to ensure high efficiency with variation in demand of steam. The steam extraction pressure at the terminal point has been defined elsewhere in the specification.

1.02.0 Scope of the proposal

For disposal of waste i.e. segregated combustible fraction (SCF)/ Refuse Derived Fuel (RDF) obtained from Surat Municipal Corporation, NTPC intends to install a 700 TPD Waste to energy plant at its plant premises at Kawas, Surat.

The complete scope of the proposal for the Design, Engineering, Manufacture, Supply, Construction, Erection, Testing, Commissioning works including Operation & maintenance of the plant for an initial period of 2 years for the EPC Package for Waste to Energy Project (2 x 350 TPD), shall be on the basis of single point responsibility, completely covering the following activities and services in respect of all the equipment & works specified and covered under the specifications:

a) Basic Engineering of the plant including preparation of Plant Definition Manuals;

b) Detailed design of all the equipment and equipment system(s) including civil, structure steel works included in bidder's scope.

c) Providing engineering drawings, equipment sizing & performance data, instruction manuals, as built drawings and other information;

d) Compliance with statutory requirements and obtaining clearances from statutory authorities, wherever required;

e) Complete manufacturing including shop testing/type testing;

f) Complete Civil, Structural and Architectural works, including survey, providing construction material and equipment, construction water supply, construction / permanent roads, drainage arrangements, fencing / boundary wall around the land boundary.

g) Packing and transportation from the manufacturer's works to the site.

h) Receipt, storage, preservation, handling and conservation of equipment at the site;

i) Fabrication, pre-assembly, if any, erection, testing, commissioning and completion of facilities including putting into satisfactory operation all the equipment including successful completion of initial operation;

j) Performance and guarantee tests after successful completion of initial operation;

k) Furnishing of spares on FOR site basis.

l) Insurance and other requirements for the complete EPC package in accordance with the provisions of general conditions of contract (Section-IV) of the bidding document.

The Contractor shall be responsible for providing all material, equipment and service, which are required to fulfill the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not

The requirements, conditions, appendices etc. given in Technical Specifications (Section-VI, Parts A, B, C, D, E, F and G) shall apply to and shall be considered as a part of this volume as completely as if bound herewith. The work to be carried out as per the above scope shall be all in accordance with the requirements, conditions, appendices, etc., stated in Section GCC, which shall be considered as a part of the Technical Specification (Section VI) as completely as if bound herewith. The Contractor shall be responsible for providing all material, equipment and service, which are required to fulfill the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. It is not the intent to specify herein all aspects of design and construction; nevertheless, the equipment and civil works shall conform in all aspects to high standard of engineering, design and workmanship and shall be capable of performing in continuous commercial operation in a manner acceptable to the Employer, who will interpret the meaning of the specification and drawings and shall have a right to reject or accept any work or material which in his assessment is not complete to meet the requirements of this specification and/or applicable to Indian/ International standards mentioned elsewhere in this specification.

Bidders are requested to carefully examine and understand the specifications and seek clarifications, if required, to ensure that they have understood the specifications. Such clarifications should be sought within the time period as stipulated in section ITB. Bidder's offer should not carry any sections like clarifications, interpretations and/or assumptions.

However, if the bidder feels that, in his opinion, certain features brought out in his offer are superior to what has been specified, these may be highlighted separately. Bidder may also make alternate offers provided such offers are superior, in his opinion, to the requirements of these specifications in which case adequate technical information, operating feed back, etc. are to be enclosed with the offer, to enable the Employer to assess the superiority and reliability of the alternatives offered. In case of each alternative offer, its implications on the performance, guaranteed efficiency, auxiliary power consumption, etc. shall be clearly brought out. In any case, the base offer shall necessarily be in line with the specifications. Under no circumstances the equipment/systems as specified herein shall be brought out as an alternative offer i.e. the system/equipment specified shall be made as a base offer. In case the above requirements are not complied with, the offers may be considered as incomplete and would become liable for rejection.

This enquiry concerns with t**wo (2) Solid Waste Fired Steam Generator units,** employing **Grate System** and **Flue Gas Treatment System, each having rated waste incineration capacity as specified in para 1.01.0 divided equally into two streams along with one turbine generator set capable of generating power output of a minimum of 14.9 MW** including but not limited to:

1.02.01 <u>Waste receipt, waste pit including,</u>

- Weigh bridges
- Waste Reception Hall
- Tipping bays and its management system,
- Shredder
- Waste Grab Crane
- Feed hopper,
- Feed hopper cooling system.
- Waste feeding Isolation system & associated hydraulics.
- Structures,
- Platforms,
- Fire fighting system
- Leachate collection & treatment system
- Methane gas sensors
- Separate Maintenance space for each crane on either side of waste pit.
- Truck waiting area.
- Power operated waste pit doors for each tipping bay

1.02.02 <u>Grate firing system including,</u>

- Complete grate firing system,
- Grates and its operating mechanism,
- Structures,
- Platforms,
- Waste feeding system (pusher / ram)
- Grate cooling system
- Supports etc

- Hydraulic system
- Flame camera
- Air feeding arrangement

1.02.03 Steam generator and auxiliaries including

- Complete pressure parts, structures, platforms, stairs, piping, valves, supports etc.
- Soot blowing system with piping, valves, controls etc.
- Waste combustion system including start up / secondary oil burners & scanners.
- Air and flue gas system & ductwork.
- Refractory, Cladding, Cleaning and Spray attemperation System,
- Boiler Automation,
- Structural Steelwork,
- Primary, Secondary, Induced air fans.
- Aux PRDS and piping
- Start up & circulation system,
- Air heaters & SCAPH.
- Chemical dosing systems as applicable.
- Bag filters.
- Oil burner system
- Slag and Ash extraction system
- Auxilliary condensate pump and tank
- Goods Elevators for Steam generators
- Activated carbon dosing system
- DeNox system, chemical preparation, metering, injection, temperature measurement etc.,
- Installation Equipment, i.e. special tools and commissioning spare parts
- Other systems like tools & tackles etc. as specified.

1.02.04 Flue gas cleaning system and auxiliaries including

- Complete layout of flue gas cleaning system with parts, structures, platforms, stairs, piping, valves, supports, ducts etc.
- Bag filters, cleaning system, ash collection system and its controls etc.
- Lime storage, metering and dozing system
- Activated carbon storage, metering and dozing system.
- Air and flue gas ductwork.
- Start up heating & circulation system for bag filter,
- Ash collection, level measurement & handling system.
- Chemical dosing systems as applicable.

1.02.05 Main Steam System including

- Live Steam Piping
- Condensing system
- Feedwater Heating System
- Cooling System

1.02.06 Turbo Generator cycle including,

- Steam turbines with internally controlled extraction to extract up to 60% of steam for District heating and cooling use
- Air cooled Condenser
- Steam Bypass system.
- Low Pressure Chemical Dosing system (as applicable)
- Condensate Extraction Pumps.

- LP and HP feed water heaters
- Deaerator
- Boiler Feed Pumps
- Turbine hall E.O.T. crane.
- Power cycle piping
- Low pressure piping.
- Equipment cooling water system, Cooling Tower
- Boiler fill system

1.02.07 Water Treatment Plant Including,

- DM plant including DM plant waste & process drain recovery, regeneration, DM plant waste water neutralization and neutralization pit etc. (whichever is applicable)
- Pre treatment Plant
- Effluent treatment plant-
- Condensate polishing unit including regeneration facility (as applicable)
- Water treatment including storage tanks, unloading and ancillary equipment-
- Waste Water Treatment Plant comprising:
  - Reverse osmosis plant for waste water (as applicable)
  - Complete waste water treatment plant
  - Waste drain water sump with piping arrangement
  - Water/waste water circulation system
- Oil separation pit and oil separation system from waste water.
- Chemicals storage room, Urea / Ammonia storage system
- Raw water storage
- Process water basin

Further,

1. Construction of complete pumping system to pump raw water from intake location to waste to energy plant along with all its accessories, is in bidder's scope. Raw water intake location is marked in GLP. Capacity of Intake water pump shall be 2 X 100 %.
2. Pre-treatment Plant of raw water is in bidder's scope.
3. DM plant for Waste to energy plant DM requirement is in bidder's scope.
4. Construction of complete leachate treatment system, is in bidder's scope.
5. Construction of effluent treatment plant is in bidder's scope. Bidder shall ensure that no effluent shall be discharged out from the Waste to Energy plant.
6. Construction of auxiliary cooling water system along with cooling towers is in bidder's scope.

1.02.08 Plant Utilities including,

- Compressed air system (service and instrument air as applicable)
- Vacuum cleaning System
- Air conditioning and ventilation system (HVAC)
- Fire detection and protection system, fire water pumping station and distribution
- Fire alarm and fire extinguishing system
- Paging system for communication

1.02.09 Material Handling System including,

- Ash Handling system for bottom ash, boiler ash and fly ash
- Crane for bottom ash storage, loading system
- Fly ash handling, storage, loading system into vehicle, feeding to conveyor etc.,

1.02.11 Acoustic enclosure along with aesthetic architecture including,

- Acoustic enclosure for entire plant / machine along with appropriate aesthetic architecture to ensure pleasant appearance on par with international standards to promote people acceptance level towards waste to energy plant.
- Appropriate ventilation for the acoustic enclosure of the entire plant, in order to maintain comfortable ambient temperature inside the acoustic enclosure.

1.02.12 Continuous Emission Monitoring system including,

- Online measurement using reliable instruments capable of measuring all the pollutants in the flue gas (as applicable), recording of the same (electronic), retrieving, transfer data into another storage medium, upload data in to website online, displaying data at the plant gate by online digital display board.

1.02.13 Elevators, Cranes and Hoisting equipments

- Elevators for boiler house and control room
- Cranes for waste pit
- EOT crane for turbine floor
- Crane for bottom ash handling
- Crane / hoisting equipment for heavy equipments like motor, fan, shredder, bag filter, flue gas conditioning tower/reactor (as applicable) etc.,

1.02.14 Electrical Equipments including,

- Electric power system complete with supply system and power supply for auxiliary services, generator, generator circuit breaker and transformers
- Main generator and associated equipment.
- All Transformers.
- Auxiliary power supply
- Overall DCS
- Power electricity evacuation (switchyard)
- Bus ducts.
- Medium and low-voltage switchgear, motor control centres.
- Motors & Cables etc.
- Illumination, Earthing, Lightning protection, DG sets, Batteries, Battery Chargers, Overhead lines etc.
- Electrical systems as required.
- Control and Instrumentation system along with accessories and Instrument Cables.
- Switchyard for power evacuation

Civil works for the complete plant covered under bidder's scope shall be as mentioned in Sub-Section II-D, Section VI, Part-A of the specification. (which includes chimney)

- Complete Mechanical, Civil, Electrical & C&I works related to Make-up water System.

Items though not specifically mentioned but needed to complete the equipment and systems to meet the intent of specification, shall be deemed to be included in scope of work of Contractor.

1.02.15 Main Plant Building, Waste Reception hall and other facilities

Plant should have main plant building/ other buildings to accommodate various equipment suitable for indoor duty and also the facilities that need to be enclosed considering noise and odour pollution.

In addition to the above plant shall have main plant building/ other buildings to facilitate guest reception, guest sitting space near the guest reception area, a space/ hall to accommodate model of the plant, a hall/ area to accommodate safety gears before the guests enter into the control room area/ area requiring wearing of safety gadgets. The guest sitting area should be suitable for sitting of at least 15 guests and shall have a serving table (approximate length of 18 meter) for serving refreshment/ tea and coffee. The area may also require to house tea/ coffee vending machine.

Further, the plant shall also house a canteen having capacity to cook meals and refreshment for about 50 employees in safe and hygienic way. The main plant building/ Other buildings shall also have provision for office cabins/ halls for sitting of 20 to 25 office staff including 3 to 4 senior officers and a conference hall to accommodate up to 30 persons.. The design of buildings shall be such that more of the natural light is utilsed in the building instead of artificial light during the day. The plant architectural design shall be attractive to give an impression of modern clean facility and it should be tried to minimize the number of buildings and shall try to integrate them with the main building, However

2.00.00 **Additional Requirements**

(a) Before submitting his bid, the Bidder should inspect and examine the site and its surroundings and should satisfy himself as to the nature of the ground and subsoil, the quantities and nature of work, materials necessary for completion of the work and their availability, means of access to site and in general shall himself obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect his offer. No consequent extra claims on any misunderstanding or otherwise shall be allowed by the Employer.

(b) Bidder shall take all necessary precautions to protect all the existing equipment, structures, facilities and buildings etc. from damage. In case any damage occurs due to the activities of the contractor on account of negligence, ignorance, accidental or any other reason whatsoever, the damage shall be immediately made good by the contractor at his own cost to the satisfaction of the Employer. The contractor shall also take all necessary safety measures with specific reference to excavation in rock, at his own cost, to avoid any harm or injury to his workers and staff from the equipment and facilities of the power plant.

(c) In line with Gazette Notification on Ash Utilization issued by MOEF and its amendment thereafter, contractor shall use ash and ash based products in works as specified in these specifications, drawings and as per instructions of the Engineer. He shall also use ash and ash based products in construction of his offices, stores, staff quarters and labour huts etc. He shall furnish a compliance report along with all details of use of ash and ash based products along with each bill.

3.00.00 **TENDER DRAWINGS**

The tender drawings are enclosed along with the specification as Part-E, Section-VI and shall supplement the requirements specified in these technical specifications. The scope and terminal points of the equipment to be furnished under this Main Plant Turnkey package shall be as identified in these drawings read in conjunction with text of the specification.

4.00.00 **OTHER GENERAL REQUIREMENTS**

Items though not specifically mentioned in the specification but needed to complete the equipment/systems to meet the intent of specification, shall also be deemed to be included unless otherwise specifically mentioned in exclusions.

In addition to the scope of supply and services indicated in other Sub-Sections of the scope of supply and services, the other general requirements are covered in this sub-section as part of the scope of the Contractor.

4.01.00 **Paints**

The Contractor's scope of work includes supply of paints and painting of all equipments and structures as per stipulated requirements and the Employer's standard colour coding scheme.

4.02.00 **Pre-commissioning and commissioning activities**

The contractor's scope shall include all pre-commissioning and commissioning activities, materials and services as detailed in other portion of technical specifications including supply of all consumables (except waste and oil for firing), temporary equipment and pipings, instruments, labour / skilled manpower's etc. The scope includes complete requirement of flushing oils including fresh oil refilling during the pre-commissioning and commissioning activities and subsequent initial operation.

4.03.00 **Guarantee Tests**

The guarantee tests for various equipment and systems shall be carried out as specified under chapter of Function Guarantees and Liquidated damages, this part of technical specification. All special equipment, tools and tackles, instruments, measuring devices required for the successful conductance of Guarantee Tests shall be provided by the contractor. All costs associated with the tests shall be included in bid price.

4.04.00 **Special Tools & Tackles and Test/Measuring Equipment**

One set of all special tools and tackles including testing, calibrating and measuring instruments required for erection, assembly, disassembly and maintenance and testing of all equipment/systems covered under the scope of the contractor shall be supplied by the Contractor as per relevant clause indicated in Part-C of Section-VI and as specified elsewhere in Part-A of Section-VI of Technical Specifications. The Contractor shall not use these special tools, tackles and testing/measuring equipment for erection/commissioning purposes and shall be in an unused and new condition, when they are handed over to the Employer. A list of all such special tools and tackles shall be submitted along with the offer.

4.05.00 The scope of the Contractor includes complete design and engineering, technical coordination (including participation and arranging technical co-ordination meetings), finalization of drawings/documents, submission of engineering drawing/documents and processing of their approvals by the Employer as per requirement indicated in Part-C of section -VI and other relevant clauses given elsewhere in the Technical Specifications. Further, the scope shall also include submission, in proper shape and format, of all types of manuals, handbooks and documents in requisite numbers to the Employer at different phases of the project as per the requirement of Employer.

5.00.00 GENERAL ENVIRONMENTAL REQUIREMENTS

The contractor shall execute all work at site as per the general environmental requirement and following the applicable local provisions and local regulations in this respect. The contractor shall provide and install suitable safeguards and facilities as approved by the Engineer for meeting general environment requirements given herein under.

5.01.00 Protect from damage and disturbance of the existing trees, shrubs, any other plants, pole lines, fences, signs, monuments, buildings, pipe lines, drains, sewers, or other surface or sub-surface systems / facilities within or adjacent to the works being carried out given herein below.

5.02.00 Take all necessary precautions against soil erosion, water and environmental pollution and safe disposal of waste material.

5.03.00 Control the ground in the vicinity of all excavations, so that the surface of the ground is properly sloped or dyked to prevent surface water from running into the excavated areas, during construction.

5.04.00 All materials obtained from excavation shall remain Owner's property. All salvaged materials of archaeological importance or of value (in the opinion of the Engineer) shall be segregated from the other materials and stacked separately at locations as indicated by the Engineer.

5.05.00 The method and arrangement of blast cleaning shall conform to factory act, local laws, stipulations of pollution control board, if any.

5.06.00 a) Excavated earth should be stockpiled properly at designated areas so as not to spread and cause air pollution (fugitive dust emission) and water pollution (suspended solids in run-off). Top soil (top 150mm layer of the fertile soil) may be stored separately for future use in landscaping / revegetation / horticulture.

b) Solid wastes generated during construction such as construction debris, excess cement / concrete, wrapping materials (e.g. plastic packets and wrappers), timber, tins, cans and drums, wire, nails, glass etc., chemical wastes and hazardous wastes, food and domestic wastes etc., should be properly disposed off so as not to cause any air / water pollution.

c) Potential pollutants (such as oils, chemicals) shall be kept, stored, and used in such a manner that any escape can be contained and the surface and ground water resources are not contaminated.

d) Water containing pollutants such as cements, concrete, lime, chemicals and oils shall be discharged through a temporary sedimentation and equalization tank.

e) The necessary precautions shall be taken to control emission of fugitive dust and suspended solids in effluents leading to sedimentation of receiving water bodies.

f) Provide necessary sanitation facilities to the labour camps.

g) All vehicles and equipment shall be kept in good working order and serviced regularly to maintain the exhaust emissions and noise levels within reasonable limits.

h) Control the movement of all vehicles so as to minimize disruption to regular users of the routes.

i) The speed of the vehicles on gravel or earth roads in and around site may be restricted to minimize the emission of fugitive dust. Further, the road surface of gravel or earth roads may be provided with suitable cover to reduce the emission of fugitive dust and the tyres/wheels of vehicles plying on such roads shall be cleaned before these vehicles leave the project area.

6.00.00 OPERATION & MAINTENANCE OF PLANT

The contractor shall execute all work at site as per the environmental requirement and following the applicable local provisions and local regulations in this respect. The contractor shall ensure operation of the plant on 24 by 7 basis with all necessary input (man, machinery, material, consumable, spare etc.,) on time, without delay and maintain the plant premises and install suitable safeguards and facilities as approved by the Engineer for meeting general environment requirements.

Operation & Maintenance of the plant as per the Indian Solid Waste Management Rule 2016, in all respects including waste receipt, processing, segregation, power generation, disposal of waste to landfill site, all consumables, all spares etc.,

1. Receive the waste as delivered by the municipality and store it in a proper manner in the waste bunker without any air pollution (fugitive dust emission) and water pollution (suspended solids in run-off).
2. Oversize waste shall have a separate bay for transferring the oversized waste into the shredder input so that it can be shredded before dumping it into the waste bunker for further processing.
3. All vehicles and equipment shall be kept in good working order and serviced regularly to maintain the exhaust emissions and noise levels within reasonable limits.
4. Provide necessary sanitation facilities to the labour camps.
5. Control the movement of all vehicles so as to minimize disruption to regular users of the routes.

6. Maintain record of all waste received, ash disposed, continuous emission data for all critical emission parameters as per Indian SWM rule 2016.
7. Procure, maintain & record of the consumables / chemicals/ spares required and consumed for the plant.
8. Make arrangements for loading of municipality vehicle for disposal off the waste viz. Bottom & Fly ash to the landfill facility. The vendor to propose suitable means of transport of ash from waste to energy plant to landfill facility who's O&M shall be in the scope of municipality.
9. All repairs and maintenance activities are to be conducted by qualified companies only.
10. NTPC Ltd reserves the right to refuse unsatisfactorily qualified companies to conduct repairs and maintenance activities.
11. Wear and spare parts are to be kept in stock according to the specifications of the Contractor.
12. NTPC Ltd reserves the right to insist on usage of original spare parts.
13. The vendor must maintain adequate inventories of all necessary operating chemicals & spares in the specified quality and operate the plant for initial period of 5 years.
14. Operation & Maintenance of the plant as per standard norms
15. Customer's staff training.
16. Coordinate with all concerned Govt. agencies as and when required to comply norms related to waste to energy plant and maintain all necessary certificate for ready reference.
17. As and when required, to entertain public / school children for creating awareness on waste to energy plant by allowing them to visit the plant with all safety precautions.
18. Maintain all the plant premises so as to show cause better operation procedure.
19. Top priority shall be given for safety of men and material.
20. Any equipment and services that are not clearly specified in the offer
21. All spare parts for operation and maintenance in addition to commissioning spare parts.
22. During defect liability period, the vendor shall need to replace the equipment / parts which is required to achieve the satisfactory performance of the plant on free of cost.
23. The vendor shall, at all times, ensure that all aspects of the plant and the processes employed in the operation and maintenance of the plant facilities shall conform to the laws pertaining to environment, health and safety aspects including rules such as MSW rules, policies and guidelines.
24. Reporting / Record keeping - The vendor shall submit / keep record to NTPC, the following reports
    - **i)** Quantity of Waste i.e. segregated combustible fraction (SCF)/ Refuse Derived Fuel (RDF) received & ash sent out and Characterization.
    - **ii)** Power generation
    - **iii)** Quantity of recyclable material segregated / dispatched (if any)
    - **iv)** Waste water / Leachate generation
    - **v)** Test reports
    - **vi)** Unit control room logbook
    - **vii)** Secondary fuel/ Electric power consumption.
    - **viii)** Consumption of Chemicals / additives, enzyme as the case may be.
    - **ix)** Brief report of any accident/incident related to the plant, injury/ fatality, property damage, cause of accident and actions taken to avoid recurrence.
    - **x)** Copies of any reports submitted for purposes of regulatory compliance and of notices received or reports or notices submitted to any competent authority or otherwise
    - **xi)** Any other report that may be reasonably required to fulfill any regulatory compliance.
    - **xii)** Attendance register of the manpower deployed
    - **xiii)** Log Book of vehicles
    - **xiv)** Register of issue of the disinfectant liquid
    - **xv)** Register of Stock of implements, and other materials and their issue

xvi) Record of acceptance of personnel carriers with registration Numbers & timings
xvii) Register for issue of uniforms and protective gears
xviii) Maintenance & operations records of all vehicles
xix) Any other record for regulatory compliance.
xx) Any other items/activity not mentioned above.

25. Maintenance

i) In order to ensure smooth and uninterrupted operations, routine maintenance of the plant facilities shall include but not be limited to
ii) Prompt repairs of the weigh-bridge, entire plant and its auxiliaries, leachate collection drainage and treatment system, electrical items, drains, internal roads, Trammel machinery, lighting.
iii) The vendor, for the purpose of routine maintenance shall, in consultation with OEM of the equipment (bought out items if any), set forth such criteria as to conform to good industry practice for sound maintenance of the plant facilities.
iv) Replacement of equipment/consumables, and repairs to equipment, structures and other civil works which are part of the plant facilities.
v) Maintaining the storm water drainage system and leachate collection and drainage system.
vi) Keeping the plant facilities in a clean, tidy and orderly condition and taking all practical measures to prevent damage to the plant facilities or any other property on or near the Site.
vii) Undertaking maintenance works in accordance with the O&M plan and OEM manual.
viii) Taking all reasonable measures for the safety of all the workmen, material, supplies and equipment brought to the site. Diesel / Fuel, if any, shall be stored, transported and disposed of by the vendor in accordance with prevalent Laws/applicable permits.
ix) Carry out emergency maintenance and repairs as may be required to repair the damages, if any, in consultation with the OEM and where required under the supervision of the OEM, if required in order to ensure that the plant facilities are returned to normal operating standards as quickly as possible

26. Plant facility
The vendor shall not to use the plant facilities for any purpose other than activities envisaged in the scope. The vendor shall not part with or create any encumbrance on the part of the plant facilities including the plant site, save and except as set forth and permitted under this contract.

27. Man power
Vendor shall provide uniforms / personal protective equipments (PPE) for all its employees' personnel which shall be worn by such employees/personnel while on duty. Also be responsible for all the security, environment and safety aspects of the plant at all times during the entire award period. Further, the vendor needs to provide PF as per industry standards, basic facilities such as canteen, toilet, resting facilities to their employees.

31. Availability
The vendor shall maintain the plant and equipment so as to provide disposal of minimum of 700 TPD of waste daily.

32. In addition to be above, the scope of work of the plant shall mean and include the provision of the following services and facilities within the waste management facility, during the initial period of 2 years.

1. Receipt and unloading of Waste i.e. segregated combustible fraction (SCF)/ Refuse Derived Fuel (RDF) at plant facility

2. Operation of weighbridge & record keeping of waste being delivered and ash sent out.
3. Operation & maintenance of the entire waste to energy plant and its auxiliaries.
4. Disposal of ash and operation and maintenance of the land fill if applicable.
5. Supply of vehicles (various types) required for movement of waste within the plant and outside (if required)
6. Disposal of recyclable materials if any (loading to vendors vehicle – as the case may be) in accordance with prevailing practice.
7. Deployment of adequate and skilled manpower for operation and maintenance management of the plant.
8. Procure and/or provide any other required support services and facilities required for the plant.
9. Maintain the entire plant area in an acceptable environment by regularly spraying permitted sprays to avoid any foul smell / odour / control flies.
10. Deployment of supervisors to ensure all the operations are carried out according to agreed practices.
11. Carry out all kinds of maintenance required to keep the machineries / facilities in good condition, supply of all consumables, spares etc.
12. Procure all the necessary consumable like grease, lub oil, oil seals, rollers, conveyor belt, hydraulic oil, gas cylinders, chemicals, enzymes, lights & fittings etc., and record all such purchases for verifications.
13. Provide and deploy all necessary tools & tackles necessary for maintenance of the equipments / facilities.
14. The entire workforce engaged in the plant shall have protective gears such as helmets, gumboots, hand gloves, masks, etc., to protect their health & ensure positive adherence to the safe operating practices.
15. Paramount importance to be given to ensure all these activities are carried out in a healthy environment in the plant so as to provide a clean and foul (smell) free / dust free / free of flying bird in and around the plant facility.
16. Noise generated from running equipment in the plant should be contained below the acceptable level as per standards by effective maintenance / tuning of the equipment/ providing noise insulation.
17. Operate, maintain & ensure availability of the Diesel generator to supply power to the plant facility, in case of power failure.
18. Carry out scheduled/ planned maintenance in accordance with the O&M requirements, so as to ensure availability of equipment all the time. The maintenance of the plant facilities or any part thereof shall be in such a way that it has not deteriorated to a level which is below the acceptance level prescribed by the OEM.
19. Establish a laboratory / make suitable arrangement with NABL accredited laboratory, capable of measuring the various parameters required for proper operation of the plant such as pH, BOD, COD, C/ N ratio, temperature, trace elements, heavy metals, air pollutant if any etc.,

During the award period, the vendor shall ensure that all waste delivered at the plant facility is processed and disposed in accordance with Applicable Laws and in accordance with this scope.

In addition to the above, it is the responsibility of the vendor to deploy all the adequate systems / services to ensure scientific way of disposal of waste. The services which are not mentioned here but are required for satisfactory operation of the Waste Management Facility shall also to be supplied by the vendor.

SUB-SECTION–I-A

PROVENESS

1.0.0 Provenness criteria for critical equipment, auxiliaries, systems and bought out items:

The bidder/its sub-vendors(s) is required to meet the provenness criteria and/or qualification requirement for the items/services listed below as per the stipulated criteria indicated in the respective clauses. For the purpose of qualification of Bidders / Sub-vendor(s), experience shall be reckoned as on date of consideration for approval but not later than six months after award date of Main plant package unless otherwise specified in the respective clauses.

1.1.0 Sub QR for critical equipments(s)/systems(s) and bought out items:

The critical equipment, auxiliaries, systems and bought out items offered shall be proven and should have been in successful operation for a minimum period of two (2) year in a waste fired unit of at least 300 TPD incineration capacity. Documents in support of the above shall be submitted along with the bid.

The bidder/ its sub-vendors(s) are required to meet the above Sub QR for following critical equipments, auxiliaries, systems:

Grate Combustion System or Waste Heat Recovery Steam Generator as applicable, flue gas cleaning system, hydraulics of grate control system, Vehicle guiding system (tipping floor), PA, FD & ID Fans, Fabric bag filter, Tubular / steam coil Air pre-heaters, Cooling towers for auxiliary cooling system, cooling water pumps, air conditioning system, ventilations system, compressed air system, leachate treatment system, liquid effluent treatment plant, Ash handling system, waste feed grab crane, bottom ash crane etc.,

Induced draught Cooling tower for auxiliary cooling system, CW pumps, air conditioning systems, Ventilation systems & air compressors having capacities same as offered capacities or more, supplied in installation other than waste fired plant is also acceptable.

1.2.0 Provenness criteria for Turbine:

The Bidder/sub vendor should have designed, engineered, manufactured / got manufactured, erected/ supervised erection, commissioned / supervised commissioning of at least two (2) number of condensing steam turbine, directly coupled or coupled through a gearbox to generator of 12 MW or above capacity. The turbine should have been in successful operation for a period not less than one (2) year. Bidder shall offer the steam turbine only from such manufacturer who meets the above provenness criteria. The offered steam turbine shall be of same arrangement i.e. directly coupled or coupled through a gearbox to generator for which the bidder or its sub-vendor is qualified. Bidder/sub vendor shall furnish experience list of module offered to substantiate provenness.

1.3.0 Provenness criteria for turbine auxiliaries:

Air cooled Condenser, Condensate Extraction Pumps (CEP), Boiler Feed Pumps (BFP), Deaerator, Gear box between turbine & generator offered by the Bidder shall be only from such manufacturer(s) who has previously designed, manufactured / got manufactured the respective equipment(s) which are in successful operation in at least two (2) steam turbine plant of minimum 12 MW capacity for a period not less than one (1) year.

Bidder/Sub vendor(s) shall offer only the type of equipment for which it is qualified.

1.4.0 Provenness criteria for Control & Instrumentation system

The offered Control system is either same or of the same series as being offered for this package & which should have been in successful operation in at least two (2) numbers of WtE plants with automatic Grate firing control system of rating 300 Tonnes per day or above for a period of not less than Two (2) years. Measuring instruments offered for this package shall have at least Two (2) years satisfactory operation in one WtE plant having unit rating 300 TPD or above or any other Power plant of unit rating 200 MW or above.

1.5.0 Provenness criteria for Fire Detection and Protection System

The Bidder/its sub-vendor should have designed, supplied, erected and commissioned at least one (1) fire protection system of contract value not less than INR 35.0 Million or equivalent in foreign currency (exchange rate applicable as on date of Techno-Commercial bid opening), in industrial installation. The fire protection system should have comprised of

a) Fire hydrant system.
b) High velocity water (HVW) spray or medium velocity water (MVW) spray or sprinkler system.
c) Fire water pumping and pressurizing arrangement.

The system mentioned above should have been designed to the recommendations of Tariff Advisory Committee of India or Oil Industry Safety Directorate (OISD) or any other International reputed authority (like LPC-U.K. or NFPA, USA) and this system should have been in successful operation for a period of not less than one (1) year.

In addition, the analogue addressable type fire alarm system proposed to be supplied shall be sourced from a firm who has supplied at least one (1) similar system which has been approved or listed by UL-USA/ FM-USA/ LPC-UK/ similar agency and should have been in operation for at least one (1) year.

1.6.0 Provenness criteria for Civil works

1.7.1 Bidder or his agency should have in past executed civil and structural works for industrial building with Electrically Operated Travelling Crane including earthwork in filling involving mechanical compaction, machine foundations and water retaining structures.

1.7.2 Bidder can engage more than one agency, in case the Bidder itself is not able to meet the requirement at 1.7.1. In case Bidder proposes to engage agency (ies) for civil & structural works on work volume basis, (except for chimney/stack works), Bidder or its agency (ies) should have executed such works in the past and the annual rate of execution in the reference works should not be less than eighty percent (80%) of the asking rate of such works (structural steel erection, RCC and earthwork in filling involving mechanical compaction) for which it is being engaged.

1.7.3 For chimney/stack, Bidder or its agency should have in the past built atleast one (1) chimney/stack of height not less than 80% of the required height.

1.7.4 Successful Bidder shall finalize the agency (ies) for each work in consultation with Engineer-in- charge at site before engaging them.

1.7.0 **PROVENNESS CRITERIA FOR ELECTRICAL EQUIPMENTS**

1.7.1 **LT SWITCHGEAR**

ROUTE 1

a) Bidder/ Sub Vendor should have manufactured and supplied at least a total of four hundred & fifty (450) numbers of draw out type Air Circuit Breaker Panels and / or draw out type Motor Control Centre Panels with fault rating of at least 45kA for one (1) second and 105kA peak under a single order and these panels should have been in successful operation for at least two (2) years.

And

b) Bidder/ Sub Vendor should have manufactured and supplied at least one hundred & fifty (150) numbers of Air Circuit Breakers having fault rating of at least 45kArmsBREAKING, 105kA peak MAKING and 45kA withstand for one (1) second, and their associated draw out type Air circuit breaker panels having fault rating of at least 45kA for one (1)second and 105kA peak, which should have been in successful operation for at least two (2) years.

ROUTE 2

a) Bidder/Sub Vendor should have manufactured and supplied at least a total of two hundred & twenty five (225) numbers of draw out type Air Circuit Breaker Panels and / or draw out type Motor Control Centre Panels with fault rating of at least 45kA for one (1) second and 105kA peak under a single order and these panels should have been in successful operation for at least two (2) years.

And

b) Bidder/Sub Vendor should have manufactured and supplied at least seventy five (75) numbers of draw out type Air Circuit Breaker panels having fault rating of at least 45kA for one (1) second and 105kA peak, which should have been in successful operation for at least two (2) years.

And

c) Bidder/Sub Vendor shall be considered qualified provided its Associate or Collaborator or Technology Provider or Licensor meets the requirement stipulated in Route-1 for sourcing of Air Circuit Breakers. The Associate or Collaborator or Technology Provider or Licensor shall provide a letter of technical support for successful performance of the Air Circuit Breakers, as per the format, given in the bidding document. This letter of technical support should be submitted at the time of placement of order on the Sub Vendor.

And

d) Bidder/ Sub Vendor should have established manufacturing facility for draw out type Air Circuit Breaker Panels and draw out type Motor Control Centre Panels in India. Further, all the panels for this project shall be manufactured and supplied from the indian manufacturing facility.

NOTE:1. Each Single Front Panel shall be counted as one (1) Panel, Double Front Panel as one (1) Panel and Air Circuit Breaker Panel as one (1) Panel.
2. The provenness criteria shall be applicable for all draw out type and fixed type switchboards except Lighting DBs and Welding DBs.

1.7.2 **11 kV / 6.6 kV / 3.3 kV SWITCHGEARS**

a) Bidder/ Sub Vendor should have manufactured and supplied at least one hundred (100) numbers of 6.6kV or above Switchgear panels with fault rating of at least 40kA for one (1) second and 100kA peak, which should have been in successful operation for at least two (2) years.

b) Bidder/ Sub Vendor should have manufactured and supplied at least one hundred (100) numbers of Vacuum Circuit breakers for 6.6kV or above panels with a rating of 40kA rms BREAKING, 100kA peak MAKING and 40kA withstand for one (1) second, which should have been in successful operation in 6.6kV or higher voltage application for at least two (2) years.

1.7.3 **NUMERICAL RELAYS**

Bidder/ Sub Vendor should have manufactured and supplied and successfully configured at least one hundred (100)numbers of Numerical Relays with IEC 61850 used for application in Feeder Protections/Transformer Protections/Motor protections. These relays should have been in successful operation for at least two (2) years.

1.7.4 **DC BATTERIES**

Bidder/ Sub Vendor should have manufactured and supplied at least two (2) numbers of highest offered voltage & AH rating or above of high discharge type plante positive plate type battery (in case bidder offers Lead Acid plante type battery) or high discharge type Nickel Cadmium battery (in case bidder offers Nickel Cadmium battery), at least one (1) each at two (2) different industrial installations, which should have been in successful operation for at least two (2) years.

NOTE:Two different installations mean two different project sites or two different contracts.

1.7.5 **BATTERY CHARGER**

Bidder/ Sub Vendor should have manufactured and supplied at least two (2) numbers of static automatic voltage regulator type Battery Chargers of highest offered current rating or above, at least one (1) each at two (2) different industrial installations, which should have been in successful operation for at least two (2) years.
NOTE: Two different installations mean two different project sites or two different contracts.

1.7.6 **Provenness criteria for Generator:**

The offered synchronous generator (alternator) shall be from such a manufacturer who has manufactured and supplied synchronous generator of offered MW rating or above rating, which should have been in successful operation in at least one (1) plant for a period not less than one (1) year.

1.7.7 **HT POWER CABLES**

The Bidder/ Sub Vendor should have manufactured and supplied following cables, prior to the date of Techno-Commercial bid opening

a) At least 50kms of XLPE insulated power cables of 6.35/11 KV or higher voltage grade, executed in one or more orders.

b) At least one (1) km of flame retardant low smoke cables of any voltage level.

1.7.8 **DG SETS**

The Bidder/ Sub Vendor should have supplied at least two (2) numbers of DG sets of rating not less than 1500 kVA, at least one (1) each at two (2) different installations, which should be in successful operation for at least two (2) years prior to the date of Techno-Commercial bid opening. The offered make of the DG sets (Alternator and Engine) shall be same as that of reference plant DG sets.

NOTE: Two different installations mean two different project sites or two different contracts

1.7.9 **GENERATOR TRANSFORMER AND AUXILIARY OIL FILLED TRANSFORMERS**

a) The Bidder/ Sub-Vendor should have manufactured & supplied at least two numbers (one each at two different installations) of 16 MVA, 11kV or higher rating oil filled transformers which should have been in successful operation for at least two (2) years.

And

b) Bidder/ Sub-Vendor should have his own facilities for conducting all routine and type tests as per IS: 2026 (except short circuit test).

And

c) 16 MVA, 11KV Class or higher rated oil filled transformer manufactured by Bidder/ Sub-Vendor should have been successfully short circuit tested.

Sub QR Requirement for Generator Protection Relays

1. Generator Protection Relays:
2.

The Generator Protection Relays offered should be from Manufacturer(s) who have manufactured and supplied the offered type of devices for respective equipment, which should have been in successful operation in a 10MW or above unit for minimum one (1) year.

SUB-SECTION–I-B

PROJECT INFORMATION

1.00.00 **BACKGROUND**

An In-Principle Memorandum of Understanding (MOU) was singed between Surat Municipal Corporation (SMC) and NTPC on 24.10.2018 at Surat for scientific processing of solid waste by setting up waste to energy (WtE) plant at NTPC Kawas premises with SMC providing Refused Derived Fuel (RDF) / processed Municipal Solid Waste (MSW) to NTPC for incineration in the WtE plant of NTPC. The present proposal is for implementation of Kawas Waste to Energy Power Project (14.9 MW) with RDF/processed MSW capacity of 700 TPD within the premises of Kawas Gas Power Project.

Kawas CCPP has an installed capacity of 645 MW consisting of Four Gas Turbines (4 GTs) and Two Steam Turbines (2 STs). The Plant was commissioned fully with Natural Gas as Main Fuel in 1992 and is under commercial operation.

1.01.00 **LOCATION AND APPROACH**

Kawas CPP is located near Mora village of Chorasi Tehsil in Surat District of Gujarat. The Plant is bounded by KRIBHCO Fertilizer Plant towards East Side, Reliance Petro-Chemical Plant towards West Side and Tapi River towards South Side. Nearest National Highway NH-53, which connects Hajira in Gujarat and Paradeep Port in Odisha, is about 5 Km from Plant.

Kawas CCPP is located at a distance of 20 Km from Surat Railway Station and is connected with Vadodara through NH-8. The nearest airports from site are located at Surat (13 Km) and Vadodara (160 Km). The Site is located at latitudes of 210 10’ N and longitudes of 720 41’ E respectively. Vicinity map of the project is enclosed at Exhibit-I.

Airport

Nearest Commercial Airport	Surat Airport, Magdalla.	About 13 Km
Nearby Major Airport	Vadodara Airport	About 160 Km

Rail

Nearest Railway Station	Surat Station	About 20 Km
Other Major Railway Stations	Vadodara Station	About 152 Km
	Ahmadabad About	272 Km

1.02.00 **LAND REQUIREMENT**

As shown in tender drawing number 8002-001-9-POC-A-001, the land has been identified. About 568 Acres of land has been acquired during implementation of Kawas Gas Power Project. About 40 Acres of vacant land has been identified in the existing premises of Kawas GPP for the implementation of WtE Power Project keeping provisions of future expansion. However, about 20 to 25 Acres of land shall be allocated to the proposed project.

1.03.00 **WATER**

The Water Requirement for the project is to be met from existing water allocation (15 MGD) of Kawas Gas Power Project. Make-up Water for Kawas GPP is drawn from Singanpore Weir constructed across Tapi River near Surat at a distance of approximately 20 Km from the Power Station.

1.04.00 **WASTE AVAILABILITY AND TRANSPORTATION**

1.04.01 **Waste Availability & Transportation**

Surat Municipal Corporation (SMC) shall provide 700 Tonnes per day of Refused Derived Fuel (RDF) / processed Municipal Solid Waste (MSW) to NTPC for incineration in the WtE plant of NTPC. The transportation of RDF/ processed MSW from designated location to WtE plant is by tripper trucks owned/managed by SMC through Road. As per draft MOU, Surat Municipal Corporation (SMC) shall make necessary arrangement to transport the RDF to WtE plant of NTPC.

1.04.03 **Fuel Quality Parameters and Fuel oil Characteristics**

The primary fuel for the plant shall be RDF/ processed MSW provided by SMC. Secondary fuel oil (LDO) shall be used for start-up, flame stabilization and low load operation and maintaining adequate temperature of 950 Degree for 2 sec as per statutory requirement. RDF quality parameters and Fuel oil Characteristics of generic in nature are enclosed as **Annexure-II** to this subsection for guidance only. **Vendor needs to visit the existing waste processing plant at Surat to collect RDF sample and study for all the necessary required characteristics**. The waste to energy plant and its auxiliaries shall be capable of obtaining maximum continuous rating as specified, safely and on sustained basis, when firing the available quality of RDF.

1.05.00 **CAPACITY & POWER EVACUATION**

The Generation voltage shall be transformed to 6.6 KV level through suitably rated Generator Transformer, which shall be connected to 6.6 KV Switchgear near WtE plant end. Two numbers of 6.6 KV cable feeders shall be laid up to second 6.6 KV switchgear located near the switchyard.

From this switchgear, two numbers of cable feeders shall be connected to the existing 6.6 KV boards 1CLGA & 2CLGA by relocating the existing colony transformer feeders from the respective boards to this new 6.6 KV board at switchyard end.

1.06.00 **METEOROLOGICAL DATA**

Important meteorological data at Kawas, Surat is given in **Annexure - III.**

1.07.00 **PLANT WATER SCHEME**

The Plant water scheme is described below.

1.07.01 **Condenser Cooling System**

It is proposed to adopt air cooled type CW system for the project.

1.07.02 **Equipment Cooling Water (ECW) System (Unit Auxiliaries)**

All plant auxiliaries shall be cooled by De-mineralized water (DM) in a closed circuit. The primary circuit DM water shall be cooled through heat exchangers by Circulating Water in a closed secondary circuit. The hot secondary circuit cooling water shall be cooled in the auxiliary cooling towers and shall be returned back to the system.

1.07.03 **Ash Disposal system**

SMC, at its own cost, shall transport in closed tankers/ bulkers and dispose the fly ash/ bottom ash/ from NTPC WtE plant to ash disposal site.

SMC shall be responsible for the construction, due operation and maintenance of the ash disposal site/ scientific landfill site and for ensuring its availability and suitability for accepting the fly ash/ bottom ash/ Residual Inert matter and Rejected wastes as per prevailing environmental norms.

1.07.04 **Other Miscellaneous Water Systems**

(a) Auxiliary CW system blow down water shall be used for meeting bottom ash quenching system requirement and service water system etc. The service (wash water) water collected from various areas shall be treated using oil water separators, tube settlers, settling pits etc. as per requirement and treated water from liquid effluent treatment plant shall be recycled back to the service water system for re-use.

(b) The drinking water requirement of the plant shall be provided from water treatment plant.

(c) Steam Cycle make-up water, makeup to the primary circuit of ECW (unit auxiliaries) system, boiler fill water shall be provided from Demineralizing plant.

1.08.00 **Criteria for Wind Resistant Design of Structures and Equipment**

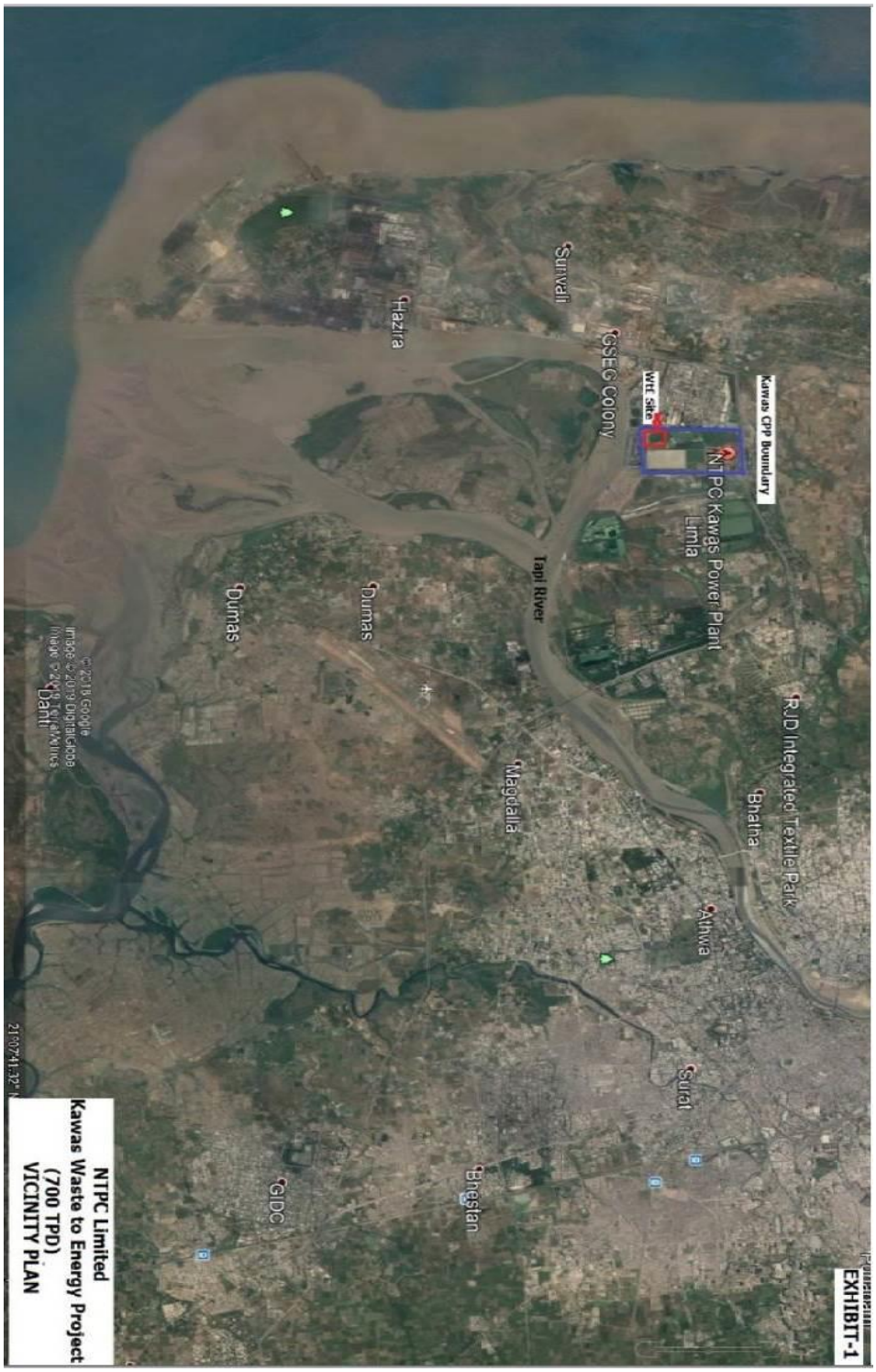
All structures and equipment of the power plant, including plant auxiliary structures and equipment, shall be designed for wind forces as given in Sub-Section- D-01, Part-B, Section-VI, i.e. Technical Specification for Civil and Structural Works.

1.09.00 **Criteria for Earthquake Resistant Design of Structures and Equipment**

All power plant structures and equipment, including plant auxiliary structures and equipment shall be designed for seismic forces as given in Sub-Section- D-01, Part-B, Section-VI, i.e. Technical Specification for Civil and Structural Works.

Annexure – 1

Vicinity Plan



Annexure – 2

REFUSE DERIVED FUEL/ PROCESSED MSW CHARACTERISTICS

Sl.No.	PARAMETERS	UNIT	RESULT	TEST METHOD
1	Moisture as received basis	%	7.25	IS 1350(P-1)1984
2	Ash as received basis	%	13.31	IS 1350 (P-1)1984
3	GCV as received basis	Kcal/Kg	2500	IS 1350 (P-2) 1970
4	Sulphur	%	0.16	EPA SW 846 Method 9038
5	Chloride	%	0.35	EPA SW 846 Method 9253
6	Density	Kg/M3	390	IS 2720 (Part-29)2015
7	NCV	Kcal/Kg	2300	By calculation
8	Reactive sulphide	mg/kg	ND	CPCB Hazardous
9	Reactive cyanide or halide analysis	mg/kg	ND	
10	Heavy Metals analysis			
11	Copper	mg/kg	33	USEPA 3050B
12	Nickel	mg/kg	6.26	
13	Zinc	mg/kg	407	
14	Cadmium	mg/kg	0.444	
15	Lead	mg/kg	10.99	
16	Cobalt	mg/kg	4.04	
17	Mercury	mg/kg	ND	
18	Arsenic	mg/kg	ND	

FUEL OIL CHARACTERISTICS

LIGHT DIESEL OIL CHARACTERISTICS

AS PER IS 15770-2008

	Characteristics	LDO
1.	Pour Point (max)	21 °C & 12°C for Summer and Winter respectively
2.	Kinematic viscosity in centistokes at 40 deg.C	2.5 to 15.0
3.	Sediment percent by mass (max)	0.10
4.	Total sulphur percent by mass (max)	1.5
5.	Ash percentage by mass (max)	0.02
6.	Carbon residue (Rams bottom) percent by pass (max.)	1.50
7.	Acidity inorganic	Nil
8.	Flash point (Min.) -Pensky Martens	66 deg.C
9.	Copper strip corrosion for 3 hours at 100°C	Not worse than No. 2
10.	Water content, % by volume (max)	0.25
11.	GCV(kcal/kg)	10,000

Annexure – III

CLIMATOLOGICAL TABLE

Rainfall data by Indian Meteorological Department (IMD) for Surat is attached (from 1999 to 2008). For additional data, Bidder has to arrange for necessary input directly from IMD under intimation to the owner.

जलवायवी सारणी
CLIMATOLOGICAL TABLE

BACK

स्टेशन : सूरत
STATION : Surat

अक्षांश LAT. 21°12' देशांतर LONG. 72°50' समुद्री तल माध्य से ऊंचाई HEIGHT ABOVE M.S.L. 12 मीटर METRES

प्रेक्षणों पर आधारित BASED ON OBSERVATIONS 1971-2000

माह / MONTH		स्टेशन का सतह दाब / STATION LEVEL PRESSURE (एच.पी.ए. hPa)	वायु तापमान / AIR TEMPERATURE — माध्य / MEAN: शुष्क बल्ब / DRY BULB (डि. से °C)	नम बल्ब / WET BULB (डि. से °C)	दैनिक अधिक तम / DAILY MAX (डि. से °C)	दैनिक न्यून तम / DAILY MIN (डि. से °C)	माह में उच्चतम / HIGHEST IN THE MONTH (डि. से °C)	माह में निम्नतम / LOWEST IN THE MONTH (डि. से °C)	चरम / EXTREMES: उच्चतम / HIGHEST (डि. से °C)	दिनांक और वर्ष / DATE AND YEAR	निम्नतम / LOWEST (डि. से °C)	दिनांक और वर्ष / DATE AND YEAR	आर्द्रता / HUMIDITY: सापेक्ष आर्द्रता / RELATIVE HUMIDITY (प्रतिशत %)	वाष्प दाब / VAPOUR PRESSURE (एच.पी.ए. hPa)	मेघ की मात्रा / CLOUD AMOUNTS (आकाश के अष्टमांश / Oktas of sky): समस्त मेघ / ALL CLOUDS	निम्न मेघ / LOW CLOUDS	मासिक योग / MONTHLY TOTAL (मि.मि. mm)	वर्षा के दिनोंकी संख्या / NO. OF RAINY DAYS	वर्षा / RAINFALL: वर्षासहित सबसे नम महीने का योग / TOTAL IN WETTEST MONTH WITH YEAR (मि.मि. mm)	वर्षासहित शुष्कतम महीने का योग / TOTAL IN DRIEST MONTH WITH YEAR (मि.मि. mm)	24 घंटोंकी सबसे भारी वर्षा / HEAVIEST FALL IN 24 HOURS (मि.मि. mm)	दिनांक और वर्ष / DATE AND YEAR	माध्य पवन गति / MEAN WIND SPEED (कि.मी. प्र. घं. Kmph)
जनवरी JAN	I	1014.0	17.4	14.0	31.0	15.0	35.0	10.9	38.3	20 1952	4.4	31 1929	67	13.5	0.8	0.1	1.5	0.2	91.7 1920	0.0	43.7	6 1920	7.3
	II	1010.8	27.4	19.0									41	15.2	0.9	0.1							
फरवरी FEB	I	1012.8	19.4	15.4	32.3	16.6	37.0	12.4	41.7	28 1953	5.6	1 1929	63	14.4	0.9	0.1	0.4	0.0	42.7 1898	0.0	38.1	10 1898	7.5
	II	1009.5	29.2	19.2									35	14.2	0.8	0.1							
मार्च MAR	I	1011.1	23.8	19.1	35.7	20.8	40.4	16.4	44.0	26 1973	8.9	9 1979	62	18.5	0.8	0.1	0.0	0.0	34.9 1967	0.0	13.0	26 1967	7.4
	II	1007.2	33.1	21.4									32	16.1	0.7	0.0							
अप्रैल APR	I	1008.5	27.7	23.3	37.0	24.0	41.5	21.5	45.6	15 1952	15.0	3 1903	67	25.2	1.1	0.5	0.2	0.0	149.3 1947	0.0	97.8	19 1947	8.3
	II	1004.7	34.2	24.0									41	21.6	0.8	0.1							
मई MAY	I	1006.3	30.0	25.7	36.0	26.3	41.0	23.9	45.6	1 1956	19.4	4 1888	70	29.7	2.5	2.0	2.3	0.2	128.0 1917	0.0	51.6	26 1974	11.4
	II	1002.8	33.2	26.2									56	28.2	0.8	0.5							
जून JUN	I	1002.2	29.5	26.4	34.0	26.5	37.8	23.3	45.6	10 1901	20.2	19 1962	78	32.0	4.9	3.3	286.3	8.0	836.7 1976	1.4 1974	260.1	27 1922	12.9
	II	999.4	31.5	26.9									69	31.7	3.7	2.2							
जुलाई JUL	I	1001.4	27.8	26.0	31.3	25.5	34.1	23.3	38.9	7 1902	19.9	11 1979	85	32.1	6.5	4.0	436.5	14.3	1614.0 1988	22.1 1899	459.2	2 1941	12.0
	II	999.4	29.4	26.5									78	32.2	6.1	3.7							
अगस्त AUG	I	1003.1	27.2	25.5	30.8	25.2	33.5	23.1	37.2	31 1932	21.1	14 1887	86	31.2	6.6	3.9	259.0	12.1	888.1 1953	0.0	324.6	13 1954	10.3
	II	1000.9	28.9	25.9									78	31.1	6.1	3.5							
सितम्बर SEP	I	1006.9	27.2	25.1	32.4	24.9	36.2	22.9	41.1	26 1951	20.6	9 1884	83	30.1	4.5	2.6	159.6	7.1	1066.3 1954	0.0	389.4	23 1945	7.1
	II	1003.9	30.2	25.7									68	29.3	3.9	2.0							
अक्तूबर OCT	I	1009.8	26.8	23.1	35.4	23.7	38.5	20.7	41.4	16 1987	14.4	20 1893	72	25.5	2.1	0.8	37.7	1.5	429.0 1894	0.0	257.1	25 1894	5.7
	II	1006.5	32.4	24.5									51	24.6	2.1	0.8							
नवम्बर NOV	I	1012.6	23.3	18.7	34.4	19.9	36.8	15.8	39.4	9 1951	10.6	19 1881	63	18.2	1.4	0.3	10.5	0.6	190.3 1946	0.0	148.3	6 1946	6.3
	II	1009.4	30.6	21.9									44	19.2	1.5	0.4							
दिसम्बर DEC	I	1014.3	19.3	15.5	32.1	16.5	34.9	12.7	38.9	2 1953	6.7	27 1903	65	14.7	1.0	0.1	1.6	0.1	42.4 1933	0.0	42.2	20 1933	7.0
	II	1011.1	28.1	19.8									43	16.5	1.0	0.1							
वार्षिक योग या माध्य ANNUAL TOTAL OR MEAN	I	1008.6	24.9	21.4	33.5	22.1	42.4	10.6	45.6	15	4.4	31	72	23.7	2.7	1.5	1195.5	44.2	2298.7	363.0	459.2	2	8.6
	II	1005.5	30.7	23.4					4	1952	1	1929	53	23.3	2.3	1.1			1976	1904	7	1941	
वर्षोंकी सं NUMBER OF YEARS	I / II	28	28	28	29	29	29	29	99		99		28	28	25	25	23	23	112	112	122		13

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जलवायवी सारणी
CLIMATOLOGICAL TABLE

स्टेशन : सूरत
STAION : Surat

माह / MONTH		मौसम परिघटना के साथ दिनों की संख्या / WEATHER PHENOMENA No. OF DAYS WITH: वर्षण 0.3 मि.मि.या अधिक / PPT 0.3 mm Or more	ओले / HAIL	गर्जन / THUNDER	कुहरा / FOG	धूल भरी आंधी / DUST STORM	चंड झंझा / SQU ALL	पवन की गति के साथ दिनों की संख्या (कि. मी. प्र. घं.) / No. OF DAYS WITH WIND SPEED (Km. p. h.): 62 या अधिक / 62 Or more	20-61	1-19	0	पवन की दिशा के दिनों की संख्या का प्रतिशत / PERCENTAGE No. OF DAYS WIND FROM: उ / N	उ.पू. / NE	पू / E	द.पू. / SE	द / S	द.प. / SW	प / W	उ.प. / NW	शांत / CALM
जनवरी JAN	I	0.3	0.0	0.0	0.3	0.0	0.0	0	0	27	4	24	32	7	7	1	1	1	13	14
	II							0	0	30	1	16	13	2	1	1	7	8	47	5
फरवरी FEB	I	0.2	0.0	0.0	0.3	0.0	0.0	0	0	23	5	17	27	4	10	3	3	2	15	19
	II							0	0	27	1	13	9	0	1	2	12	13	48	2
मार्च MAR	I	0.1	0.0	0.0	0.0	0.0	0.0	0	0	25	6	11	18	4	11	7	9	6	16	18
	II							0	0	30	1	8	4	1	1	2	21	18	41	4
अप्रैल APR	I	0.1	0.0	0.0	0.0	0.0	0.0	0	0	26	4	7	7	1	9	13	28	8	13	14
	II							0	0	29	1	4	1	0	1	3	48	17	24	2
मई MAY	I	0.6	0.0	0.3	0.0	0.0	0.0	0	0	29	2	3	2	1	1	10	57	12	6	8
	II							0	1	30	0	1	0	0	0	7	69	16	5	2
जून JUN	I	10.1	0.0	1.1	0.0	0.0	0.0	0	0	28	2	1	1	0	6	10	63	11	3	5
	II							0	1	29	0	0	0	0	1	11	76	9	1	2
जुलाई JUL	I	19.0	0.0	0.6	0.0	0.0	0.0	0	0	28	3	0	0	0	3	8	58	18	3	10
	II							0	1	29	1	0	0	0	1	6	75	14	1	3
अगस्त AUG	I	18.2	0.0	0.4	0.0	0.0	0.0	0	0	27	4	1	0	0	1	3	55	22	4	14
	II							0	0	30	1	0	0	0	0	3	78	14	2	3
सितम्बर SEP	I	10.1	0.0	1.1	0.1	0.0	0.0	0	0	24	6	2	4	1	7	6	31	18	11	20
	II							0	0	28	2	2	2	1	1	5	59	15	9	6
अक्तूबर OCT	I	2.2	0.0	0.4	0.2	0.0	0.0	0	0	24	7	8	12	11	22	9	6	3	7	22
	II							0	0	28	3	6	10	6	3	5	24	14	22	10
नवम्बर NOV	I	1.5	0.0	0.1	0.0	0.0	0.0	0	0	25	5	8	31	19	15	2	0	1	5	19
	II							0	0	27	3	13	19	10	4	1	6	8	29	10
दिसम्बर DEC	I	0.2	0.0	0.0	0.0	0.0	0.0	0	0	26	5	16	34	15	10	1	0	1	7	16
	II							0	0	28	3	18	20	4	1	1	4	8	35	9
वार्षिक योग या माध्य ANNUAL TOTAL OR MEAN	I	62.7	0.0	4.1	0.8	0.0	0.0	0	1	311	53	8	14	5	8	6	26	9	9	15
	II							0	4	344	17	7	6	2	1	4	40	13	22	5
वर्षों की संख्या NUMBER OF YEARS	I	26						28				28								
	II																			

माह / MONTH		मेघ: मेघ मात्रा (सभी मेघ) सहित दिनों की संख्या - अष्टमांश / No. OF DAYS WITH CLOUD AMOUNT (ALL CLOUDS) OKTAS: 0	से-2 / 1-2	3-5	6-7	8	निम्न स्तरी मेघ मात्रा सहित दिनों की संख्या - अष्टमांश / No. OF DAYS WITH LOW CLOUD AMOUNT OKTAS: 0	से-2 / 1-2	3-5	6-7	8	कुहरा / FOG 8	दृश्यता: दृश्यता सहित दिनों की संख्या / No. OF DAYS WITH VISIBILITY: 1 कि.मी. तक / UP TO 1 Km.	1-4 कि.मी. / 1-4 Km.	4-10 कि.मी. / 4-10 Km.	10-20 कि.मी. / 10-20 Km.	20 कि.मी. से अधिक / OVER 20 Km.
जनवरी JAN	I	24	3	3	1	0	29	1	1	0	0	0	0.2	1.6	9.7	19.5	0.0
	II	24	3	3	1	0	29	1	1	0	0	0	0.0	0.0	7.0	24.0	0.0
फरवरी FEB	I	21	3	3	1	0	27	0	1	0	0	0	0.1	1.1	8.3	18.4	0.0
	II	20	3	4	1	0	26	1	1	0	0	0	0.0	0.0	5.4	21.2	1.3
मार्च MAR	I	23	3	4	1	0	29	1	1	0	0	0	0.0	0.9	7.6	22.5	0.0
	II	24	3	3	1	0	31	0	0	0	0	0	0.0	0.0	5.8	22.5	2.7
अप्रैल APR	I	21	3	5	1	0	25	2	3	0	0	0	0.0	0.4	6.8	22.8	0.0
	II	23	3	3	1	0	29	1	0	0	0	0	0.0	0.0	5.2	22.8	2.0
मई MAY	I	9	4	15	3	0	11	4	15	1	0	0	0.0	0.0	7.3	23.6	0.1
	II	23	4	3	1	0	25	4	2	0	0	0	0.0	0.0	5.9	21.9	3.2
जून JUN	I	3	1	12	9	5	4	4	19	3	0	0	0.0	1.0	9.0	19.9	0.0
	II	6	4	7	10	3	10	6	12	2	0	0	0.0	0.8	6.8	22.0	0.5
जुलाई JUL	I	1	0	6	13	11	2	3	21	5	0	0	0.0	1.7	12.0	17.2	0.0
	II	1	1	8	13	8	3	5	20	3	0	0	0.0	1.3	9.4	20.3	0.1
अगस्त AUG	I	0	0	6	11	14	1	3	22	5	0	0	0.0	0.5	13.0	17.4	0.0
	II	1	1	8	12	9	2	5	21	3	0	0	0.0	0.4	9.7	20.8	0.0
सितम्बर SEP	I	3	4	11	8	4	7	6	15	2	0	0	0.0	0.6	9.7	19.7	0.0
	II	5	5	10	7	3	10	8	10	2	0	0	0.0	0.2	7.5	20.8	1.5
अक्तूबर OCT	I	14	5	8	3	1	22	3	6	0	0	0	0.0	1.1	7.9	21.8	0.2
	II	12	7	8	3	1	20	6	5	0	0	0	0.0	0.0	6.3	20.8	4.1
नवम्बर NOV	I	20	3	4	2	1	26	1	3	0	0	0	0.0	1.8	8.1	20.0	0.1
	II	19	3	5	2	1	25	2	3	0	0	0	0.0	0.0	7.2	21.1	1.7
दिसम्बर DEC	I	21	4	4	2	0	29	0	2	0	0	0	0.0	2.3	9.3	19.4	0.0
	II	21	3	5	2	0	28	1	2	0	0	0	0.0	0.1	7.4	22.5	1.0
वार्षिक योग या माध्य ANNUAL TOTAL OR MEAN	I	167	33	79	53	33	218	29	99	18	1	0	0.4	13.0	108.9	242.3	0.5
	II	183	40	68	50	24	241	39	74	11	0	0	0.0	2.7	83.6	260.5	18.2
वर्षों की संख्या NUMBER OF YEARS	I	25					25						28				
	II																

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SUB-SECTION–IIA

SCOPE OF SUPPLY & SERVICES

SUB-SECTION–IIA-01

SG AND AUXILIARIES

1.00.00 **GENERAL SCOPE OF SUPPLY AND SERVICES**

1.01.00 The scope of work for the equipment and accessories to be furnished in accordance with this Sub-section "Steam Generators and Auxiliaries" shall include design, manufacture, engineering, inspection and testing at suppliers works, packing, forwarding to site, unloading, erection, supervision, pre-commissioning, testing and commissioning and performance testing of the equipment/system and works indicated in this Sub-section of the technical specification. Any item or works though not specifically mentioned in this specification but needed to complete the equipment & systems to meet the intent of the Specification shall also be furnished.

1.02.00 **Tests**

The scope of the Contractor includes all shop tests, type tests, site tests, routine tests, etc., fulfillment of complete quality assurance & inspection requirements and related activities for all the equipment & systems covered under the scope of work of bidder as per the stipulations of Technical Specifications.

1.03.00 **Pre-commissioning and Commissioning Activities**

Contractor's Scope shall include all pre-commissioning and commissioning activities, required for successful performance of all equipments and systems under this Sub-section and shall include, but will not be limited to, activities detailed in Part-B of Technical Specification. Contractor's scope shall also include supply of all materials and services including the following for successful conductance of pre-commissioning and commissioning activities:

1.03.01 Complete pre-commissioning work including tests of facilities such as line flushing, hydraulic testing of pressure parts, air and gas tightness tests of steam generator enclosure, chemical cleaning of pressure parts, steam blow off etc. and all other tests as mutually agreed in the Contractor's quality assurance program as well as those identified in the specification.

1.03.02 Commissioning and initial operation of the facilities.

1.03.03 Supply of all consumables (except waste and oil for firing) like chemicals for chemical cleaning, passivation, inhibition etc., oil for line flushing, nitrogen for blanketing, consumables for air/ gas tightness tests and any other consumable as may be required for above pre-commissioning/ commissioning activities.

1.03.04 (a) Supply of all temporary equipments such as tanks, piping, including supports, valves, Electrically Operated Temporary Valves (EOTVs) including one (1) no. as a spare in addition to the required number for Steam blowing process, nitrogen blanketing equipments including nitrogen cylinders, pumps, blowers and all necessary instrumentation for successful conductance of pre-commissioning and commissioning activities. All temporary equipments, pumps, blowers, valves etc. brought to sites, by the Contractor for pre-commissioning/commissioning purpose shall be in good working condition to ensure its safe and reliable operation at site. All such temporary equipments/components shall be brought to site atleast three (3) months prior to commencement of relevant pre-commissioning/commissioning activities. On receipt of the temporary equipments/components at site, the same shall be inspected by the Employer to ensure its safe and reliable operation and if in the opinion of the Employer the temporary equipments/components are not in

satisfactory conditions to ensure it's safe and reliable operation the same shall be immediately replaced by the Contractor.

(b) The temporary equipments specifically brought by the Contractor solely for the pre-commissioning and commissioning work shall on completion of these activities, remain the property of the Contractor. However, the nitrogen blanketing equipment including nitrogen cylinders and one (1) no. spare Electrically Operated Temporary Valve (EOTV), required for pre-commissioning/commissioning activities of Steam Generator & Auxiliaries, shall get included in the Contractor's permanent scope of supply and become property of the Employer.

(c) The selection of material of all the temporary equipments/ instruments shall be compatible with the service conditions expected during pre-commissioning/ commissioning activities.

(d) All temporary equipments and instruments along with the respective control system shall be clearly listed out in the bid.

1.03.05 Supply of all labour, skilled/ semi skilled supervisors, engineers and any other manpower.

1.03.06 The scope of Contractor shall also include necessary approach & Platforms for all the instruments required during commissioning and testing. These approach platforms shall be provided to meet all required safety norms and these shall be of permanent nature.

2.00.00 STEAM GENERATOR AND AUXILIARIES

The Contractor's scope of supply & services for Steam Generator (SG) shall include all equipment required for one (01) number of multi pass boiler, balanced draft, outdoor type, municipal solid waste fired steam generating units having steam parameters with all necessary auxiliaries, integral piping, ducts, elevators, etc. Items though not specifically mentioned but needed to complete the equipment and systems to meet the intent of specification, shall be deemed to be included in scope of work of Contractor. The scope of supply and services for each steam generating unit shall include all items indicated but will not be limited to the following:

2.01.00 Furnace/Evaporator

For recovery of heat from flue gas and production of superheated steam a steam boiler needs to be provided with the following sections

- Vertical radiation pass made of membrane evaporator walls with refractory lining
- Vertical / horizontal radiation pass made of membrane evaporator walls
- Vertical / horizontal convection pass, evaporator, superheater, flue gas/ steam coiled air preheater and economiser.

The steam drum and down comers are to be placed so as to allow thermal expansion in the system.

The radiant boiler section located above the incinerator grate consists of membrane walls. The sidewalls extend downward and form an integrated part of furnace, providing cooling of the incinerator. In addition, the front and back walls of the first pass extend downwards to create the sloped roofs of the incinerator. The thermal

expansion of the boiler will be compensated by expansion joints between the grate and the vertical first pass as well as between the final pass and the duct to the flue gas treatment section. The vertical passes consist of membrane walls and convection tube banks. All walls are membrane walls, i.e. they consist of tubes that are connected by short metal plates. These walls form the main part of the evaporator system, which supplies saturated steam to the steam drum. Superheated steam emerges from the final superheater outlet header by means of one single outlet pipe. This pipe needs to be equipped with the stop valve. Spring-loaded safety valves are to be provided to protect the heating surfaces from excessive pressure as per the code.
The furnace temperature shall never be more than the ash fusion temperature, so as to avoid slag or clinkering formation in the boiler. Necessary heat recovery systems need to be designed to limit the boiler temperature.

All necessary provisions for normal maintenance access to be made. Access doors needs to be placed wherever required. Adequate space is to be provided between each tube bundle for adequate inspection and cleaning activities.
The pressure parts shall be equipped with large fitting doors for easy access to the grate bars during shut-down and with inspection openings in both radiation and heating surface sections.

The opening for the following needs to be provided in membrane walls

- Inspection doors / peep holes
- Auxiliary / start up / secondary burner
- Probes for gas-side measurements
- DeNOx system
- Inspection doors
- Frame for connection with expansion joint (in the 1st pass)
- Main supports for the walls
- Buckstays and their supports
- Probes, nozzles etc.

The membrane walls of the first pass and the furnace are refractory lined. The evaporator bundle is fully drainable.

(a) Refractory lined furnace in first pass and water cooled furnace rest of the passes complete with drum, water wall, headers, steam generating tubes, risers, observation ports, inspection doors/manholes, sample connections, Metal Temperature Measurement (MTM) thermocouples etc.

(b) Two (2) numbers of optical type temperature probes at the furnace outlet, complete with all accessories like guiding supports, cooling arrangement, control circuit, indicator etc.

Adequate quality of refractory lining to be provided for furnace and first pass. The lining shall protect heating surfaces from corrosion and erosion. The refractory lining shall be designed to achieve complete burnout of the waste without any deposits in different zones of the furnace and first pass of the boiler.

Alloy 625 type filler and cladding material to service temperatures below 450 °C. (such as cladding of membrane walls, evaporators and preheaters).

Alloy 686 type filler and cladding material to service temperatures above 450 °C.

Necessary arrangement to be provided for internal cleaning of the boiler if required with adequate hoses, hose reel, nozzle along with facility for draining of cleaning medium.

2.02.00 **Drum**

The single steam drum includes steam / water separating baffles or cyclones and all necessary pipe and trim connections. The boiler drum is welded construction and fabricated from steel plate. The drum features a manhole and all necessary nozzles, connections, and openings required for operation, maintenance and testing. All drum nozzles for valves, fittings and tubes are welded to the drum. All its internals, safety valves, mountings, fittings and accessories including the nozzle for connections and service manholes/suitable arrangement for checking and maintenance, necessary tapping points along with root valves for level measurement, drains, valves, piping and associated fittings.

2.03.00 **Super heater(s)**

The final superheater needs to be made of high temperature resistant alloy steel to avoid high temperature corrosion. Superheater(s) including safety valves, main steam stop valves at superheater outlet with integral bypass valves, drains, start up vents, air release valves, nitrogen connections, sampling connections, MTM thermocouples etc.

2.04.00 **Economizer**

In line, bare tube economizer, including vents, drains and sampling connections etc.

2.05.00 **Superheater Desuperheating Spray Systems**

Desuperheating spray type attemperators with headers shall be provided for the spray for Superheaters. The saturated steam leaving the steam drum is to be superheated in superheaters. Water spray type attemperators are to be installed between superheaters in order to accurately control the steam temperature.

2.06.00 The requirements indicated below for each leg of each stage of desuperheating spray system is for superheater spray system.

(a) Two (2) nos. pneumatically operated spray control valves, each rated for full duty with two (2) nos. motor operated isolating valves upstream & two (2) nos. manually operated isolating valves down stream of the spray control valves (2 x 100 % lines)

b) Drain lines with individual isolating valves.

(c) Quick acting pneumatically/motor operated block valve (with solenoid) at upstream of each superheater spray control station in common super heater attemperation line.

(d) Non-return valves in each individual spray leg nearest to the spray point.

(e) Welded type attemperation water flow nozzle before/ after spray control valve in the common line along with all accessories for flow measurements and controls.

2.07.00

VALVES

All necessary isolating, control, regulating, check and relief valves whether pneumatically operated, motor operated valves, hydraulic or manually operated including main steam stop valves, vent valves, drain valves, root valves, safety valves, mountings etc., as required for the steam generator integral piping system and associated piping system. All power operated valves shall be complete with actuator assemblies and accessories like limit switch assemblies, position transmitters, air locks etc. Integral bypass valves with actuators and accessories, for all high pressure isolating valves as specified. Any valve/ mounting not specifically indicated but required for safe/efficient/reliable operation of the steam generator shall also be included. The valves and accessories shall comply with the following requirements and shall include:

(a) All drain, vent, air release, instrument root, isolation drains and sampling lines shall be provided with two valves in series if the pressure is equal to or above 40 Kg/ cm^2(a) or temperature is above 300 degree Celsius. However, single isolating valve shall be acceptable in the other case.

(b) Main steam stop valves with motor drives along with double motorised integral bypass valves and piping.

(c) All necessary level control valves, electro hydraulic operated fast acting valve with safety features, their isolating valves, bypass valves, non-return valves and drain valves etc., for the start up recirculation circuit.

(d) One non-return valve and flow element on feed line(s) at inlet and as close as possible to the economizer.

(e) Drum and Main steam safety valves and drain pans.

(f) Superheater safety valves and the drain pans for these.

(h) Start-up drain and vent regulating valves with motor drives and position feedback transmitter with control from SG C&I system.

(i) Start-up drain and vent isolating valves with motor drives with control from SG C&I system.

(j) All start-up vents, lowest set pressure spring loaded safety valve at superheater outlet and lowest set pressure spring loaded safety valves on Drum shall be provided with silencers for each safety valve. The silencers shall enable meeting specified noise levels and the safety/ relief valve floats.

(k) All instrument tapping point with root valves. Two root valves in series shall be provided for lines above 40 kg/cm^2 (g) pressure or temperature above 300 deg.C.

(l) Isolating and drain valves for all gauge glasses.

(m) Necessary drain system including low noise drain valve to ensure draining of the steam generators in one hour without any assistance.

(n) A non return valve and isolation valve on steam generator fill line.

(o) Any other valves not mentioned specifically but needed to complete the system with drives, wherever required.

(p) Valves on atmospheric flash tank drain cooling water pipelines.

(q) The start-up, load maneuvering and shut down of steam generator is proposed from the central control room. The Contractor shall provide all required valves with their actuators and remote operation facilities to achieve this.

(r) All other operational requirements specified elsewhere shall also be complied with. The Contractor shall provide all required valves with specified type of actuator to meet such operational requirements.

2.08.00 **Soot Blowing System**

2.08.01 Soot blowers and soot blowing system shall be provided to effectively remove all ash deposits from the heat transfer surfaces of the Steam Generator. Short retractable rotary wall blowers shall be provided for the furnace long fully retractable rotary blowers for superheater and economizer. Each blower shall be provided with motor drive with coupling and coupling guards, base plate frame and holding bolts, speed reducers, cam, chain drives and other ancillaries, emergency hand cranks, flanges, gaskets, seals and bearings for each soot blower and its supporting structures.

2.08.02 Soot blower piping including supply piping to all soot blowers through pressure reducing station, drain piping, vent piping, relief valves and escape piping with silencer, support & hangers etc. Complete soot blower piping shall have warm up and automatic self draining features to preclude water being blown on to the heat absorption surfaces.

2.08.03 Valves for soot blower operation shall include pneumatically operated pressure reducing control valves, (one control valve of 0-100% capacity for all types of blowers taken in service in any combinations, one standby 0-100% capacity motorised inching valve with position feedback, drain valves), isolating valves with motor drives up stream of each of pressure control valves, all other valves and steam supply lines as required for soot-blower operation, coupling, air purge, vent and relief valves etc. Manually operated isolation valves on steam supply line shall be provided at each stream of furnace blowers or as per standard proven practice of the bidder. These valves shall be designed for full flow and shall be tight shut off type.

2.08.04 Complete soot blower control system inclusive of control system components, control cabinets, transmitters, sensors, temperature elements, interlocks, prefabricated cables and all required accessories shall be provided.

2.08.05 Wherever required, based on vendors experience, complete system of mechanical type soot blowing system shall be provided as per the vendors standard proven practice, considering the severe blocking of heat transfer coils – a general phenomena observed in most of the Waste to Energy plants.

2.08.06 Auxiliary condensate tank (if applicable) with necessary valves, fittings, lines, pumps, safety valve, level measurement system to collect condensed steam from various auxiliaries like SCAPH, leachate treatment system, bag filter heating system (if applicable) shall be provided.

2.09.00 **Steam Generator Integral piping**

All integral piping/fittings required for proper, efficient and safe operation of Steam Generator including links, headers, drains, vents and other integral piping. The piping shall be designed to meet the requirements of Indian Boiler Regulations (IBR) and the requirements indicated in Steam Generator Specifications. Any piping not specifically excluded and required for completion of Steam Generator and specification requirements shall be provided.

2.09.01	The scope covers all piping upstream of the Main Steam Stop Valve (MSSV) with by-pass arrangement including valves and piping, complete drain piping from various headers, desuperheaters, equipment etc. to drain collection headers, all piping downstream of and including the NRV on the feed water piping at economizer inlet, all piping associated with start up recirculation drain system, all auxiliary steam piping to SCAPH, and drain piping from SCAPH tank(s) to atmospheric flash tank – if any.
2.09.02	Drain collection headers and drain connection lines up to atmospheric flash tank – if any.
2.09.03	All drain piping from safety valves and drains of vent lines led to and terminated at ground level. All free drains, wash water drains discharge of fire fighting water etc, shall be taken up to and connected to the nearest drain.
2.09.04	All vent pipes and safety valves escape pipes to a level above boiler house roof. The vents on the headers and links shall be provided with drain lines connected to a common trough and further to and terminated at the drain trench at the ground level.
2.09.05	All hangers and supports with auxiliary steel structure, including columns and beams, base plates, foundation bolts, nuts and washers wherever applicable, weather hoods for pipes crossing ceiling & walls, drain funnel.
2.09.06	Thermal insulation with cladding and accessories for all piping covered herein.
2.09.07	Cooling water lines upto drain receiving Tank for cooling of tank drains.
2.09.08	Superheater (SH) attemperation lines along with attemperation system
2.09.09	Boiler fill lines, Start-up vent piping, Soot blower piping, Instrument air & service air piping
2.09.10	All the above piping systems shall be complete with valves, specialties, stubs including instrument stubs pipe headers, manifold, bends, elbows, reducers/expanders, matching flanges and suitable gaskets, nuts and bolts, etc. T-connections along with root valves in impulse pipes from where tappings are required to be taken for remote measurement in case provision does not exist for separate tapping points from the equipment for remote measurement and control. However all such T-connections and tapping points shall be subject to Employer's approval.
2.09.11	Drain lines up to atmospheric flash tank, as applicable.
2.10.00	**Draft Plant** Complete draft plant for the balanced draft system including the following:
2.10.01	**Induced Draft Fan** One (1) no. ID fan with VFD drive system with motor, base plates, foundation bolts, diffuser, drain point, coupling, coupling guard and silencer inlet box, discharge case,

coupling, coupling guard and suitable arrangement to prevent rain water entry to fan motor. ID fan shall be provided with bearing lubrication unit(s) consisting of.

(1) 2x100% oil pumps each with motor, coupling and coupling guard.
(2) 2x100% oil coolers.
(3) 2x100% filters, differential pressure switches, etc.
(4) One (1) oil storage tank.
(5) Instrumentation, vibration monitoring, inter connected piping, valves and fittings including pressure relief valves and NRVs.
(6) Electrical actuator with accessories etc.

At least two (02) nos. of duplex thermocouples or duplex platinum RTDs (100 ohm at 0^oC) and one no. of temperature indicators shall be provided for bearing metal temperature measurement, control and monitoring. Vibration measurement system also needs to be provided.

ID fans shall be suitable for the type of foundation and crane for handling needs to be provided.

2.10.02 **Auxiliary Steam Pressure Reducing Station**

Contractor shall provide complete auxiliary steam pressure reducing system to meet the auxiliary steam requirement during unit normal operation, intermittent auxiliary steam requirement of units and auxiliary steam requirement for the startup of units such as air preheater, seal air heater, water treatment system and deaerator.

Necessary system shall be provided with a pressure reducing station taking tap off from Main Steam (MS) or from turbine extraction (as per bidder's standard practice).

One electro-hydraulically/electro pneumatically operated steam pressure reducing valve**(**either combined pressure reducing valve cum desuperheating or pressure reducing valve with separate desuperheater) rated for full duty with a motorised isolation valve with integral bypass at the upstream and one number non-return valve and one number manual isolating valve at the downstream.

a) Spray control station (if applicable) comprising of one number of electro hydraulically / electropneumatically operated temperature control valve or one number each of pressure and temperature control valve, as the case may be, on the desuperheating spray water line rated for full duty with a motorised isolation valve at the upstream and one number non-return valve and one number manual isolating valve at the downstream.

b) Spray control station shall be provided with 100% capacity bypass arrangement, if required.

c) One pneumatically operated quick acting block valve (with solenoids) upstream of the Desuperheating spray water control station in common line.

d) One flow element upstream of station to measure total auxiliary steam flow.

2.10.03 Necessary piping, draining arrangement with valves, etc., integral to the Auxilliary steam station along with safety valves. The safety valve down stream of the steam pressure reducing valve shall be designed for a flow corresponding to the pressure

control valve fully open condition and the upstream main steam (as the case may be) pressure being maximum expected.

2.10.04 If Pressure reducing valves are provided with electrohydraulic actuators, the required oil pumps, accumulators, E/H converter instrumentation and other accessories to make the system complete shall be provided. The oil pumps and accumulators shall have redundant facility.

2.10.05 If Pressure reducing valves with pneumatic actuators are envisaged, microprocessor based electronic positioners with other accessories to make the system complete shall be provided.

2.10.06 All instrumentation as per the process requirements for Control/monitoring the plant.

2.10.07 All stub connections on Aux. PRDS headers are to be provided with isolation valves.

2.10.08 Isolation valves with blank flanges shall be provided on both low temperature as well as high temperature station headers for future interconnections.

2.10.09 SG C&I based control system as elaborated under relevant clauses of this specification.

2.11.00 Steam Coil Air Pre-Heaters (SCAPH)

Steam Coil Air Preheater's for primary and or secondary air (as applicable as per vendor's standard practice) and seal air shall be provided.

The SCAPH shall be installed on the Primary Air (PA) fan outlet with necessary dampers, along with drain pipe up to atmospheric flash tank, auxiliary steam piping to supply heating steam to each SCAPH from the auxiliary steam system along with individual temperature control valves shall be provided. Bidder shall design and supply adequate number of SCAPH's to raise the combustion air to a required level in order to achieve complete combustion of waste considering high moisture and the low energy content of Indian kind of Municipal solid waste.

2.12.00 Primary Air Fan (& Secondary Air Fan – if provided)

(a) One (1) number PA fan for each steam generator, with VFD drive system with motor, base plates, foundation bolts, drain line, inlet box, inlet bird and trash screen, diffuser, coupling, coupling guard and silencer.

(b) Lubrication for each fan consisting of:
- (1) 2x100% oil pumps, each with motor, coupling and coupling guard.
- (2) 2x100% oil coolers.
- (3) 2x100% oil filters along with differential pressure switches etc.
- (4) One (1) oil tank.
- (5) Instrumentation, vibration monitoring. Interconnecting piping, valves and fittings including pressure relief valves and NRVs etc.

(c) PA fans shall be suitable for the type of foundation being provided.

(d) At least two(02) nos. of duplex thermocouples or duplex platinum RTDs (100 Ohm at 0 Deg. C) and one no. of temperature indicator shall be provided for bearing metal temperature measurement, control and monitoring.

2.13.00 **Burner Air Fans**

2 x 100% burner air fans shall be provided. The fans shall be complete with motors, base plate, foundation bolts, coupling and coupling guard, air piping, dampers, supports etc.

2.14.00 **Burner Cooling Air Fans**

2 x 100% burner cooling air fans shall be provided. The fans shall be complete with motors, base plate, foundation bolts, coupling and coupling guard, air piping, dampers, supports etc.

2.15.00 **Air Nozzles / Flaps**

Required number of air nozzles / flaps / dampers shall be provided to distribute adequate supply of air to different zones of grate.

2.15.01 On line fuel measurement facility for accurate measurement of waste mass flow rate/ air fuel ratio shall be provided.

2.15.02 Cold air inlet duct to PA fan suction from waste pit, PA fan discharge to SCAPH, as applicable, bypass ducting for locating SCAPH downstream of PA fan.

2.15.03 Hot air duct from APH / SCAPH to grate.

2.15.04 Flue gas duct from economizer outlet to Flue gas cleaning systems. Economizer dust hoppers, (if applicable) and dust hopper for each pass shall be provided with high level Radio Frequency (R.F.) type ash level switches along with suitable access and platform for each hopper & ash level switches.

2.15.05 Flue gas ducts from Flue gas cleaning system to ID fans inlets and ID fans outlets to chimney flue inlet including chimney.

2.15.06 Gas recirculation ducting (if applicable) from downstream of ID fan to Steam Generator.

2.15.07 Adequately sized flow splitters, plates/duct stiffening devices, bracing, side plates, expansion joints, matching flanges, access doors and brackets, sampling points, ash hoppers, etc.

2.15.08 Supporting structure and hangers for all Ducting.

2.15.09 Suitable metallic type expansion joints wherever necessary shall be installed.

2.15.10 Economiser bypass ducting (if required) with gates and ash collection hopper as required along with high & low level RF type ash level indicators along with suitable access and platform for each hopper & ash level indicators.

2.15.11 Any other ducting required for the completeness of the system.

2.15.12 Provision for manual sampling (stub, nozzle, port, sampling port, door if any) of flue gas for Dioxin & furan measurement before chimney. Adequate platform / enclosure / approach with enough free space for movement of equipment and person to collect sample.

2.16.00 Dampers

2.16.01 Isolation dampers on all cold air, hot air, seal air, burner air, burner cooling air and flue gas ducting, before and after equipment on these systems and wherever required.

2.16.02 Interconnecting dampers on air and flue gas ducting where necessary.

2.16.03 Burner air registers (if applicable) with drives at burner wind box.

2.16.04 Regulating dampers in cold and hot primary air ducts at each grate section.

2.16.05 Supporting structure for all dampers & drives.

2.16.06 Access and platforms for all dampers and drives including gratings, toe plates and hand rails.

2.16.07 Any other gates/dampers required for the completeness of the system to ensure operational flexibility and on-load maintenance of any of the equipment or sections of the air/flue gas path, equipment & personnel safety etc.

2.17.00 Fuel oil System

Fuel oil system shall cater to LDO firing requirements of two (02) Steam Generators. Oil storage system such as oil tanks (considering start up / shut down / stabilization & secondary firing requirements), pumping systems like pump (2 x 100 %), oil strainer (2 x 100 %), oil recirculation, fire hydrant system etc.,

Start up burner

A oil preparation and firing system shall be provided with adequate firing capacity as per the grate and emission requirements. The above Fuel oil system shall also be capable of firing LDO fuel.

Secondary burner

Oil fired secondary burner shall be provided to maintain minimum gas temperature of 950 Degree C and minimum 2 seconds residence time. Appropriate sizing of this burner shall be done. The waste material allowed to feed into the boiler only when the furnace temperature is above 950 Degree C. Further, whenever the furnace temperature falls below the 950 Degree C, the secondary burner needs to be automatically put into service, so as to maintain 950 Degree C.

(1) Fuel oil burners complete with diffusers, tips extension pipes, air mixers, burner shut of valves / dampers, flexible hoses and all other ancillaries.
(2) HEA gas igniters for each burner (if applicable)
(3) Complete Piping along with suitable hangers, support etc, including following
  (i) Fuel oil piping

(ii) Interconnecting fuel oil piping integral to the system to make it complete.

(iii) All drain / vent piping from oil supply line along with all valves and fittings.

(iv) The oil piping shall be complete with isolating valves, relief valves, check valves, drain valves, vent valves, pneumatically operated control valves, strainers, accumulators, local instruments, sensing device, switches, flow meters, transmitters, controls such as pressure control, flow control, temperature control etc.

(v) Burner air piping complete with all valves, accessories, instrumentation etc.

(vi) Flame scanner instruments along with scanner cooling and control system, accessories, instrumentation etc.

(4) Adequate local and equipment mounted instruments and devices with connections required for pressure, temperature and other controls for supervision and interlocking with all associated auxiliary during purging, shut down and of sensing device.

(5) Trip valves on common fuel oil line to valves for each individual burner (if any) along with all accessories such air filter, regulators, limit switches, control valves, and connecting fittings to make the system complete.

(6) Integration with the furnace safeguard and supervisory system.

(7) All other piping valves and accessories as required to make the system complete.

(8) Supply of one (1) number of flow meter of suitable type (for oil fuel) for start up burner including all its accessories.

(9) Supply of one (1) number of flow meter of suitable type (for oil fuel) for auxiliary(secondary) burner including all its accessories.

(10) All local instrumentation (gauges, switches, transmitters etc.) and associated control devices for fuel oil system in Contractor's scope.

(11) Control system for oil firing system shall be implemented in SG-C&I system.

(12) Approval is required from statutory authorities for the entire oil firing system. Contractor shall prepare all necessary drawings/data/documents as per the requirements of the Statutory Authority and obtain the necessary approval from the authorities.

2.18.00 **Sampling Station**

Steam / Water sampling system shall be capable of measuring pH, conductivity, dissolve oxygen & Silica for boiler feed water, saturated steam, super heated steam to be provided.

2.19.00 **Chemical Dosing System**

Feed water dosing systems like Ammonia or Hydrazine, into the feed water to be provided as per vendor’s standard practice.

2.20.00 **Garbage Chute**

A garbage chute of minimum 500 mm dia and made from minimum 10 mm thick mild steel pipe shall be provided for each Steam Generator, from pent house level to ground level for disposal of debris & scrap generated during erection, operation and maintenance. The chute shall be provided with branch connections with doors & approach platforms at all platform levels. Garbage collection trolleys shall also be provided at the ground level.

2.21.00 **Galleries, Walkways, Roofing, Platforms**

2.21.01 Galleries, walkways, platforms, staircase, hand rails, ladders and gratings etc. as specified shall be provided at the Steam Generator floors including the interconnecting platforms between the Steam Generator floors and main building at least two (2) elevations.

2.21.02 Necessary access, platforms, walkways, handrails, staircase, ladders and gratings etc. for proper approach shall be provided for all equipments and accessories in the scope of this sub-section so that operators and maintenance personnel can function conveniently and safely. The above provision shall include but will not be limited to the following locations:

- Waste pit floor / feed hopper area.
- All maintenance hoist levels.
- All dampers and their drives.
- Slag extractor inlet chute level.
- All fans and associated motors.
- SCAPHs
- Air preheaters
- All valves.
- All Observation ports, access manholes etc.
- All soot blowers.
- Desuperheating station
- Drum floor
- Oil firing floor
- All Ash hoppers of each boiler pass, economizer, Air-Preheaters, economizer bypass (if provided) and duct (if any) which require fly ash removal by the ash handling system.
- All field control and instrumentation equipments.
- Storage platforms for storing of scaffoldings and other maintenance item during overhaul of steam generator(s).

2.21.03 Provision shall be made by the Contractor, for adequate space in various platforms, galleries etc. for locating local instrument enclosures and junction boxes etc. under contractor's scope without encroaching upon specified width.

2.21.04 The exact requirements of the access platforms, walkways, stairs etc., depending upon the layout and location shall be subject to Employer's approval during detailed engineering. Contractor shall furnish detail floor plan drawings covering all platforms and shall clearly indicate all the dimensions of platforms and clear platform floor area in each drawing.

2.22.00 **Elevators**

One (1) no. passenger elevator having a capacity of 680 kg. (or suitable for 10 persons) and one (1) number goods elevator having a capacity of 3000 kg for steam generator. The scope for each elevator shall include all items/accessories including all electrical equipment, services etc. required to meet all design, installation, operation, safety, protection and other requirements of IS:14665 (all parts). "Electrical Traction Lifts" (Latest Edition). The scope shall also include items/services needed to comply with requirements of IS: 14665. Two nos., adequately sized Air conditioners each having minimum cooling capacity of 2.5 Ton shall be provided for each elevator machine room to make it dust proof.

2.23.00 **Refractories and Insulation**

Refractories in furnace area, first pass and insulation including cladding, lagging, reinforcement, wire mesh, cleats and supports for all the equipment, auxiliaries, ducting, dampers, piping and valves in the scope of this specification so as to ensure skin casing temperature of any surface in Contractor's scope is not more than 60 deg.C. with ambient temperature of 45 deg.C. and air velocity of surface air being 0.25 m/s when the steam generator is operating at Full load.

2.24.00 **Field Control & Instrumentation Equipments**

All sensors such as transmitters (pressure, level, flow, temperature & diff pressure) for remote operation and gauges for local indication (pressure/temperature, level flow) and process switch devices shall be provided as per process requirements & automatic operation as defined in specification elsewhere, of all associated system and auxiliaries of steam generator.

2.24.01 Valve actuators conforming to specification requirement as detailed in relevant Sub-Section of Part-B shall be provided.

2.24.02 For actuators in HOT AREA such as air filter regulator, E/P convertor, air lock etc to be mounted away from actuator body to minimize chance of damage from high temperature.

2.25.00 **Special Tools & Tackles and Test / Measuring Equipments**

2.25.01 One complete set for each Steam Generator unit, of all special tools and tackles for maintenance of all equipments. Each set of tools & tackles shall necessarily include but will not be limited to following:

(a) Special tools & tackles for grate, ram, crane erection, testing and maintenance of equipment system including those required for instruments and controls.

(b) Set of maintenance tools, including following:

(1) **General Maintenance tools**

(i) Pulling cable, eyebolts, cable slings, chaining falls, snubbing lines or cables.
(ii) Bar and sledge hammers.
(iii) Brass and lead hammers.
(iv) Power type jacks and jacking screws.
(v.) Feeler gauges and shims.
(vi) Dial indicators.

(vii) Wire brushes & scrappers.
(viii) Bearing and coupling pullers.
(ix) Spanners and wrenches of various sizes.

(2.) **Special Maintenance Tools**

(i) Tube expanders for heat exchangers.
(ii) Lapping plates, grinding stones and ring cap for the valves.
(iii) The burner maintenance trolley with vice, burner.
(iv) Spanners and wrenches specific to the equipment.
(v) One intrascope suitable for inspection of all steam generator pressure parts. This shall be of the flexible optical fibre pattern appropriate to the design of the headers and shall incorporate low voltage lighting via either a portable transformer or rechargeable battery. A rigid type is not acceptable. It is envisaged that the instrument may be made in section to give adequate variations in reach to suit different headers. The viewing head must permit a vision of 90 deg., forward and/ or rear by interchangeable heads. The degree of magnification desired is 1:1 at a distance of about 70mm to 100mm with a maximum of 3:1 for very close viewing.
(vi) Two (2) nos. of pneumatic emergency retract drives with matching crank tools for each type of soot blower shall be provided along with required length of connecting pipe, fitting etc. Service air points for actuation of pneumatic drive shall be provided at convenient locations.
(vii) Any relevant special tools for hydraulic system of grate and feeding system (ram feeder) and its healthiness checking tools (if any).

2.25.02 One (1) set of power operated gondola or furnace maintenance cradle/cradle for furnace tube repairs and maintenance. Each set of gondola/maintenance cradles shall be suitable for complete and simultaneous coverage of all the four walls of a steam generator and shall be complete with all slings etc. Steam generators shall have suitable provisions for suspending this cradle from the top.

2.25.03 Complete lifting tools and tackles. Contractor shall provide motorized hoists and trolleys for all items requiring maintenance and weighing 500 kg or more. All auxiliary structures, monorails, runway beams for all lifting tackles, hoists etc., are included in Contractor's scope of supply. Access ladders with suitable platform shall also be provided for approach to all motorized hoists/trolleys mounted on their runway beams for the maintenance of hoists/trolleys. Items weighing more than 50 kg and required to be replaced for maintenance shall be provided with manual hoists/trolleys with runway beams/supporting structure etc.

2.25.04 One (1) set of quick erect scaffolding erectable inside of the grate / Steam generator ensuring full height coverage for capital overhaul. The man days required for erection shall not exceed 4 (four) considering the workforce deployed for 24 hours in 3 shifts a day or as per vendors proven practice. The locking arrangement shall not call for any welding.

2.25.05	One set of Igniter Testing kit shall be provided (if applicable) for the purpose of testing healthiness of (a) solenoid valve, power cylinder, limit switches of the igniter carriage assembly (b) igniter cable, rod and spark tip of the sparking system. This shall include stand for holding / fixing the igniter carriage assembly, LED for igniter advance/retract feedback, necessary air line accessories for solenoid/power cylinder operation, Pushbutton for advance/spark command, etc.. Installation and commissioning of the Testing kit shall be in the bidder's scope.
2.25.06	Base plates, foundation bolts, Anchor materials, matching pieces, inserts & packing shims etc. as required for steam generator and auxiliaries & associated equipment.
2.25.07	Auxiliary steel for piping supports, including base plates, foundation bolts, nuts, washers, 'U' bolts and hangers for drum, superheaters, furnace rear pass tubes, boiler passes (if applicable).
2.26.00	**SNCR System** Bidder shall supply multi level (atleast two level) SNCR system so as to reduce the NOx. The system shall be designed to provide control of NOx for the entire operation range of grate / boiler as mentioned in the firing diagram.
2.26.02	Required number of ammonia / urea spray nozzles per level in different sides of boiler (as per vendors proven practice) shall be provided to cover the entire furnace for better control of NOx. The bidder shall design number of nozzles considering outage of one or two nozzle for maintenance in each level.
2.26.03	An array (required to scan the entire furnace) of optical type of temperature measurement system shall be provided to monitor the furnace temperature and control of the SNCR operation.
2.26.03	The entire operation of SNCR spray nozzles like ON/OFF, selection of elevation/level, flow control of ammonia / urea etc., shall be fully automatic and based on the NOx level to be achieved at furnace exit.
2.26.04	There shall be provision to replace the SNCR spray nozzle at any point of time with isolation facility. The bidder shall supply nozzle cleaning tools / equipment as applicable. Further, bidder shall also supply test bench to check the performance of nozzle with required instruments for the same.
2.26.05	Bidder shall design and supply 2 x 100 % capacity equipment for SNCR spray system like pump, filter (as applicable), preparation system, flow meter etc., There shall be a system for flow meter with totalize facility to measure the actual amount of urea / ammonia injected.
2.26.06	The design of grate and combustion system (over fire air, secondary air injection, flue gas turbulence) shall such that NOx generation is always at minimum and optimize the SNCR operation, only when it is required.
2.27.00	**Segregation Facility** Solid Waste Management (SWM Rule) 2016, highlights the importance of segregation of waste and intend to feed only burnable waste into the grate for

burning in a waste to energy plant. Though supplied fuel is RDF, minimum segregation facility is required at site to prevent undesired material in waste.

2.27.01 **Scope**

The vendor has to suggest a preferred way for segregation of waste, considering the unsegregated nature of waste and its size/composition/climate/seasons. The exact process layout / sizing may be finalised during detail engineering stage, the same shall be approved by the employer.

2.27.02 **Layout**

In order to optimize the plant layout and to ensure minimum land requirement for the waste to energy plant, the waste which is unloaded into the waste pit needs to be carried to the segregation area, preferably located adjacent to the waste pit (opposite side of chute/boiler) with minimum transportation / movement. The area below the tipping floor (truck movement floor) may be utilised for conveying raw waste from the waste pit and returning the segregated waste into the pit. The waste pit crane may be used for loading raw waste into the segregation conveyor with necessary hopper type arrangement (if any), which supplies raw waste into segregation facility.

2.27.03 **Equipment**

In the segregation area, the equipment's such as removal of metallic / non-metallic materials, size reduction, removal of construction and demolition waste (if any) to be incorporated (such as shredder, conveyors, trommels, density separation, suspended magnet, metal detector as applicable) along with their final disposal and feeding lines (by conveyor or loading into truck). After segregation the waste which is suitable for burning needs to be conveyed back into the waste pit again for storage, mixing and feeding into chute of grate etc., All the drives / equipment shall be provided with adequate foul free approach for ease of operation and maintenance, platforms, hand rails, toe guards, fencing, ladders, enclosures, coupling guard, maintenance space etc.,

However, bidder may offer / suggest alternate suitable proven solution for segregation facility strictly meeting recent SWM rules subject to approval by the employer.

2.27.04 **Protection systems (fire/odour)**

There shall be system to avoid waste spillage during handling of waste and entire facility needs be completely covered on all sides and kept under slight negative pressure along with air cleaning, deodorization, chemical spray system to control smell, foul odour, waste degradation, anti-fly systems to ensure healthy working conditions.

Adequate system for fire protection, methane monitoring shall be provided covering the entire facility. All the equipment / systems shall be selected in such a way that the noise generated in the facility is well within the acceptable Indian industry standards. All the electric drives / lights shall be of flame proof type to avoid

damage due to fire/flame, which may also arise in the event of methane gas getting released from the biodegradation of waste.

2.27.05 **Leachate collection and treatment**

The leachate which is generated during handling of waste, requires to be collected and transported to the main leachate treatment facility. Separate storm water collection / cleaning water collection system needs to be provided (without mixing with leachate) and routed to corresponding liquid treatment systems. The floor of the system shall be designed in such a way that, it ensure self-draining of liquids into corresponding collection system without accumulation.

2.27.06 **Control system**

The entire segregation facility shall be operated & controlled by the DDCMIS system being provided by Bidder however there will be provision of local control & with least human interference. The segregation system shall have minimum 2 numbers of additional PTZ cameras & 2 numbers of IP based B-type PA stations in addition to as defined in C&I section of the specification.

SUB-SECTION–IIA-02

GRATE AND FLUE GAS CLEANING SYSTEM

1.00.00 1.01.00	**GENERAL SCOPE OF SUPPLY AND SERVICES** The scope of work for the equipment and accessories to be furnished in accordance with this Sub-section "Grate & flue gas cleaning" shall include design, manufacture, engineering, inspection and testing at suppliers works, packing, forwarding to site, unloading, erection, supervision, pre-commissioning, testing and commissioning and performance testing of the equipment/system and works indicated in this Sub-section of the technical specification. Any item or works though not specifically mentioned in this specification but needed to complete the equipment & systems to meet the intent of the Specification shall also be furnished.
1.02.00	**Tests** The scope of the Contractor includes all shop tests, type tests, site tests, routine tests, etc., fulfillment of complete quality assurance & inspection requirements and related activities for all the equipment & systems covered under the scope of work of bidder as per the stipulations of Technical Specifications.
1.03.00	**Pre-commissioning and Commissioning Activities** Contractor's Scope shall include all pre-commissioning and commissioning activities, required for successful performance of all equipment and systems under this Sub-section and shall include, but will not be limited to, activities detailed in Part-B of Technical Specification. Contractor's scope shall also include supply of all materials and services including the following for successful conductance of pre-commissioning and commissioning activities:
1.03.01	Complete pre-commissioning work including tests of facilities such as line flushing, hydraulic testing of pressure parts, air and gas tightness tests of steam generator enclosure, chemical cleaning of pressure parts, steam blow off etc. and all other tests as mutually agreed in the Contractor's quality assurance program as well as those identified in the specification.
1.03.02	Commissioning and initial operation of the facilities.
1.03.03	Supply of all consumables (except waste and oil for firing) like chemicals for chemical cleaning, passivation, inhibition etc., oil for line flushing, consumables for air/ gas tightness tests and any other consumable as may be required for above pre-commissioning/ commissioning activities.
1.03.04	(a) Supply of all temporary equipment such as tanks, piping, including supports, valves for successful conductance of pre-commissioning and commissioning activities. All temporary equipments, pumps, blowers, valves etc. brought to sites, by the Contractor for pre-commissioning/commissioning purpose shall be in good working condition to ensure its safe and reliable operation at site. All such temporary equipments/components shall be brought to site atleast three (3) months prior to commencement of relevant pre-commissioning/commissioning activities. On receipt of the temporary equipments/components at site, the same shall be inspected by the Employer to ensure its safe and reliable operation and if in the opinion of the Employer the temporary equipments/components are not in satisfactory conditions to ensure it's safe and reliable operation the same shall be immediately replaced by the Contractor. (b) The temporary equipment specifically brought by the Contractor solely for the pre-commissioning and commissioning work shall on completion of these activities, remain the property of the Contractor. (c) The selection of material of all the temporary equipments/ instruments shall be compatible with the service conditions expected during pre-commissioning/ commissioning activities. (d) All temporary equipments and instruments along with the respective control system shall be clearly listed out in the bid.
1.03.05	Supply of all labour, skilled/ semi skilled supervisors, engineers and any other manpower.

1.03.06 The scope of Contractor shall also include necessary approach & Platforms for all the instruments required during commissioning and testing. These approach platforms shall be provided to meet all required safety norms and these shall be of permanent nature.

The Contractor's scope of supply & services for “Grate & Flue gas cleaning” system shall include all equipment required for one (01) number of grate, waste feeding system with all necessary auxiliaries, integral piping, elevators, etc. Items though not specifically mentioned but needed to complete the equipment and systems to meet the intent of specification, shall be deemed to be included in scope of work of Contractor. The scope of supply and services for each Waste handling & Grate unit shall include all items indicated but will not be limited to the following

2.00.00 Waste Delivery

Waste (RDF/PROCESSED MSW) is delivered to the WtE plant by closed type trucks. Waste deliveries are typically scheduled Monday through Sunday during regular working hours. At the entry gate of the WtE plant, registration of all relevant information is to be noted. Further the trucks move towards Weigh Bridge and then enter into waste reception hall. The trucks further unload the RDF/processed waste into the waste bunker through waste bays.

2.01.00 Waste Logistics

Weigh Bridge

At least two numbers of weighbridges of adequate capacity shall be provided, suitably located at a location to record the weight of trucks while entering and leaving the pant premises. The waste is to be weighed at the weigh bridge, for knowing gross weight and net weight for recording the net receipts of RDF/PROCESSED MSW received at the plant on yard wise, truck wise and date wise. Hence, a suitable capacity of Weigh Bridge is to be envisaged which is having a minimum capacity of 50 Tons each. Both the weigh bridges are needs to be places side by side, so that the operator station can locate at the middle and oversee the operation of two weigh bridges.

2.01.01 A weight recording system shall be provided for recording the accurate data of actual vehicle payloads, which is further linked to vehicle and driver identification codes in order to capture and to record of all RDF/PROCESSED MSW delivered to the Plant and as well as residue (waste, bottom ash, fly ash), consumables (materials, chemicals etc.,) or waste fraction. The actual payloads of the truck are weighed both while entering the plant and while leaving the plant after having unloaded. The contents of RDF/PROCESSED MSW deliveries shall be identified and recorded. The computerized weights will be recorded automatically.

2.01.02 The system shall have the facility of recording using computer in e-form (data back up, printer, data retrieval etc.,) in a air conditioned room / provision to issue computerized slip containing vehicle number, Date, time, weight etc.,

2.01.00 Waste Reception Hall:

Waste reception hall shall be suitably sized to accommodate at least 8 large (20 m3) compactor trucks at a time. The hall shall be suitably sized considering reversal and positioning of trucks for unloading at various waste bays. Waste bays shall be separated by sufficient distance so that the trucks while parking shall not have chances of collision due to cramped space.

The waste reception hall shall be kept at negative pressure so that the odour does not escape the hall when the entry and exit doors are opened during truck entry and exit.

The waste reception hall shall have sufficient ventilators for entry of fresh air so that the truck drivers do not feel suffocated. The air from the waste reception hall shall be sucked into the waste pit/ bunker so that the odour from the waste pit does not escape into the waste reception hall.

The waste reception hall shall be provided with automatic operated gates which can be operated by push button/remote switch so that driver alone can open the gate and enter into the waste reception hall. Once the truck enters the reception hall, the doors shall close automatically to keep the hall under negative pressure. Similarly while exiting the waste reception hall, the driver shall be able to open the door by pressing a pushbutton/ remote

switch. In addition to the electric operation, provision should be there to operate the doors manually, in case the electric system fails.

2.02.00 **Waste Pit**

The waste pit needs to be designed to handle RDF/PROCESSED MSW for at least five days of plant capacity. The RDF is supposed to be in dry form, still in case of high water content in the waste, a drain system is to be provided with a pump to extract the water from the waste pit and the same is treated in the waste treatment plant, further the treated water is sent to the process water tank.

Five number of waste unloading bays shall be provided in the waste pit/bunker towards the waste reception hall. The waste bays shall have a screen to disallow oversized waste into the waste pit/bunker. A separate bay (out of the five bays) shall be provided for unloading oversized waste, which directs the oversized waste into the shredder inlet for breaking it into smaller sizes for disposing it into the waste bunker.

2.02.01 Primary air aspirated from the waste pit is required for maintaining the negative pressure in the waste pit/bunker, to avoid smell / bad odour. During normal operation, the primary air shall be taken from the waste-bunker. In order to maintain negative pressure inside the waste bunker, and to avoid foul smell to escape into the atmosphere, the bunker shall be properly sealed. In an emergency case, (for example waste bunker fire), there shall be provision to take the primary air from the boiler house instead of bunker house.

2.02.02 Methane sensor needs to be provided in all the area of waste pit to identify methane formation. The number of methane sensor shall be selected in such a way that, it covers the entire area of the waste pit and tipping bay area. The methane sensor needs to be interfaced with fire fighting system to avoid methane related fire / explosion.

2.02.03 The entire structure of the waste pit/bunker and roof needs to be painted with a high temperature resistant paint, which can withstand high temperature which is caused in case of fire in the waste pit. (minimum of Two coats of heat and acid resistant paint over above the vendors standard proven practice).

2.02.04 Fire fighting system shall consist of smoke detectors, manual fire alarm push buttons, zonal panels and central alarm annunciator panels. In addition a central alarm annunciation panel to be provided in the Plant control room as well as in the plant fire fighting room. Each detector is to be of addressable system. Fire fighting equipment shall facilitate fire fighting in the event of detection of fire in the total Plant area including electrical rooms, control rooms, waste Pit etc. as specified in the Fire Safety Rules of TAC shall needs to be provided.

2.02.05 **Shredder**

Required size and capacity of one number of shredder shall be designed & supplied by the vendor. The shredder shall be located in the waste bunker area, with adequate feeding hopper facility of loading only oversized RDF/PROCESSED MSW into the shredder by the grab crane as well as unloading bay.

2.02.06 **Segregation**

Though supplied fuel is RDF/processed MSW, though Bidder shall provide minimum required equipment and system for Mechanical separation of burnable and non burnable; size reduction through shredding, separation and screening to prevent any undesirable material from going grate.

2.03.00 **Tipping bays**

This is the area from which waste is delivered into waste pit. The tipping hall shall be provided with at least five numbers of unloading bays with individual automatic power operated gates/shutter.

2.03.01 Fire fighting system shall consist of smoke detectors, manual fire alarm push buttons, zonal Automatic system for guiding incoming waste laden truck in tipping floor to unload waste in designated chute (vehicle guiding system coordinated with waste pit monitoring system). Display of chute number and automatic opening of door / shutter of particular chute to unload the waste needs to be provided. The tipping bay needs to have adequate space for the vehicle to move around without any hindrance.

2.03.02 The layout shall be designed in such a way that the vehicle delivers the waste into the waste pit, shall no way topple down in to the waste pit. Appropriate barricade / suitable means to be provided to stop the vehicle at safer distance from the pit and ensure complete empty of vehicle in addition to delivery of waste only into the waste pit not outside the waste pit.

2.04.00 Waste Crane

Waste crane is required to clear the waste from the tipping bays, mixing and transferring it to the feed hopper and stocking of waste. In general, one crane shall be in operation, the second crane is on stand-by for higher availability. The crane shall be remotely controlled from the crane operator's cabin located in the control room at slightly higher level than the feed hopper. The location of the operator cabin is at the same side of the feed hopper (at corner and towards the boiler side). The location shall need to facilitate the ease of view for the operator to oversee the entire waste pit including tipping bays, boiler feeding chute, shredder etc.

2.04.01 The crane cabin needs to be a situated as a part of main control room next to the feed hopper. Full visibility of entire waste pit, waste level in the feed hopper, crane operation without any hindrance, tipping bay gates shall be visible from the grab crane operator seat.

The envisaged crane system has to meet the following functions

- Charging the feed hoppers.
- Feeding of oversized RDF/PROCESSED MSW into shredder.
- Re-piling and mixing of the waste.
- Keeping the dumping areas clear.
- Weighing the waste feed rates.

The waste crane shall be designed such that the firing line can be charged and that there is enough time to keep the bunker dumping areas clear and allow a scheduled re-piling of the waste.

2.04.02 The waste grab crane is equipped with a weight measuring system to record the waste flow transported to the feed hopper. The grab is selected based on its suitability for handling Indian kind of waste. For crane operation, fully automatic with manual provision needs to be available. Fully automatic operation of crane without operator intervention needs to be provided.

2.04.03 The grab shall be designed for storing of waste in waste pit, shredding for oversized waste, mixing of waste by using automated grab crane system integrated with necessary control system, computer integration, and display of weight in each cell of waste pit (additional provision for manual operation of crane at any time).

2.04.04 Operation in dangerous zones, such as in front of the operator's cabin needs to be prevented by hardwired limit switches and programming in the semi and full automatic modes. To prevent damage by the grab the waste crane is equipped with control and monitoring devices next to walls and steel structures. The waste crane needs to be designed as a bridge crane with a grab trolley, hoisting gear and electro hydraulic motor grab. It includes the motor control cubical (MCC), switchgear and control consoles required for smooth & safe operation.

The crane is designed for clearing the unloading area, mixing, stocking and continuous feed of waste (24h/day, 7 days/week).

2.04.05 To simplify maintenance and upkeep, the design emphasizes good accessibility and easy changeability of components. The maintenance space for the grab crane needs to be provided in either side of the waste pit, to facilitate ease of maintenance of individual grab crane. One spare grab needs to be provided. The hydraulic power pack up of the system shall be of 2 x 100 % for pump, filter, cooler, actuator etc., to ensure the standby availability.

2.04.06 Four display screens shall be provided for grab crane operator to view the unloading bay, waste pit, shredder top view, feed hopper top view.

2.04.07 Fisher grab (in addition to waste crane) of suitable capacity and size to be provided above feed hopper (to cover the entire area of hopper with rail) for removal of RDF/PROCESSED MSW from feed hopper in case of feed hopper chocking / jam / fire in the hopper etc., Necessary control system / drive to be provided for safe operation from both local and remote of the same. Provision of maintenance bay for fisher grab needs to be provided.

2.05.00 Fire fighting in Waste pit

Automated temperature / flame monitoring system in waste pit, shredder, bunker area with adequate fire fighting equipment, which has provision to operate both manual / auto option. A system of continuous mapping of entire waste pit using an infrared device for sensing high temperature / fume areas and automatic spray of water whenever required needs to be provided. The bidder to supply required fire fighting system including fire water pumps, valves, hose, fittings, piping, nozzle, related drives etc.,

2.06.00 Leachate treatment system

Leachate collection system for waste pit shall be provided to collect leachate from the waste pit with necessary tank for storing. Tank level measurement of both local and remote indication and automatic control of pumps shall needs to be provided. The collected leachate needs to be pumped to the leachate treatment facility. Necessary leachate treatment system for reuse of water. All the drives in the leachate treatment shall be of 2 x 100 % capacity. Adequate space for maintenance for leachate treatment equipment needs to be provided, together with methane sensor, fire fighting system etc., Leachate system shall be of evaporative type using steam extraction either from boiler / turbine. Necessary system needs to be provided to dispose sludge / solid waste generated from leachate treatment system.

2.07.00 Feed hopper

The hopper shall be designed such that it feeds waste into the furnace, sealing of furnace from outside environment. The feed hopper shall be designed to have a waste column in the waste chute which allows a continuous feed to the grate in the combustion chamber, prevents trap air flowing into the combustion chamber, prevents backflow of flue gas to the waste pit in case of short term overpressure in the combustion chamber.

2.07.01 The entire hopper and feed chute shall be made of adequate steel to avoid any wear and tear, facilitate ease of flow of material, without rusting / corrosion. The slope of the hopper walls is to be designed in such a way to prevent arch build-up and to ensure continuous feed to the grate in all the loading conditions. Adequate size and capacity of feed hopper to be made considering the entire operating range of the grate, considering margin. Further, the feed chute needs to be designed to resist thermal stress that may occur during operation and thermal expansion if any. The volume of the inlet chute shall be capable to charge at least 1 hour waste or as per the vendors proven practice.

2.07.02 The column of waste in the feeding hopper shall always to be sufficiently height, which is verified by 2 level monitors installed at the top and bottom. The hydraulically actuated cut-off

gate shall be provided to close whenever the level of waste in the feeding chute (level probe) has dropped below the minimum alarm level.

2.08.00 **Feed Hopper Cooling System**

Cooling of the feed chute parts needs to be provided that are exposed to extreme thermal loads. Feed chute and support frame are needs to be equipped with a cooling water jacket. A feed system needs to be envisaged to be provided to fill the water system and compensate for any water losses.

2.09.00 **Ram feeder**

Adequate systems are to be provided to feed the waste to the incineration grate. At least two ram feeder of 2 x 60 % feeding capacity or as per the vendor standard practice shall be provided. The ram feeder shall be of hydraulically operated type with necessary hydraulic systems. The hydraulic power pack up of the system shall be of 2 x 100 % for pump, filter, cooler, etc., to ensure the standby availability. There shall be provision to operate the hydraulic feeder both automatic and manual mode. The speed of the ram feeders shall be controlled by combustion system automatically based on the actual feeding requirement and shall stop the feeding of waste when boiler temperature falls below 950 Degree C, to avoid pollution.

2.10.00 **Grate**

The grate size shall be designed to allow thermal treatment of waste according to the combustion diagram proposed by the vendor. The entire support structure needs to be designed to allow thermal expansion. The movement of grate bars / system shall be optimized to promote combustion of low heating value waste by proper mixing. All the hydraulic elements in the grate shall be adequately designed for movement of waste through the grate and finally transport bottom ash to the extractor.

The grate & all the auxiliary of he unit shall be designed as the requirement prescribed in the Annexure I (Firing Diagram)

2.11.00 **Grate cooling**

The vendor shall need to propose the best technology for grate cooling considering the nature of Indian waste (either air / water cooled type). If air cooling is being offered, provision should be there for its conversion into water cooling system in future.

2.12.00 **Hydraulic Power drives**

Combined or separate hydraulic station needs to be provided for ram feeder and grate, but each system shall be separate control block with necessary control system and redundancy.

Ram feeder system

Pumps	: 2 x 100 %
Filter	: 2 x 100 %
Cooler	: 2 x 100 %
Accumulator	: 1 x100 %

Grate system

Pumps	: 2 x 100 %
Filter	: 2 x 100 %
Cooler	: 2 x 100 %
Accumulator	: 1 x100 %

3.00.00 **Combustion air system**

The combustion system shall be capable of regulation of air for the combustion on the grate. Combustion air shall be aspirated from the waste pit, measured and distributed to the different locations (Primary Air, Secondary Air & wall cooling). There shall be a reliable

measurement using a venturi system for air flow measurement. There shall be provision to distribute the air by adjusting flaps and slide gates. A flue gas to air heat exchanger shall be provided to reach sufficiently high primary air temperatures for burning low calorific waste with high water content, suitable for Indian kind of waste.

3.00.01 Bidder to provide adequate system for supplying and controlling of hot pre heated primary air into the different sections of the grate at different suitable temperature level such as preheating zone, drying zone, combustion zone, re-burning zone (as applicable) in order to ensure complete combustion of high moisture content / low calorific value Indian kind of RDF/PROCESSED MSW.

3.01.00 **Secondary air system**

Secondary air injection system shall be designed to ensure complete combustion of waste for facilitation good mixing and burnout. Secondary air may be supplied from separate fan or tapped of from primary air fan, as per vendor's proven practice. Flow of secondary air needs to be measured using a venturi tube system and regulated by an automatically operated flap / damper / gate.

3.02.00 **Cooling air system**

Necessary system shall be provided for cooling of refractory walls to prevent caking of fly ash.

The opening for the following needs to be provided in grate zones

- Inspection doors / peep holes
- Auxiliary burner / start up burner
- Probes for gas-side measurements
- Inspection doors
- Provision for mounting flame camera
- Probes, nozzles etc.

4.00.00 **Special Tools & Tackles and Test / Measuring Equipments**

One complete set all special tools and tackles for maintenance of all equipments for grate. Each set of tools & tackles shall necessarily include Special tools & tackles for grate, ram, crane erection, testing and maintenance of equipment system including those required for instruments and controls.

5.00.00 **FLUE GAS CLEANING SYSTEMS**

The Contractor's scope of supply & services for flue gas cleaning shall include all equipment required for flue gas cleaning of flue gas generated from municipal solid waste fired steam generating units having steam parameters with all necessary auxiliaries, integral piping, elevators, etc. Items though not specifically mentioned but needed to complete the equipment and systems to meet the intent of specification, shall be deemed to be included in scope of work of Contractor. The scope of supply and services for each steam generating unit shall include all items indicated but will not be limited to the following:

5.01.00 The flue gas ducts are to be sized to prevent excessive pressure losses and avoid high gas velocities. Special attention is paid to optimum flow dynamics as well as to the design of diverters and inlets. Where required, access doors are to be provided for the inspection and maintenance of the flue gas ducts and the plant components associated with them. The ducts are needs to be reinforced in order to prevent vibrations under pulsating flow conditions.

5.01.01 During start-up and shutdown processes, necessary arrangement is to be provided to avoid temperature drop below dew point. The condensate produced in such instances is drained at the low points or upstream of the expansion joints. Flue gas bypass system for flue gas quenching reactor and Bag filter shall be provided as per vendor's proven practice.

5.01.02 As per the vendors proven practice flue gas heating system shall need to be provided to heat the flue gas during start up / shut down period. The flue gas ducts between the ID-Fan and the stack are operated under positive pressure. These ducts feature leak-tight designs (particularly of doors and expansion joints).

5.02.00 Emission Measurement

The emission measurement system shall be continuous monitoring type capable of measuring the flue gas properties and composition in the stack. The main system components shall include

- Instruments for temperature, pressure and flow rate measurement
- Measurement instrument for particulate matter (dust)
- Gas concentration measurement system for determination of gaseous flue gas components (H2O, O2, CO2, CO, HCl, SOx, Nox, HF, heavy metals, TOC, Hg etc.,)

5.02.01 All these instruments need to be installed directly on the flue gas duct. The emission measurement system is to be designed to meet the particular requirements of the operating permit for the plant. CEMS are to be supplied along with all fittings, connections and interfaces as needed.

5.02.02 Provision for manual sampling (stub, nozzle, port, sampling port, door if any) of flue gas for Dioxin & furan measurement before chimney. Adequate platform / enclosure / approach with enough free space for movement of equipment and person to collect sample.

5.02.03 Online measurement using reliable instruments capable of measuring all the pollutants in the flue gas, recording of the same, retrieving, transfer data into another storage medium as defined in C&I section of specification & upload data in to website.

5.03.00 **Flue gas cleaning system**

The flue gas cleaning system shall be of semi dry type / dry type consists of evaporation cooler, lime / hydrated lime and activated carbon injection in order to meet the required emission norms as prescribed in SWM rule 2016.

5.03.01 **Evaporative cooler / Reactor**

Evaporative cooler shall be designed as a vertical mounted cylinder in its own support structure. The flue gas conditioning is based on the evaporation of atomised water. The water injection system along with nozzle and pressure pump (2 x 100 % capacity) needs to be supplied. The water supply into the head tank shall have a level controlled type. The volume of atomised water shall needs to be controlled in response to the flue gas temperature at the outlet of the evaporation cooler. Water spray needs to be optimized for temperature regulation and activation of the reaction process. There shall be a provision to measure the amount of water sprayed, by means of flow measurement device for remote indication. The water injection shall be automatic based on flue gas temperature.

5.03.02 **Chemical injection**

The adsorbents like hydrated lime / lime and activated carbon shall be designed to be added to the flue gas path after evaporation cooler.

5.03.03 **Additive handling**

Complete system for storage of lime and activated carbon including silo, pneumatic / mechanical handling, exhaust fans, metering system, level measurement system for silo, fire

	protection system, emptying system for silo (in event of fire / chockage clearing) needs to be provided. Appropriate system shall be provided for handling of activated carbon and lime stone from silo (mechanical / Pneumatic conveying).
5.03.04	There shall be a provision to measure the amount of lime and activated carbon spray, by means of flow measurement device for remote indication and control. The chemical injection shall be automatic based on flue gas temperature / emission level. There shall be a totaliser for amount of lime and activated carbon injected into the system.
5.03.05	The vendor shall need to supply lime and activated carbon unloading system to unload the chemicals from supplier vehicle and store it in an adequately spaced storage room. Necessary tools to measure the purity of chemicals and other required parameters needs to be provided. The silos shall be designed in such a way to ensure free flow of chemicals without any requirement for regular check up. Appropriate safety device needs to be provided for silo against over pressure etc.,
5.03.06	Necessary level control / display of silo needs to be provided to facilitate loading of chemical into the silo. The system of loading / unloading of chemicals shall be fool proof to avoid any dust emission.
6.00.00	**FABRIC BAG FILTER** Contractor's scope shall include supply fabric bag filter complete in all respects with all components and accessories etc., The scope shall include but will not be limited to the following
6.01.00	One fabric bag filter for each Steam Generator of 1 x 500 TPD units complete in all respects including all components and accessories stated in this section.
6.01.01	Each fabric bag filter shall consist of number of filter chambers independent casings including outside shell, structural steel supports and frame work, access ladders, platforms, safety rails, stairways, walk ways, access doors and weather proof pent house etc.
6.01.02	Matching flanges along with all bolts, nuts, gaskets, and all the expansion joints etc. as required to connect the fabric bag filter passes to the duct work.
6.01.03	Flue gas inlet distribution system complete with perforated plates, turning vanes, deflector plates, flow splitters, guide vanes and all necessary gas flow control devices in the inlet and outlet cones and duct, warranted by the results of flow model test, complete duct stiffening devices, interior bracings, slide plates, access doors, brackets, supporting structures, hangers, sampling connections, etc.
6.01.04	Fabric bag filters, its cage, retaining slots and holding, online cleaning systems.
6.01.05	Ash hoppers complete with panel type heater, level monitors and indicators, outlet flanges, jointing material, poke holes, access doors and walkways beneath the hoppers.
6.01.06	Foundation base plates, bolts along with templates, nuts, anchor materials, packing shims, inserts & embedments along with lugs etc.
6.01.07	Opacity monitors complete with all accessories at the outlet of each filter chamber in parallel (if applicable) of fabric bag filter upstream of the ID Fan.
6.01.08	Inspection and maintenance access doors, frames and safety locks.
6.01.09	Safety devices, safety barriers, etc.

6.01.10	Monorails with electrically operated hoists including monorail beams on the roof for handling filter bags (if any).
6.01.11	Water washing system for the fabric bag filter and its hoppers along with all piping, valves and nozzles etc.
6.01.12	Thermal Insulation, Lagging, Cladding & Refractories. Thermal Insulation along with aluminum cladding, lagging, reinforcement wiremesh, cleats and supports, shall be provided for all the equipments/surfaces having skin temperature more than 60 degree Celsius. The insulation shall be as specified in Sub-Section-IIIA-10, Part-B Section-VI.
6.01.13	Dressing of foundations, grouting of pockets and underpinning of base plates for structures/ equipment etc., civil works associated with directly buried cables.
6.01.14	Corrosion protection painting for structures as described in the specification.
6.01.15	Sheeting work for roof (pent house)/ canopy/ side cladding.
6.01.16	Fabric filter shall be designed to separate solids from the flue gas and formation of an adsorbent layer on the filter surface for further reaction of pollutants. The solids are separated from the flue gas in the fabric filter, which is located downstream. Residues are extracted from the system.
6.01.17	Pressure drop of the flue gas passes through the filter bags needs to be uniform in the filter bags. There shall be provision for automatic cleaning of filter bags. The cleaning operation needs to be controlled in relation to the pressure drop. From there, the solids need to be conveyed into conveyors for discharge into the residue silo.
6.01.18	The control system required to operate and clean the filters shall be installed in a control cabinet in the immediate vicinity of the fabric filter.
6.01.19	Compressed air cleaning shall be provided from reservoir (one per filter chamber). From there air needs to be distributed by nozzle lances to each row of filter bags installed.
6.01.20	The fabric filter shall be provided with high level Radio Frequency (R.F.) type ash level switches along with suitable access and platform for each hopper & equipped with differential pressure, temperature and level measuring instruments. The devices shall assure the supervision of the filter operation and the detection of possible malfunctions well in advance.
6.01.21	The filter house shall be of welded sheet steel construction with external sectional steel reinforcements. Stripper sections are to be provided inside the chambers to separate the raw gas and clean gas sides. These sections shall have openings for the attachment of the filter bags with snap ring fasteners. The hoppers underneath the filter chambers shall be of welded sheet steel constructions and are equipped with access doors.
6.01.22	On top of the clean gas chamber there shall be an accessible platform with complete enclosure.
6.01.23	Enough space shall be provided to install and remove bags from the fabric filter via horizontal access doors to the clean gas chamber.
6.01.24	Each filter bag shall be fitted with an internal spreader consisting of longitudinal bars, spacer rings and press-fit bases.

6.01.25 There shall be provision to prevent dew point undershooting and solids deposition during start-up, shutdown, and during operational interruptions the fabric filter hoppers are to heated with electric heaters. If required flue gas recirculation system with heating provision to be adopted as per vendor's proven practice.

6.01.26 The compressed air requirement for de-dusting of bag filter shall be provided. The system of de-dusting of bag filter shall be designed to have minimum noise during operation. Adequate instruments needs to be provided in the bag filter for remote monitoring of

- Inlet and Outlet pressure / temperature
- Inlet and outlet moisture concentration
- Inlet and outlet dust concentration
- Inlet an outlet CO/CO2/ O2 concentration
- Differential pressure across bag filter

6.01.27 Flue gas bypass system for flue gas condition tower and Bag filter if required, as per vendor's proven practice.

6.01.28 Adequate fire fighting system needs to be provided for the bag filter area with necessary fitting, valves, lines, nozzles etc.

6.01.29 There shall be a automatic system for control of flue gas inlet temperature into the bag filter.

7.00.00 Ash Handling System

The contractor shall provide ash evacuation system to collect and transport ashes (different pass of the boiler & Economiser) from the boiler to ash handling silos.

Separate Silos shall be provided for hazardous and no hazardous ashes. There shall be a system for transporting the ash either by mechanical / pneumatic means to the silo. The silo shall be made of welded carbon steel. The silos shall be of adequate capacity to store ash for 3 days without evacuation.

The silos shall be equipped with a mechanical system for easy discharge and fine particles are separated by an exhaust filter

The level in the silo needs to be measured continuously; the maximum fill level is detected by a level switch. Necessary heating system to be provided for bag filters hoppers to maintain uniform flow of ash from the bag filter hopper.

The silo shall be provided with thermal insulation. The silo shall be placed on an elevated position to facilitate loading along with bottom ash belt conveyor.

7.01.00 Inspection and maintenance access doors, frames and safety locks.

8.00.00 Environmental performance

The bidder shall need to design the flue gas cleaning systems to maintain maximum emission from the unit shall not be more than the tabulated as follows during the entire operating range of grate operation for the range of waste specified. The emission shall needs to be continuously measured and recorded and also to be upload into the plant website.

The vendor shall guarantee that maximum emission from the unit shall not be more than the tabulated as follows within the load range defined by the Firing Diagram (LP D – 1 – 2 – 3 – 4 – 5 – D) and also in the region provided as overload area.

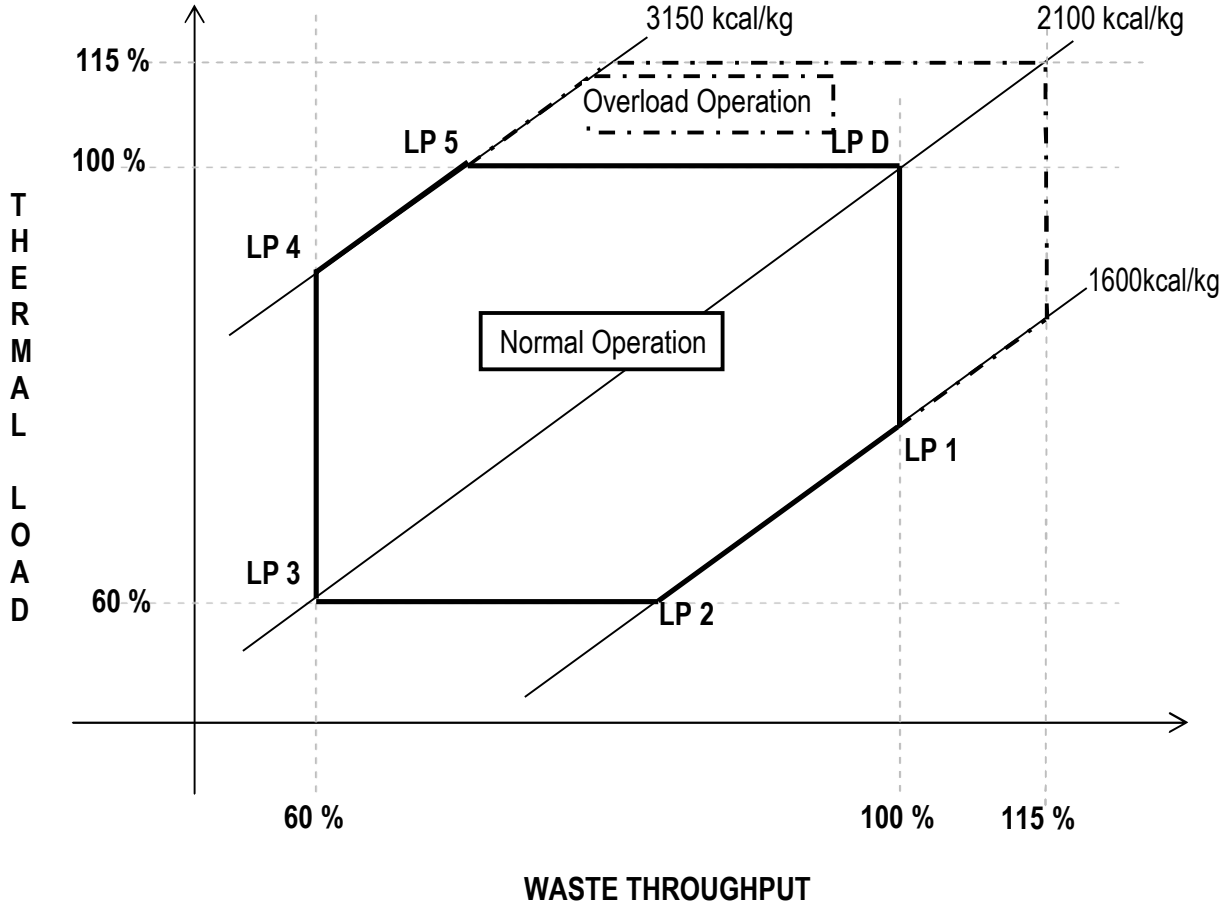
Sl.No	Parameter	Unit	Emission value at 11 % vol O_2 Dry	Sampling average Time
1	Dust (particulates)	mg/Nm^3	25	Half hourly average
2	CO	mg/Nm^3	40	Half hourly average
3	NOx (NO and NO2 expressed as NO2)	mg/Nm^3	200	Half hourly average
4	SO_2	mg/Nm^3	100	Half hourly average
5	HCl	mg/Nm^3	25	Half hourly average
6	TOC	mg/Nm^3	10	Half hourly average
7	HF	mg/Nm^3	4	Half hourly average
8	Heavy metals Sb + As + Pb + Cr + Co + Cu + Mn + Ni + V + their compounds	mg/Nm^3	0.5	Half hour to 8 hours average
9	Hg and its components	mg/Nm^3	0.05	Half hour to 8 hours average
10	Cd+Th + their components	mg/Nm^3	0.05	Half hour to 8 hours average
11	Total Dioxins and Furans (TEQ)	ng/Nm^3	0.1	6 to 8 hours average

Note.- All values corrected to 11% oxygen on a dry basis

Combustion conditions	min. 950°C / 2 s
Bottom ash quality	TOC ≤ 3% or LOI ≤ 5%

ANNEXURE - 1

Firing Diagram



Details of Various Load points in the Firing Diagram

POINT	ENERGY CONTENT [kCal/kg]	LOAD POINT [%]	THROUGHPUT [%]
LP D	2100	100	100
LP 1	1600	~ 78	100
LP 2	1600	60	~ 81
LP 3	2100	60	60
LP 4	3150	~ 90	60
LP 5	3150	100	~ 68

Note: Energy content - Lower calorific value as NCV (dry basis)

1. In addition, the vendor needs to provide a margin of 15 % for both Waste throughput and thermal load beyond 100 % as overload area, as shown.
2. Bidder should clearly define the operation area requiring supplemental fuel in this diagram.

SUB-SECTION–IIA-03

STEAM TURBINE AND AUXILIARIES

1.00.00 **STEAM TURBINE AND AUXILIARY SYSTEMS**

1.01.00 **Steam Turbine**

Rating

The steam turbine generator unit shall conform to the following design and duty conditions:

(i)	Output under economic maximum continuous rating (EMCR) at generator terminals	At least 14.9 MW
(ii)	Turbine throttle steam pressure	40 kg/cm2
(iii)	Turbine throttle main steam temp.	400 °C
(v)	Design & operational requirement including variations in rated steam temp. & pressure	Generally as per IEC 45 or otherwise specified elsewhere in the specification
(vi)	Condenser pressure	120 mm to 135 mm of Hg (abs) at 40 °C ambient Condenser vacuum greater than 135 mm of Hg at 40°C ambient shall not be accepted. No evaluation credit shall be given for heat rate offered for vacuum lower than 120 mm of Hg at 32°C (ambient)
(vii)	Turbine speed	As optimized by the bidder to suit the grid condition.
(viii)	Frequency variation range around rated frequency of 50 Hz	+ 3% to - 5% (47.5 Hz to 51.5 Hz)
(ix)	DM water make up to thermal cycle under EMCR condition	3% of throttle steam flow
(x)	Turbine protection against water induction	As per ASME-TDP-I-latest edition
Xi	Steam Extraction for heating/cooling/ industrial use	Internally controlled extraction to provide up to 60% of the steam at

		the upstream of the extraction point to provide steam at 8 ata at the terminal point.

TMCR: The term "TMCR" (Turbine maximum continuous rating) appearing in the technical specification shall mean 14.9 MW or more electrical power output at generator terminals under rated steam parameters, 0% cycle make-up and 160 mmHg (abs) condenser pressure unless used in conjunction with a different cycle make-up and/or a different condenser pressure and /or a different throttle steam pressure.

EMCR: The condition corresponding to economic continuous maximum rating (EMCR) at generator terminal shall be 14.9 MW or more output under rated steam conditions with cycle make up of 3% of throttle steam flow and design condenser pressure.

VWO: The condition corresponding to valves wide open to generate 17.1 MW or more at generator terminal at rated steam parameters and design condenser pressure.

In case of static excitation system, the EMCR/TMCR/VWO output at generator terminal shall be at least 14.9 MW plus excitation power requirement.

1.02.00 **MATERIAL REQUIREMENTS**

The proposal shall include the schedule of materials used in turbine construction indicating chemical composition and designation of materials for following components:

Description

(i) **Turbine Casing**

Turbine casing

Turbine blade carrier

(ii) **Turbine Shaft and Shaft Coupling**

(iii) **Moving Blades**

First stage

Other stages

(iv) **Fixed Blades**

First stage

Other stages

(v) **Casing Joint Bolts**

(vi) **Turbine steam admission valves**

Valve Body

Valve Spindle

Valve seat

The steam turbine shall be built up using materials which are proven for rated turbine inlet

steam temperature.

1.03.00 **MAINTENANCE REQUIREMENTS**

(i) Turbine Preservation:

(a) Provide Portable Turbine preservation system to protect against corrosion during idle periods.

(b) Write-up on the recommended system to be furnished.

1.04.00 **TURBINE CASING**

1.04.01 The turbine casing design shall have following features:

(a) Turbine casing design: Maximum pressure & temperature to be encountered during service including as specified under operational capabilities.

(b) Adequate drainage facility with temp. sensing devices in casings, strainers housings, stop and control valves, extraction lines etc. and drain lines.

(c) Provide pressure relief bursting diaphragm for turbine casing to limit the exhaust hood pressure within a safe margin from design pressure.

(d) Provide a completely self contained exhaust hood spray system for turbine casing to protect the turbine against excessive temperature due to windage at no load / low load and turbine bypass operations.

(e) Bearing inspection should be possible without necessity of dismantling the turbine casing.

1.05.00 **STEAM TURBINE ROTORS**

(a) Maximum permissible shaft vibration measured at bearing housing will be as per zone A of ISO 7919 and maximum permissible bearing vibration measured at bearing housing will be as per zone A of ISO 10816-2.

(b) Critical speed of composite rotor and blade assembly shall not be within -10% and +15% of rated speed.

(c) Turbine assembly radial seal clearances at rotor blade tip and inter stage area shall not be less than 0.8 mm.

1.06.00 **NOZZLES AND BLADES**

(a) Ensure that there is no resonance of turbine blading in the continuous operating frequency range of 47.5 Hz. to 51.5 Hz. Furnish Campbell diagrams for all free standing blade stages.

(b) Ensure independent tuning of all free standing turbine blades to avoid resonance frequency in the operating frequency range of 47.5 Hz. to 51.5 Hz.

1.07.00 **BEARINGS**

(a) Provide adequate number of Journal and thrust Bearings with:

(1) Tin base babbit lining properly secured to the bearing shell.
(2) Pressure lubrication.
(3) Provision for measuring bearing temperature as near the point of heat generation as possible and for measuring the oil temperature leaving the bearing. Turbine protection on bearing temperature HI HI and on bearing vibration HI HI shall also be envisaged.

1.08.00 **TURNING GEAR**

(a) Provide suitable turning gear device, either High-speed hydraulic type or motorised turning gear as per standard proven practice of the Bidder.

(b) Ensure automatic engagement / disengagement with shaft speed decrease/increase at preset value.

(c) Provide manual hand barring facility also for manually cranking the turbine in case of emergency including A-C power failure. Ensure availability of lube oil to the bearings during manual barring operation.

(d) Provide instrumentation & control for remote operation (from unit control room).

(e) Ensure proper interlocks of lubrication system with operation of turning gear.

1.09.00 **GLAND SEALING SYSTEM FOR STEAM TURBINE**

1.09.01 **DESIGN REQUIREMENT**

(a) Gland sealing system for the T.G set shall comprise of:

(1) Spring back Labyrinth seal or seals as per standard practice of the bidder.

(2) Turbine shaft glands sealed with steam.

(b) Fully automatic gland sealing steam supply system including necessary piping, valves, fittings and control and Instrumentation as required.

(1) Gland Steam condenser to condenser and return to cycle all gland leak off steam along with 2x100% capacity exhausters (AC motor drive) to remove air and non-condensable gases. The exhaust gases shall be left outside the TG hall roof level.

1.10.00 **STEAM ADMISSION VALVES (EMERGENCY STOP AND CONTROL VALVES)**

1.10.01 **Design, constructional and operational requirement:**

(a) Designed to allow blowing out of Steam leads prior to start-up.

(b) Locate the steam admission valve close to the turbine casing for limiting turbine over speeding to safe limits because of entrapped steam volumes.

(c) Lagged with insulation and provided with lifting eyebolts.

(d) Provide Temporary & Permanent steam strainers for Emergency stop or control valves. In case there is no provision for temporary strainer, one set of strainers shall be provided in addition to the permanent strainer. The strainers shall be arranged to permit easy inspection and cleaning.

(e) Provide hydraulically operated valves, fail safe type & equipped with test device.

1.11.00 **INSULATION (STEAM TURBINE)**

(a) The turbine cylinder, steam chest and other parts of turbine as considered necessary and all associated piping and valves shall be efficiently insulated with inner thermal insulating materials. In case the noise limit as specified elsewhere in the specification
is exceeded ,the insulated portion of the steam turbines shall be covered with fabricated steel cover, provided with suitable anti-drumming and sound pressure attenuating material inside. The insulation and steel covering should be so designed and erected as to provide easy accessibility to parts requiring frequent inspection.

(b) Suitable stainless steel lugs shall be tack welded on turbine casing to support the insulation. In places where welding is not permitted, suitable alternative arrangement shall be provided by the Contractor. The design of the support shall be so as to involve minimum number of lugs.

(c) The thermal insulation designed, furnished and installed by the Contractor shall be such that the following items of performance shall be guaranteed, and the specific design and application features adopted shall be so as not to exceed the stipulated limits in temperature differentials. The Employer shall

have the option to have any random check of specimen as per his choice, to establish conformity to guaranteed particulars:

(1) The difference in temperature between upper and lower metallic parts of the turbine casing in the zone of governing stage/ steam admission shall not be more the 40°C during cooling of the casing.

(2) The difference in metallic temperatures of upper and lower halves of turbine casing, during normal operating conditions shall not be more than 15°C.

(d) Applicable Standards:

1. IS15402 Ceramic mattress insulation
2. IS - 9742 Sprayed mineral wool thermal insulation.
3. IS - 5696 Loose mineral wool.
4. IS - 3677 Unbonded rock and slag wool for thermal insulation.
5. IS - 8183 Lightly bonded mineral wool for thermal insulation.
6. IS - 7413, IS - 3144, IS - 9482

(e) The use of asbestos in any form for insulation and elsewhere is not permitted.

1.12.00 **TURBINE GOVERNING SYSTEM**

(a) Capable of controlling with stability the turbine speed between zero to maximum power output.

(b) Overspeeding of turbine during full load loss shall be limited to turbine overspeed trip value.

(c) Provide adjustable steady state speed regulation between +3% to +8% of rated speed.

(d) Ensure dead band at rated speed and at any power output within rated output shall not exceed 0.06% of rated speed.

1.13.00 **TURBINE PROTECTIVE DEVICES**

(a) **Emergency Governor**

(1) Bidder shall provide overspeed trip of the Unit at 110% of rated speed in case speed governor fails to limit the turbine overspeed.

(2) The emergency governor resetting shall be as per manufacturer's standard practice. However, it shall meet the IEC-45 requirements for overspeed trip.

(3) Bidder shall provide means for testing the operation of emergency governor when the machine is on load without exceeding the rated speed of the unit.

(b) **Emergency Hand Trip**

Bidder shall provide emergency local hand trip device to facilitate manual tripping of the unit along with facility to trip turbine from UCB.

1.14.00 **VACUUM BREAKER**

Bidder shall provide D.C operated device for rapid reduction of vacuum in condenser for turbine rotor to be brought to rest as quickly as possible.

1.15.00 **TURBINE LUBRICATION OIL SYSTEM**

(a) A self contained LUBRICATION oil system for each TG Unit consists of:

1. Centrifugal / gear type, Main oil pump (MOP) directly driven by Turbine as per Bidder's standard practice with capacity to cater control oil, lube oil for bearings & emergency seal oil requirement (if applicable for bidder design). In addition of above 2x100% AC Aux. oil pumps for start up, shut down of TG unit and as standby to M.O.P. for automatic operation shall be provided. Each pump shall also be capable of start up, shut down of TG unit and stand by to each other for automatic operation .

OR

2x100% AC oil pumps as per Bidder's standard practice with capacity to cater control oil, lube oil for bearings & emergency seal oil requirement (if applicable for bidder design). Each pump shall also be capable of start up, shut down of TG unit, normal operation and stand by to each other for automatic operation **.**

(2) One DC motor driven emergency oil pump with sufficient capacity for meeting lube oil requirement of bearings during emergency with automatic starting on low lube oil pressure preset value.

(3) 1x100% each AC & DC jacking oil pumps (if required) with an interlocking not to start till lube oil pressure is established. Provision of jacking oil shall be as per proven practice of the OEM. If jacking oil

system is not offered, then bidder shall provide supporting documents to establish its proven practice.

(4) Each Unit Lube Oil tank to have capacity to allow 5 to 8 oil charges per hour (at normal operating level), fitted with non-corrodable strainers, level measuring device & local indicators and necessary manholes, 2x100% duty vapour extraction fans, platforms, railings, necessary piping, supports and accessories etc.

5) **Lube oil cooler**

(i) **Configuration:**

2x100%, DM water cooled having oil pressure greater than water pressure. Lube oil coolers to be provided with Manual 3-way valve on oil side for changeover of coolers.

(ii) **Type:**

Either shell & tube type or plate type heat exchanger as per the standard practice of the turbine manufacturer.

(iii) **Heat transfer area:**

Lube oil coolers to be provided with 15% excess tube / plate surface

area. Thermal calculation considering fouling factor, overall heat

transfer coefficient, corrosion allowance, plate / tube thickness etc.

shall be furnished for employer's approval.

(iv) **Material of construction:**

The tube / plate material shall be SS316. Further the material of any other part of the lube oil cooler which is coming in contact of lube oil shall be SS316.

(iv) **Design codes:**

(a) Shell and tube type: TEMA (latest).

(b) Plate type: Pressure parts as per ASME Sec-VIII.

(v) **Other features:**

Temperature measurement device to be provided at inlet and outlet of oil and water side of the lube oil coolers.

(b) **Purification System**

Provide permanently Connected, Continuous Oil Purification system having following major equipment / features.

(1) **Capacity and purity:**

Oil purification system having capacity to purify 20% of total oil charge in system per hour. Purified oil shall have moisture not more than 500 PPM & max. particle size conforming to code 15/12 as per ISO 4406 or requirement of the turbine manufacturer which ever is better. The above particle size and moisture content shall be demonstrated with inlet oil quality conforming to 21/18 as per ISO: 4406 and 15000 PPM moisture respectively in one pass.
All the piping, valves and fittings of the purification system shall be of stainless steel.

Provide duplex type filters/strainers with stainless steel element, with differential pressure devices with alarm at common oil supply line. The filter elements size shall be of five (5) microns or a size suited to TG manufacturer's requirements. In addition to above, the Bidder may provide filter/strainers at oil supply line to /oil return lines from bearing and generator seals as per his standard practice.

(d) **Oil Piping & fittings**

(1) Provide double oil piping or equivalent shielding arrangement for all high pressure lines and all pipes close to hot pipes and parts to protect against fire hazards.

(2) Ensure oil return lines from bearings fitted with illuminated sight fittings, or any other device to see the flow of oil depending upon the standard proven practice of the bidder.

(3) All the piping, fittings, valves, Main Oil Tank and complete strainers including body and element shall be of stainless steel. Further all the parts of lube oil coolers (tubular or plate type) which are coming in contact of lube oil shall be of stainless steel.

1.15.00 **GEAR BOXES**

(1) **Type**

Double helical gear by hobbing process, dynamically balance. The high speed pinion of heat treated forged steel and low speed gear of forged steel. The gear casing shall be horizontally split and accurately machined to provide oil tight joints. The gears shall be enclosed in an oil and dust proof gear casing made of grained cast iron or fabricated steel. Oil used to be same as for the pump, motor and turbine and supplied from pump lubrication system. Gear to be designed for continuous service.

(2) **Instrumentation**

Suitable oil level / flow indicator on gear casing for local monitoring.

(3) **Service Factor**
Between turbine and generator 2.0

(4) **Bearings**

Gear box with separate thrust bearings or combined journal cum thrust bearings as per their standard practice shall be provided to meet worst duty conditions.

(5) **Applicable Code** : AGMA 420 and 421 (Latest)

1.16.00 **STEAM TURBINE BYPASS SYSTEM**

(a) Ensure turbine bypass aggregate capacity not less than 65% of the main steam flow at BMCR condition considering rated main steam parameters at the upstream of valves & downstream parameters matching with those of Turbine exhaust steam. The bypass system shall have 1X100% or 2x50% capacity valves as per bidder's standard practice. In addition, the aggregate capacity of Bypass valve shall be adequate to evacuate the required minimum steam flow from the boiler under various start up conditions (viz. Cold/warm/hot start up) as per combined boiler turbine start up curve.

(b) Seat tightness of the bypass valves shall be equivalent to block valve tightness conforming to MSS SP61.

(c) Provide bypass station spray water requirement from a point as optimised by the bidder. Spray system to include spray water control valves, NRVs and isolating valves.

(d) Ensure all valves (both in steam and spray water service) to be electro hydraulically operated.

(e) Provide separate oil system with 100% redundant pumps, motors, accumulators and control cubicles etc. for bypass system. Accumulators shall be sized to take sufficient number of stroking operations of all actuators under a condition of loss of oil supply from the pumps.

(f) Provide warming up arrangement of bypass valves and associated piping.

(g) Capable of operation in parallel with turbine.

(h) Facilitate hot/warm restarting following a trip from full/part loads, controlled shutdown and cold start-up following a long shut down.

(i) Ensure that boiler operation is not affected in the event of loss of load on the turbine, by disposing off the steam produced in the boiler automatically by providing a quick opening device. The full stroking time of valve under quick action shall be within 2 to 3 seconds.

1. 17.00 **PERFORMANCE REQUIREMENTS**

(a) The steam Turbine Generator set apart from being capable of operation on base load shall also be suitable for cyclic load variations as the unit is expected to operate in automatic load frequency control system.

(b) Bidder to provide adequate temperature measurement and other instrumentation etc. for adequately guiding the operator to regulate loading of unit to keep the thermal stresses and fatigue levels within safe limit.

(c) Ensure normal make-up to cycle in the condenser hotwell at 3% which at times may go upto 5% and emergency make-up shall be sized for 5% BMCR, 10% BMCR & 15% BMCR for Min/Normal/Maximum flow respectively.

(d) Ensure during turbine bypass operation deaerator shall heat feed water to saturation temperature corresponding to deaerator pressure optimized by the bidder.

(e) Ensure all recoverable cycle drains to condenser as per the standard practice of the bidder. Bidder to however note that manifolds on condenser shall not be acceptable. Start-up drains to be led to atmospheric flash tank.

(f) Under all conditions of operation, the steam turbine generator set shall perform continuously without the noise levels of its components and auxiliaries (individually or collectively) exceeding the limits as specified under General Technical Conditions.

(g) Maximum permissible vibration for auxiliaries shall conform to Zone-A/B of ISO-10816 (latest).

1.18.00 **Heat balance Diagrams:**

1.18.01 Following Heat balances complete in all respects to be computed & furnished for the conditions stipulated with units indicated in MKS system & IAPWS-IF 97 steam tables. Pressure (in ata), temperature (in deg C), enthalpy (in kcal/kg) and flow (in tonnes/hr) to be indicated at all required locations to facilitate manual checking by the Employer.

i. VWO output under rated steam condition at design condenser pressure, with 0% & 3% make up. (guaranteed output and heat rate)

ii. Output corresponding to VWO under rated steam conditions at worst condenser pressure with 0% & 3% make-up.

iii. Bypass operation under rated steam conditions with steam generator output of 65% of BMCR.

iv. Bypass operation under rated steam conditions with bypass valves open to full capacity and turbine on house load operation.

v. Steam generator output corresponding to BMCR flow under rated steam conditions, turbine in parallel operation with bypass valves open to full capacity

vi. Steam Generator output corresponding to BMCR flow under rated steam condition, turbine under VWO operation, design condenser pressure, 0% & 3% make up. Difference of BMCR flow and VWO steam flow through turbine shall be assumed to be drawn of from Main steam line. Same quantity of flow to be added to condenser as additional make up.

Note:

a. Bidder to submit all of the above Heat Balances for system/ equipment design as specified elsewhere in the specification.

b. Any additional heat balances deemed necessary by the Employer shall be furnished. All the heat balances shall show turbine output, mechanical and electrical losses in turbine and generator and input to shaft driven auxiliaries, if any.

c. Steam supply to de-aerator shall be from a point as per optimised cycle of the bidder and the minimum de-aerator pressure shall be a pressure optimized by the bidder during low-load operation and Bypass operation. The optimised pressure should be same during warm, hot startup conditions and bypass operation.

1.18.02 Furnish turbine expansion line diagrams for EMCR load point along with group efficiencies.

1.18.03 Furnish thermal kit data for plant performance by DDCMIS. .

1.18.04 Furnish turbine clearance diagram indicating values for radial & axial clearances and leakage rate from glands.

2.00.00 **CONDENSING PLANT**

Design, manufacturing and testing as per Heat Exchanger Institute, USA (latest edition) for air cooled condenser with proven design. The condenser shall be designed for heat load corresponding to Valves Wide Open (VWO) conditions, 0% make-up, at ambient temp 32 ºC, and conditions given in Table A at clause 2.04.00.

The value of condenser pressure to be measured at 300 mm downstream of 1st welding joint of turbine exhaust and hot box at VWO output under rated steam conditions, 0% make-up at ambient temperature 40 °C

Condensate temperature at all loads shall be near to the saturation temperature corresponding to condenser pressure.

The Condensate tank shall be sized for three (3) minute storage capacity (between normal & low-low level) of total design flow with the turbine operating at VWO condition, 3% make-up, design condenser pressure. The low-low level of hotwell shall be at least 200 mm above the bottom of hotwell.

2.01.00 **TYPE:**
Direct air cooled, forced cooling.

2.01.01

(a) Air cooled condenser (ACC) and associated system shall be designed as per HEI for Air cooled condensers. The exhaust steam from the turbine shall be cooled using an Air Cooled Condenser with forced convection air as a cooling medium. Expanded steam from the Steam Turbine after passing through hot box and then through main steam duct is condensed through the condenser tubes. Cooling air is drawn over the condenser tubes by motor fans to produce condensate. The condensate is collected in a common condensate tank and returned to the feed water tank / deaerator via the condensate pumps.

(b) Design of air removal section to cool the air and vapour mixture to at least 4.17 deg. C below saturation temperature corresponding to guaranteed condenser pressure. Connections to air evacuation pumps shall be made at this section.

(c) Provision of air evacuation pumps: Condenser to be designed for minimum air leakage and under normal operating conditions, the air leakage in condenser not to exceed more than 50% of design value taken for sizing of vacuum pumps. The same
shall be demonstrated at site under actual operating condition failing which Bidder
shall carryout necessary modifications.

(d) Suitable for (site specific) ambient air conditions.

(e) Suitable lifting/handling arrangement shall be provided for Air Cooled Condenser and its all associated systems.

(f) The supplier to provide all galleries, crawl beams, platforms, handrails, ladders necessary for safe and efficient access to the fan deck and other equipments for erection, Operation & Maintenance

(g) Provision for leakage testing of ACC and associated system along with blanking arrangement. Individual street isolation valve shall be provided for leakage detection and repair work.

(h) Stand pipes with necessary connections for instruments, with water level gauges and isolation valves.

(i) ACC shall include :

i. Condenser modules, finned heat exchanger tube bundles, steam and condensate collection header.

ii. Complete air moving system incl. fans, speed reducer, couplings, electric motors, fan support bridges and equipment required for safe operation.

iii. Steam distributing system from steam turbine outlet to the ACC unit including main steam duct, steam distribution manifold, steam header, as defined elsewhere in the specification.

iv. Condensate tank including connections for make up water with condensate strainer, standpipe, manholes, nozzles connection, insulation, hand railing etc.

v. Connections for Steam turbine bypass connections.

vi. Fin tube cleaning system of semi-automatic type as per HEI is to be provided. The fin tube bundles shall be cleaned using high pressure water. Cooling fins shall be designed to withstand the cooling water jet pressure.

vii. Necessary vacuum breaker valves and provision of rupture devices as per HEI.

viii. Provisions for accommodating expansion and contraction with changes in thermal load.

ix. Painting of all exposed parts of ACC and structure shall be as specified elsewhere in the specification.

xv. Provision for isolating the individual street (from steam, condensate and air evacuation side) for maintenance purpose while unit is on load.

2.02.00 **Design requirement:**

(a) The ACC is to be designed to sustain and operate in all climatic conditions, max./ min ambient temperature and effects of wind excess without damage. Air Cooled
Condenser fans shall supply wind homogeneously whatever are the main wind orientations.

(b) The ACC shall be designed taking into account the environmental conditions and seismic conditions.

(c) Corrosion allowance shall be as per HEI.

(d) The inlets to each fan shall be protected with a screen capable of preventing objects/foreign materials.

(e) Design for full vacuum and min. internal pressure 0.5 bar (g). Minimum shell side design temperature 121 deg. C. It should not be less than the maximum pressure and temperature which the ACC may be exposed to during transient conditions.

(f) Steam dumping device to accept the steam from turbine bypass with necessary spray water including abnormal conditions.

(g) Design for exhaust steam from steam turbine, turbine bypass system, boiler drains (if any) during start up, low load and abnormal conditions and other miscellaneous drains.

(h) Bidder to also consider exhaust steam quality and back pressure, Site meteorological data, site topography, maximum height limitations and compact layout for Air Cooled Condenser Design.

(i) The gearbox shall be designed as per AGMA and design life of the gearbox shall be 100 000 hours. Gear box shall be designed for continuous operation. All the bearings in the gearbox shall be designed for a life of 100,000 hours. Gear box shall have self-contained lubrication arrangement of sump oil / oil pump type as per standard practice of the bidder. All couplings shall be as per standard practice of the bidder.

2.03.00 Leakage Testing as per HEI

2.04.00 **Table-A**

1.Condenser Design Parameters:		
(i)	Design pressure	to be optimised by the bidder

		between 120 mm of hg to 135 mm of hg
(ii)	Design ambient temperature	40 Deg C
(iii)	Ambient temperature corresponding to worst vacuum	45 Deg C
(iv)	Tube type and material	As per standard practice of the bidder
(v)	Fouling Resistance	As per HEI
(vi)	Performance Margin on ACC	5% Margin over steam flow corresponding to VWO output under rated steam conditions, 0% makeup at ambient temperature of **40oC** and guaranteed condenser pressure after considering fouling resistance.
(vii)	Wind velocity	5.0m/s (any direction)
(vii)	Air Cooled Condenser (ACC) design pressure	Full vacuum and 0.5 bar(g)
(vii)	Minimum ACC design temperature	121 deg.C
2.Condenser air evacuation system design parameters		
(i)	Source of vacuum pump heat exchanger cooling water	ACW system
(ii)	Source of sealing water	Condensate
(iii)	Source of make-up water	Condensate
(iv)	Design Pressure(cooling water side) for vacuum pump	Vacuum(0.1 kg/cm2(abs) heat exchanger & as per ACW system design pressure
(v)	Pressure of make-up water	CEP discharge pressure
(vi)	Maximum temperature of cooling water	3 deg C above design cold water temp.
(vii)	Duty code	HEI (latest)
(viii)	Design back pressure	25.4 mm(1 inch) of Hg (abs)

2.05.00 **Operational requirement:**

(a) Steam dumping device for dumping of desuperheated steam from turbine bypass along with all accessories and instrumentation.

(b) Provision for maximum deaeration and removal of non-condensable gases from steam and make-up water. Air removal section to be suitably baffled to prevent water carryover.

2.06.00 **CONDENSER AIR EVACUATION PUMPS**

i) The unit shall consist of 2x100% vacuum pumps for holding operation and minimum one (01) start up hogging pump with all accessories and instrumentation for condenser air evacuation.

Pumps shall be sized as per latest HEI requirements. Capacity of each pump in free dry air at standard condition with condenser operating at design pressure of 1 inch (25.4 mm) of Hg (abs) and sub cooled to 4.17 deg.C below temperature corresponding to absolute suction pressure shall be suitable for the intended application. Vacuum pump capacity in SCFM shall be under standard condition i.e. 760 mm Hg (abs) and 21.1 deg C.

ii) All three pumps running together should be able to bring condenser pressure from atmospheric pressure to 10 inch of Hg (abs) in 30 minutes.

(a) Single/two stage liquid ring type with both stages (if two stage pumps provided) mounted on a common shaft.

(b) Each pump and its accessories shall be mounted on common steel base plate. Pump shall be connected to motor by flexible coupling.

(c) The stand-by pump shall cut in automatically in case running pump fails or when condenser pressure falls back to a preset value.

(d) No cavitation under all operating conditions without air ejector.

(e) Noise levels should not exceed limitations as specified in Section of General Technical Requirements and vibration levels shall be Zone A/B of ISO 10816(latest).

3.00.00 **CONDENSATE EXTRACTION PUMP**

3.01.00 i) **Pump sizing**

a) **Design Capacity:**

Capacity of 1X100% condensate extraction pumps to be based on 15% margin over highest Condensate flow envisaged during unit operation (excluding turbine bypass operation).

Design Head:

Corresponding to above considering 10% margin over deaerator pressure.

b) **Best efficiency point:**

Capacity of 1X100% CEP shall be based on TG unit EMCR and corresponding head. Best efficiency point of the selected pump shall be preferably corresponding to above point.

ii) **Motor Rating**:
Motor rating at 50 deg.C ambient temperature shall not be less than the maximum load demand of its driven equipment in its entire operation at frequency variations from 47.5Hz to 51.5Hz and motor shall not be overloaded during any mode of operation of driven equipment.

3.02.00 (a) **Configuration:**

2 X 100 % Condensate extraction pumps per unit.

(b) **Drive**
Variable frequency drive motor with speed variation meeting all operating conditions.

(c) **Constructional Requirements**

Vertical, Multistage, Canister type, Centrifugal, diffuser type with double suction first stage impeller. Alternatively Horizontal, Multistage, Centrifugal, diffuser type with double suction first stage impeller.

(d) **Shaft sealing**

Either mechanical seals or packed type with external water sealing designed to prevent air ingress to condenser even when the pump under shut down and exposed to condenser.

(e) **End Connections**

Discharge and suction connection of weld neck type, raised steel flange as per ANSI B. 16.5 and to be located above floor mounting flange.

(f) **Thrust Bearing**

Thrust bearing for the combined thrust load of pump and motor with a rigid coupling between pump and motor or individual thrust bearings for pump and motor with a flexible coupling between motor and pump.

(g) **NPSH Margin**

NPSH (R) at 3% head drop shall not be more than half the NPSH(A) at design flow with low-low hotwell level and NPSH(R) at 3% head break shall be well below NPSH(A) under all conditions.

(h) **Motor bottom level**

Bottom of motor to be above zero meter by suitably considering the pit level and motor stool dimensions.

(i) **Minimum recirculation flow**

Common recirculation line for CEP shall be provided.

(j) **Performance curve**

Characteristic curve of pumps should be continuously rising type with decrease in flow and shut off head shall be between 115% to 130% of TDH at design point.

(k) **Critical Speed**

First critical speed in water shall not be within 20% of design speed.

(l) **First stage impeller life**

Life due to wear due to Cavitation of first stage Impeller not less than 40,000 running hours.

(m) **Peripheral speed at the eye of the impeller**

Not to exceed 20m/sec.

(n) **Suction specific speed**

Suction specific speed of first stage impeller not to exceed 11,000 U.S. units based on 3% head break of that impeller at design point.

(o) **Interchangeability**

Complete interchangeability in all respects of the pumps and their components.

(p) **Design Pressure**

(1) Bowls and discharge components design pressure shall correspond to shut off head at maximum possible speed of Variable Frequency

Drive (VFD) and operating specific gravity and maximum suction condition.

(2) Suction components shall be designed for 8 ata and full vacuum.

(q) The pump internals to be capable of being lifted out of casing after removal of motor and disconnecting discharge flange but not disturbing the discharge piping.

(r) **Applicable Code**
HIS (Latest Edition)

4.00.00 **DEAERATOR**

4.01.00 The deaerator shall be designed such that maximum oxygen content shall be 0.005 cc/litre at deaerator outlet measured as per ASTM D5543-09 or Indigo Carmine method at all operating conditions.

l b Based on 6 (six) minutes of BMCR flow (approx.) between normal operating level and low-low level with a filling factor of 0.66. This capacity shall be exclusive of the volume of internal piping, baffles and volume of the dished end. It shall be designed for maximum incoming steam flow when working under turbine bypass condition. Low-low level from bottom of the vessel shall be suitable capacity to ensure NPSH required for boiler feed pump under all conditions.

4.02.00 (a) Horizontal/vertical, Spray-cum-tray with integral direct contact vent condenser mounted on horizontal storage tank.

(b) Alternatively, Spray type STORK or Equivalent with minimum two (2) spray control valves of disc type or equivalent, in order to ensure fine atomisation of incoming condensate and rapid heating up by the steam. In case spray type Deaerator is provided, Bidders to provide cladding on internal surfaces of storage tank and/or stainless steel vessels to meet HEI requirements.

(c) Design and construction as per Indian Boiler Regulations (if applicable), ASME code for unfired pressure vessels, Section-VIII or any other equivalent code and Heat Exchange Institute Standards.

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(d) Reinforced wide mesh strainer and antivortex baffles at discharge connections from deaerator.

(e) All pressure parts like shell, heads and nozzles shall be of carbon steel as per ASTM A-516 Gr. 70. Shell plate min. thickness 15.8mm of welded construction.

(f) Hardened 400 series or 304 series stainless steel impingement plates for flashed drain inlet from HP heaters, BFP recirculation, boiler startup drains etc.

(g) All water spray valves, splash plates, trays, vent condenser and other elements in contact with undeaerated water or non-condensable gases shall be of stainless steel SS-304 or SS-410.

(h) Floating pressure type. Deaerator pegging pressure during cold, warm, hot startup and during turbine bypass operation, shall be as optimized by the bidder and shall be suitable to ensure required deaeration and water quality required for boiler. The optimised pressure should be same during warm, hot startup conditions and bypass operation. Deaerator pressure shall vary with load when it gets steam from turbine extraction. Design pressure & temp. shall not be less than extraction pressure or worst operating condition with sufficient margins above the same.

(i) Sources for heating:

(1) Extraction steam from turbine (normal operation) as optimized by the bidder.

(2) Steam from an Auxiliary steam header till extraction steam (normal source) pressure is available. Such auxiliary steam header should necessarily be connected to a source upstream of MS stop valves of same unit and suitably interconnected with the other unit(s).

(j) Design to withstand full vacuum and pressure decay.

(k) Shell thickness corrosion allowance 3.2 mm.

(l) Size of vent orifice for one half percent of TMCR extraction steam flow to deaerator

(m) Provision of access platforms and ladders along with hand rails on deaerator and storage tank. Provision of manholes of 450 mm dia (min) on deaerator and storage tank for access to and removal of internals including trays.

5.00.00 **BOILER FEED PUMP**

5.01.00 Pump sizing

1) Design capacity and design head:

Capacity of 1x100% boiler feed pump to be based on 10% margin over feed flow corresponding to turbine V.W.O condition, 3% makeup, design condenser pressure and corresponding head.

In case continuous overpressure operation of unit is envisaged then the capability of pump for such an operation shall be verified.

2) Best efficiency point:

Capacity of 1x100% BFP shall be based on TG unit EMCR and corresponding head.

3) Emergency point:

One boiler feed pump to be capable of generating the discharge pressure not less than steam generator highest safety valve set pressure corresponding to 105% of boiler maximum continuous rating (at 0% make up).

5.02.00

(a) **Configuration**
2 x 100 % Motor driven feed pump per unit.

(b) **Drives**
Constant speed squirrel cage induction motor with hydraulic coupling between motor and main pump.

(c) **Construction Requirements**

Horizontal, centrifugal type, multistage, outer casing barrel type with end rotor removal.

(d) **Shaft Sealing**

Mechanical seals for boiler feed pump.

(e) **NPSH Margin**

The ratio between NPSH (A) and NPSH (R) at 3% head drop for boiler feed pump shall be not less than 1.5 at design point corresponding to Low-Low level of deaerator.

(f) **Performance curve**
The characteristic curves of pump should be continuously rising type with decrease in flow and shut off head shall be in the range of 115% to 130% of TDH at design point.

(g) **Minimum recirculation**

(1) The minimum flow of the pump shall not be less than 25% of design flow.

(2) Minimum recirculation valve with valve body designed for 40% of design flow.

(3) Seat tightness of recirculation valve shall conform to MSS SP61.

(h) **Inter-changeability**

Identical design of boiler feed pumps, motors, hydraulic coupling and major equipment in order to provide complete interchangeability.

(i) **Motor drive start up time**

Motor shall be able to accelerate the pumps from standby conditions to rated pumping conditions in less than 15 seconds after receipt of starting signal while operating either singly or in parallel with other operating pump. BFP and associated auxiliaries to be designed for auto startup on failure of running equipment/auxiliaries.

(j) **BFP lube oil system**

Common lubricating oil system for BFP, motor and hydraulic coupling complete with shaft driven lube oil pump, AC motor driven auxiliary oil pump, working oil cooler / lube oil cooler / oil filters / strainers, valves, fittings, instruments etc.

(k) **Critical speed**

The first critical speed in water with internal clearance 150% of new clearance shall be more than 130% of design speed.

(l) **Dry running**

Capable of accepting complete loss of water due to incidents such as inadvertent complete closure of suction valve and brought down to rest in controlled manner from design condition with simultaneous closure of suction valve.

(m) **First stage suction specific speed**

Not in excess of 8000 (US units) based on 3% head break down of that impeller of pump at design point.

(n) **Casing design pressure**

TDH at minimum flow and maximum pump speed at 51.5 Hz for BFP under lowest operating density plus maximum suction pressure.

(o) **Thrust bearing**

Two times the worst thrust under maximum speed of BFP, pump at shut off head and internal clearances 200% of new clearance. Thrust bearing should be suitable for reverse rotation.

(p) Applicable Code : HIS (latest edition)

5.03.00 **Operational and maintenance requirement:**

(a) Warm up arrangement

Suitable warm up arrangement (if required) to start the pump rapidly shall be provided. However, pump should preferably be capable of starting from any conditions without having any warm up in emergency.

(b) Emergency Lubrication of BFP

Pressure lubrication (if necessary) of BFP at the time of coasting down of the boiler feed pump set in the event of AC power failure shall be arranged by Bidder.

(c) Handling arrangement

BFPs to be accessible to Turbine hall EOT crane for their erection and maintenance.

5.04.00 **Mechanical Seals**

(a) Type : Fully cartridgised design.

(b) Seal face Materials : Not inferior to rotating silicon Carbide and Stationary Carbon seal face combination.

(c) Life : Not less than 20,000 running hours between overhauls and having dry running withstand capability as specified running with the specified feedwater PH of 8 to 8.5.

(d) Supporting system

Each seal to be provided with 2x100% magnetic filters, 2x100% tubular coolers, Piping, Valves, Control and instrumentation etc. Each cooler to be designed with margin of 20% over worst condition of heat generated in seals.

Further in case of AC power failure, seal should be able to withstand without cooling water.

5.05.00 **HYDRAULIC COUPLING**

(1) Type

Combined fluid Coupling/Gear box type, Electric actuator and linkages alongwith necessary amplifier units.

(2) Rating

Adequately rated to meet the requirement of pump characteristics while operating in the range of capacities specified.

(3) Material and other accessories

Complete with stainless steel impellers, bearings, pillow blocks and Kingsbury or Mitchell thrust bearing or proven thrust bearing as per bidder's standard practice for input/output with removable Covers, oil sump, duplex filters to remove all particles upto 25 microns, oil temperature and pressure gauges, Control pump for oil regulation if provided, regulating Valves, stainless steel scoop tube, 1x100% lube oil cooler, 1x100% Working oil cooler, one portable type oil purifier of adequate capacity to be included to form the centralized lubrication system for BFP set.

Material for oil cooler:
Tubes of type 304 stainless steel and shell of mild steel construction. Suitable Corrosion allowance shall be added to all carbon steel and iron parts including shell, flanges etc. If plate heat exchanger type oil cooler is provided, plate material shall be SS 316 and material of other components shall be compatible for the application.

6.00.00 **EOT CRANES**

6.01.00 **TURBINE HALL EOT CRANE:**

(i) RATING

(a) Capacity — One (1) number of Electrically operated overhead travelling cranes of single/double girder type shall be provided.

EOT crane shall be capable of lifting at least 105% of the weight of single heaviest component/ equipment, including lifting beam

		and slings etc. (as applicable) to be handled in TG hall for erection as well as maintenance of the equipment provided in AB bay.
(b)	Auxiliary Hoist Capacity	Not less than 3 Tonne
(c)	Crane span (i.e. centre to centre of rail tracks)	To suit the span of turbine hall
(d)	Total height of crane	Top most level of crane w.r.t. the top of runway rail level shall be approximately 4.5m
(e)	Main/Aux. hook levels (Above operating floor level & below ground floor level)	To suit handling requirements of equipment
(f)	Top of Rail Elevation	To be confirmed by the vendor
(g)	Creep speed of main hook and auxiliary hook	10% of max. speed

(ii) Type

Single/double girder type Electrically operated indoor travelling.

(iii) Applicable codes

(a) Design and duty of crane structure, main hoist, auxiliary hoist, cross travel, long travel in accordance with class M5 of IS: 3177 (latest edition).

(b) All other structure of cranes in accordance with IS-807.

(iv) Buffer

(a) Suitable buffer to be fitted to each end of carriage assembly and crab.

(b) Buffers to be designed to bring the loaded crane to rest from a speed of 50% of the rated speed.

(v) Operator's cabin and platform

(a) Open type for indoor service to be located at B-row column. Cabin shall be designed as per IS3177 so as to have unrestrictive view of load from operator's cabin.

(b) A foot operated electric warning horn of double bell type suitable for 240 V AC. of noise level 95 dBA at 3.5 m.

(c) One brass gong suspended outside the Cabin and operated from inside.

(d) A distinct type alarm with conspicuous warning lights on either side of the crane bridge to indicate overloading of crane.

(vi) Safety

(a) To meet the requirements of Factories Act.

(vii) Over load test ,travel and hoist speed checks etc. shall be demonstrated as per IS 3177 (latest edition)

7.00.00 **PRECOMMISSIONING ACTIVITIES**

The pre-commissioning activities including some of the important checks & tests for certain major equipment/ systems are mentioned under respective equipments, although it is the Contractor's responsibility to draw up a detailed sequential & systematic list of checks / tests and various activities / procedures connected with pre-commissioning of the complete facilities with all systems, sub-systems and equipment supplied and installed by him and get the same approved by the Employer.

8.00.00 **COMMISSIONING OF FACILITIES**

Upon completion of pre-commissioning activities/test the Contractor shall initiate commissioning of facilities. During commissioning the Contractor shall carryout system checking and reliability trials on various parts of the facilities.

Contractor shall carry out these checks/tests at site to prove to the Employer that each equipment of the supply complies with requirements stipulated and is installed

in accordance with requirements specified. Before the plant is put into initial operation the Contractor shall be required to conduct test to demonstrate to the Employer that each item of the plant is capable of correctly performing the functions for which it was specified and its performance, parameters etc. are as per the specified/approved values. These tests may be conducted concurrently with those required under commissioning sequence.

09.00.00 **NOISE LEVEL**

In case the noise level pertaining to equipments covered under the scope exceeds the specified values, as given in relevant clause of General Technical requirement portion of Technical Specification, suitable acoustic enclosures alongwith all accessories in order to complete the system shall be provided to achieve the specified values. The acoustic enclosures & accessories shall be designed as per internationally accepted standards and shall be subject to Employer's approval.

10.00.00 **INSULATION**

(a) Bidder shall provide insulation for all equipments, valves, piping etc. with surface temperature more than 60°C. The insulation and sheet covering should be so designed and erected as to provide easy accessibility to parts requiring frequent inspection.

(b) The density of the mineral fiber felt shall be carefully controlled at about 200 kg/m³ and the thermal conductivity of mineral wool shall be 0.052kcal/m. hr. °C at mean temperature.

(c) The mineral wool shall be capable of passing standard combustibility test, both immediately after application and also after being subjected to its maximum operating temperature for not less than 100 hours. The mineral wool shall be free from objectionable odour at the ambient conditions in which it is used. The mineral wool shall not contain substances, which will support pests or encourage growth of fungi. The mineral wool shall not suffer permanent deterioration as a result of contact with moisture due to condensation. The mineral wool shall not suffer quality deterioration under the specified conditions of use. In this connection, both hot and cold face temperatures are relevant. The mineral wool shall be capable of being applied to the surface concerned without causing corrosion of the surface being insulated or the cladding on it under normal site conditions.

(d) The temperature difference between the cold face of finished insulation and ambient shall not be more than 20°C. The ambient temperature shall be considered as 40°C.

12.00.00 All stand-by turbine auxiliaries shall be designed for auto start up, on failure of running auxiliaries with minimum time delay and without runback on unit load.

12.01.00 Adequate maintenance facilities shall be provided as required for assembly, disassembly, alignment work particularly in respect of turbine casing, inner and outer casings, diaphragm glands, steam valves, journal bearings, thrust bearings, turbine rotors, generator rotor, particularly end rings, shaft seals, generator bearings, hydrogen coolers, condenser waterbox , vacuum pumps, condensate extraction pumps and boiler feed pump catridges, , regenerative feed heaters, turbine oil coolers and pumps, etc. The offer shall give details like components requiring replacement or repairs during the life cycle of the plant, meantime between failures and list of tasks to be carried out during major overhauls.

13.00.00 **PAINTING**

a) All un-insulated equipments, pipes, valves etc covered in this sub-section shall be painted with paint not inferior to Epoxy resin based paints with minimum DFT of 150 micron.

The paint shall be applied in three stages i.e primer, intermediate and finish coats in following manner.

- Primer coat -Epoxy based Zinc phosphate
- Intermediate- Epoxy based TiO2 pigmented coat
- Finish Coat- Epoxy based Finish coat/ Two pack polyurethane coat.

b) Equipment, pipes etc. with high temperature shall be painted with Heat Resistant Aluminium Paint (to be selected based on the service condition of component as per IS-13183). Two coats of paint shall be applied with total DFT 40 microns.

c) Surface Preparation before painting shall be carried out according to requirement indicated in other chapter of the technical specification and international standard.

SUB-SECTION–IIA-04

POWER CYCLE PIPING

1.00.00 **POWER CYCLE PIPING**

1.01.00 **General:**

1.01.01 The scope for Power Cycle piping system shall include complete design, engineering, manufacture/fabrication, statutory/IBR approvals, supply, transportation, storage, erection, cleaning, testing and successful commissioning of below mentioned piping systems complete in all respect.

a) Condensate piping system from condensate storage tank to deaerator.
b) Feed water piping system from deaerator to economizer.
c) Main steam piping system from boiler to turbine
d) Spray water piping system for Superheater & Turbine bypass system,
e) Extraction steam piping system (if applicable)
f) Valve gland sealing piping system,
g) Vent & drain piping systems.
h) Temporary piping for steam blowing, chemical cleaning & hydro static testing
i) Any other piping system required to make the power cycle piping system complete.

1.02.00 **Scope of Supply:**

1.02.01 The scope of supply for the piping systems identified above and/or as per schemes approved during detailed engineering shall comprises of but not be limited to the following:

1.02.02 Pipes, pipe fittings, bends, Y-pieces, valves including safety valves, relief valves, instrument root valves & valve actuators, specialties like expansion joints, strainers, steam traps & orifice plates, stubs including thermo well & other instrumentation stubs, boss/half coupling, weldolet, plugs, flanges, caps, orifice assembly, hangers & supports including variable & constant spring hangers, restraints, anchors, snubbers, vibration dampers, etc. along with necessary auxiliary steel structures/beams/sections, steel insert plates, graphite/Teflon/Stainless steel plates, pipe/beam attachments like clamps, welding lugs etc., flash tanks, drip pan, weather hood for pipes crossing ceilings and walls and other accessories etc..

1.02.03 Supply & installation of thermal insulation and cladding along with all necessary accessories for the piping systems and equipment, tanks etc. in bidder's scope.

1.02.06 Special accessories like floor stands, chain operator, extended spindle etc. as required for valve operation. Valve, especially for which approach from existing floors are not possible for O&M, appropriate platforms with the access ladders for the same shall be provided.

1.02.07 In case the steam to the turbine enters from the top casing, flange(s) shall be supplied for the piping connected to the steam inlet nozzle on turbine top casing. This is to facilitate dismantling of turbine top casing during maintenance without cutting the pipe. The material of flange shall be same or compatible with the material of connecting piping so that direct welding between pipe & flange can be done at site.

1.02.08 Paints and primers for pipes, fittings, hangers & supports, valves, specialties, aux. steel structures etc. as specified elsewhere in this technical specification.

1.02.09 All erection material such as bolts, nuts, washers, gaskets, electrodes, filler materials, welding gas, consumable inserts and backing rings, accessories and miscellaneous specialties etc. required for the proper installation of piping systems.

1.02.10	Complete temporary piping system including hangers & supports, valves, pipe spools for valves, control valves, flow nozzles & specialties, plugs, caps, blanking plates, pipe spools at terminal points for blanking of piping to carry out hydro test/ steam blowing, temporary valve heads/valve blow down cover plate/ flanges, blanking inserts, blow tools, target plates, pumps, tanks, strainers, hydraulic kits, instrumentation & control, gaskets, bolts & nuts, tools & tackles, special devices and any other accessories as required to complete the hydro testing, chemical cleaning (including chemicals) and steam blowing operation of piping systems as specified elsewhere in the technical specification.
1.02.11	All auxiliary steel required for providing proper supporting arrangement for the piping systems in bidder's scope.
1.03.00	**Scope of Services**
1.03.01	It is the responsibility of the contractor to identify and obtain all necessary approvals from various Government agencies/board/statutory authorities/ IBR (CBB, Delhi / CIB of the state in which the power plant is being installed) etc., as applicable for the material, design, manufacture, erection and testing of pipes, valves, fittings, specialties etc. and furnishing the same to employer. This includes furnishing all required documentation, certificates of manufacturing & testing in IBR formats, IBR fees, etc.
1.03.02	Following drawing / documents shall be furnished by contractor for employer's review/ record: (a.) For Employer's review & approval: (i) P&IDs, Composite piping layout drawings, design philosophy & design parameter selection for each piping system, Pressure drop calculation (ii) System-wise or P&ID wise prepared pipe schedule, valve schedule, insulation schedule, hanger schedule and Piping isometric/ fabrication isometric drawings for pipe size 65mm NB and above with BOM, (iii) painting schedule (b.) For approval under information category: (i) Hanger/support arrangement drawing with BOM, (ii) Valve GA drawings (iii) Layout drawings for site routed piping (i.e for pipe sizes below 65NB) along with BOM (and submission of the same to the employer/project manager before start of work) and (iv) System wise stress analysis/dynamic analysis report (including input) along with stress isometric drg./sketch marked with node points.
1.03.03	Basic engineering as well as detailed engineering including static & dynamic analysis, hanger engineering and engineering of thermal insulation etc. for the power cycle piping systems. This also includes design and engineering of all temporary piping that are required for the pre-commissioning/commissioning activities of the power cycle piping system.
1.03.04	Hydro static testing, steam blowing & chemical cleaning of piping systems, as specified elsewhere in the specification, after complete erection is to be carried out, which also includes supply, erection, making temporary closures, dismantling and removal of all temporary material/piping, equipment and materials from site, disposal of water/waste water/effluent including providing of all facilities/equipment required for the same, clean up and reinstatement of the cleaned piping system.
1.03.05	In case any localized modifications/re-routing/re-erection etc. is required for the piping systems/supporting arrangement after approval of the drawings or during erection, the same shall be carried out by the bidder/piping contractor under his scope with material in consultation with employer. Obtaining IBR approvals, if any required, for the modification work shall also be in the scope of the contractor.

1.03.06 Providing all other necessary services for making the piping systems in bidder's scope complete.

1.03.07 In order to ensure that all supporting elements, anchor and restraints etc. have been installed and adjusted in accordance with design documentation, the Contractor shall inspect and log the hanger readings for the hangers associated with the power cycle piping system as follows:

(a.) After hydrostatic test with the piping in the cold position, with all travel stops removed, with the pipe completely insulated and in all respect ready for startup.

(b.) Piping in hot position, with the unit operating at rated parameters

(c.) Piping in hot position (rated parameter condition) after six (6) months of operation

(d.) Piping in cold position during the first complete shutdown after at least six (6) months of operation.

(e.) After steam blowing, in case steam blowing is applicable for the line.

1.03.08 At the time of each inspection, the Contractor will determine the necessity for revision, adjustment or replacement of pipe supporting elements, restraints and anchors. Any changes proposed shall be subject to the concurrence of the Employer. The changes shall be incorporated by the Bidder after Employer's concurrence. A written record shall be furnished to the Employer

1.03.09 Performing all tests including all shop tests as required by the applicable codes, ANSI Standards, IBR and other standards enumerated or specified and implementing all quality control procedures as specified herein including provision of testing equipment, stress relieving equipment, radiography equipment and any other equipment necessary to meet the requirements of the specification.

1.03.10 Certified copies of test reports for all tests and examinations specified elsewhere in the technical specification shall be furnished to Employer.

SUB-SECTION–IIA-05

LOW PRESSURE PIPING

1.00.0 **LOW PRESSURE PIPING**

1.01.00 The Scope of Low Pressure (LP) piping systems for the following services shall be as defined in various tender drawings & relevant sub sections and shall include the following systems:

a) Cooling water and other Balance of Plant water system Piping.

b) Cycle make-up piping.

c) Boiler and Deaerator initial fill piping.

d) Instrument and Service Air piping.

e) Tanks as described elsewhere in the specification for the above systems. (Including condensate storage tanks etc.).

f) Any other piping system required making the Low Pressure (LP) piping systems in the bidder's scope complete.

1.02.00 Bidder's scope of supply & works shall include but not be limited to the following:

a) Pipes, headers and manifolds, bends, elbows, returns, tees, laterals, crosses, reducers/ expanders, caps and closures, couplings, plugs, sleeves, and saddles, stubs and bosses, unions and other similar fittings, flanges, gaskets, fasteners and sealants, ring joints, backing rings, all types of valves including drain/ vent/ air release valves, 3-way valves(where applicable) with test connection for instruments/ manifolds etc. actuators, specialties, orifices, flow nozzles, etc. as per finalized single line flow diagrams and layout drawings/ isometric drawings.

b) Complete assemblies of hangers, supports anchor, guides, restraints, etc. including welded attachments, clamps, devices tie-rods, turn-buckles, springs and spring cages, shoes, rollers, trapezes etc.

c) Weather hoods for pipes crossing ceilings and walls.

d) Instrument tapping and stub connections, root valves, 3-way valves (where applicable) with test connections, drains and vent valves & expanders / reducers as required and instruments as indicated else where for instruments supplied by the Contractor.

e) Drain funnels, drip pans, moisture traps etc. wherever required shall be provided.

f) All supporting attachments like plates, saddles, stools, shoes, base plate, saddle plates, angles, channels, I-beams, trapeze, cantilevers, brackets, sways, braces, nuts, bolts, cleats, clamps, needed to complete the erection of piping system covered under this specification.

Anchor bolts, bed & foundation plates, pipe sleeves and Nuts to be embedded in concrete for piping where ever indicated in the drawing. All grouting and chipping work (including supply of cement, sand and stone chips) for equipment foundations, pipe supporting etc.

Reinforced concrete valve chambers wherever required for underground piping.

g) Surface preparation, priming and painting of all non-insulated above ground piping and equipment except galvanized steel piping & surfaces, stainless steel piping & surfaces, and gun metal surfaces.

h) Bidder shall provide anti-corrosive protection anticorrosive tape or coating wrapping on the external surfaces of pipes to all directly buried piping including galvanized carbon steel piping.

i) On the internal surface of all pipes 1000 mm and above, a coat of primer followed by a hot coat of coal tar enamel paint or coal tar epoxy paint shall be applied.

j) Excavation, preparation of bed, backfilling with compaction of soil and removal of extra-earth to designated places in case of pipes to be buried.

k) Bidder shall also design, supply, fabricate, erect, set and commission all hangers, tie-rods, turn-buckles, supports, guides, restraints, anchors, etc. as required for the, piping system. This includes the provision of all associated steel work including brackets, cradle supports, duck foots, channels, angles, etc.

l) Bidder shall supply all necessary drains and vents with drain & vent valves including anti-flash funnels and moisture traps for compressed air system as required for the safe and effective draining-venting of the piping systems.

m) All equipment/ materials as required for cleaning, flushing, blowing out and hydro testing of the piping systems. (All to be taken back by Bidder after completion of work).

1.03.00 The Bidder shall provide Services of erection superintendent and foremen, fitters and riggers, welders, transport and crane operators and other skilled and unskilled labour.

The design engineering and providing all temporary pipe work as required for erection, cleaning, flushing, blowing out, testing and commissioning of the piping system is the responsibility of the Bidder.

SUB-SECTION–IIA-06

NOT USED

SUB-SECTION–IIA-07

WATER SYSTEM

1.00.00

SCOPE OF WORK (WATER SYSTEM)

The scope includes the design, engineering, manufacturing, supply, packing and forwarding, transportation, unloading, storage, installation, testing and commissioning of following equipment/ system.

1. Raw water intake location is marked in GLP. Construction of complete booster pumping system along with all its accessories, to pump raw water from plant reservoir (tap-off in existing raw water header shall be provided) to waste to energy plant, is in bidder's scope. Capacity of raw water booster pump shall be 2 X 100 %.
2. Pre-treatment Plant of raw water is in bidder's scope.
3. DM plant for Waste to energy plant DM requirement, is in bidder's scope.
4. Construction of complete leachate treatment system, is in bidder's scope.
5. Construction of effluent treatment plant is in bidder's scope. Bidder shall ensure that no effluent shall be discharged out from the Waste to Energy plant.
6. Construction of auxiliary cooling water system along with cooling towers.
7. Supply of Mandatory spares (for two years).

SUB-SECTION–IIA-08

NOT USED

SUB-SECTION–IIA-09

PLANT UTILITIES
(COMPRESSED AIR SYSTEM, HVAC, FDPS)

1.00.00 **COMPRESSED AIR SYSTEM**

a) Two (2) numbers (1 working+ 1 standby) oil free, rotary screw type air compressors for Instrument air duty for the complete plant each of adequate capacity & adequate pressure, with their motor drives and other accessories as per equipment sizing criteria mentioned under relevant clause of technical requirement. However, minimum capacity of Air compressor shall be 15 Nm^3/min and discharge pressure of 8.5Kgf/cm^2 (g).

b) Two (2) numbers (1 working+ 1 standby) Air Drying Plants (one for each instrument air compressor) of adequate capacity with all interconnecting piping, valves, fittings, etc.

d) One (1) number (working) oil free, rotary screw air compressors for Service Air duty for the complete plant each of adequate capacity & adequate pressure, with their motor drives and other accessories. However minimum capacity of Air compressor shall be 15Nm^3/min and discharge pressure 8.5Kgf/cm^2 (g).

e) One number of Air Receiver of minimum capacity 5 m^3 (normal) at the discharge of each Air compressor or as per design requirement whichever is higher. (Total: 3 numbers). Apart from the above, if air receiver is required at utility location, then the same with required capacity shall also be in Bidder's scope.

f) 1 no Monorail electric Hoist with chain pulley block of required capacity (minimum capacity 150% of heaviest parts to be lifted) in **Air Compressor House** for handling of various equipments.

i) Complete instruments, control system with panels as required for compressor house which shall be integrated with DDCMIS for operation.

j) Supply of Mandatory spares as specified.

k) Any additional items required to make the system complete.

2.00.00 **FIRE DETECTION AND PROTECTION SYSTEM**

The scope includes Engineering, Supply, Construction, Erection, Testing and Commissioning for Fire Detection and Protection System for WTE Plant (1x400 TPD), Badarpur. The complete fire detection and protection systems shall be as per the guidelines/codes/standards/rules of the TAC/NFPA/IS:3034/OISD. The fire detection and protection system shall consist of:

a) **Fire Water Pumping System**

Complete fire water pumping system consisting of two (2) nos. fire water storage tank, hydrant pump & drive, Spray System (Common for HVW & MVW spray) pumps & drives, Batteries and Battery Chargers for the diesel engines drives, automatic pressurization system consisting of electric motor driven Jockey pumps, required instruments, controls, and panels as per the detailed specifications in Part-B of technical specification.

b) **Hydrant System**

Hydrant system for Main plant various areas such as waste pit area, TG and Boiller area, Ash Handling area and other offsites area, Administrative building, etc. as per the detailed specifications of technical specification.

c) **HVW Spray System**

Automatic fire detection cum high velocity water spray system for various transformers , lube oil tanks/system, Boiler Burner fronts (as required) and other equipment of Bidder's scope of work where it is required to provide HVW spray system .

d) **MVW Spray System**

Automatic fire detection cum medium velocity water spray system for the various cable galleries in Main plant, Waste pit (as applicable) , DG set oil tanks, and other equipment of Bidder's scope of work where it is required to provide MVW spray system .

e) Bladder tank foam protection System
Bladder tank foam protection system for the LDO tanks as per the detailed specifications in Part-B of technical specification.

f) Apart from the above, Waste Pit area is prone to formation of methane and hence to be protected by suitable system as per TAC/NFPA/IS:3034/OISD standards or norms having proven design with respect to industry practice.

g) **Control System for Fire Detection & Protection**

Fire detection & protection control system shall consists of

i) DDCMIS based control system for fire water pumps and associated systems located in main fire water pump house.

ii) It is envisaged that a local control panel shall be provided at fire water pump house for final operation of the fire water pumps. The DDCMIS commands for the pumps are to be routed through this panel to the MCC/SWGR. Local operation of the fire water pumps shall be possible from this panel, when the system is selected in LOCAL mode.

iii) Analogue addressable fire alarm system consisting fire alarm panels, repeater panel, various types of fire detectors, control cabling, centralized monitoring station etc.

h) **Fire Alarm System**

Bidder to provide fire detection system as described below:-

i) Addressable fire alarm panels shall be provided in each CER and shall include but not be limited to the following elements:-

Analog Addressable Fire Detection and Alarm System panels with Master processor module, monitoring modules, supervisory control modules, input/output modules, auxiliary relay modules, network modules and Power supply system (batteries and battery chargers, suitable for providing battery backup of 24 hours (stand by) and 30 minutes (in alarm conditions), etc

ii) Addressable fire alarm panels shall be provided in Service building / Administrative building and shall include, but not be limited to the following elements:-

Analog Addressable Fire Detection and Alarm System panel with Master system CPU, monitoring modules, supervisory control modules, input/output modules, auxiliary relay modules, network modules, PC based monitoring station with color graphics display monitor, mini UPS, A4 size color printer and Power supply system (batteries and battery chargers, suitable for providing battery backup of 24 hours (stand by) and 30 minutes (in alarm conditions), etc.

All the above fire alarm panels shall be interconnected with each other & repeater panel such that information related to Fire Alarm system can be viewed from any panel.

iii) Centralized PC based monitoring station along with mini-UPS and one A4 size color laser printer shall be provided for each Central Control Room. It shall serve the purpose of Central PC Station with facility of monitoring information related to all Fire Alarm system and of operating drives of Fire Water pump house and Booster pump house.

iv) One number addressable type repeater annunciation panel in central fire station with power supply system (batteries and battery chargers, suitable for providing battery backup of 24 hours (stand by) and 30 minutes (in alarm conditions), etc.

v) Software and hardware as required to provide a complete functioning of the system.

vi) Fire alarm panels shall provide contacts to CCTV, Air Conditioning system for initiating control functions like closure of fire dampers, shutdown of fans/air conditioning equipment, tripping of transformers, etc. Details for the same shall be finalized during detail engineering.

vii) Fire detection & protection system shall be provided with necessary hardware and software for interconnection with LAN/WAN of DDCMIS preferably from a single point.

viii) Detector cables outside the building shall be corrugated steel taped armoured laid through cable trays wherever available and for rest of the areas, cable shall be buried at 600 mm depth with sand filling and brick covering at the top.

Detector cable within the building shall be unarmoured & laid through GI conduits to prevent damage.

ix) Remote manual operation of the deluge valves shall be possible from the respective fire alarm control panel through the keyboard operation of PC monitoring station when the system is selected in remote manual mode.

i) Power Supply System

The DC Power Supply system shall consists of the following system(s):-

i) One set of 24 V DC power supply system comprising of 2x100% Chargers and 1x100% batteries for each fire alarm panel and repeater alarm panel with battery backup of 24 hours (standby) and 30 minutes (in alarm conditions).

For detailed specification of power supply system, please refer part B of technical Specification.

j) Fire Extinguishers

i) Fire extinguishers shall be installed in all the buildings within plant boundary as per TAC requirement.

ii) The Contractor shall supply the following quantities of fire extinguishers and install the same at various locations.

1.	**Portable type:**	
	Pressurized water type (9 lit. cap.) (IS:15683 operated by CO2 cartridge type)	25 Nos.
	Foam type (9 lit. cap. IS: 15683)	5 Nos.
	CO2 type (4.5 kg. Cap. IS: 15683)	10 nos
	Dry Chemical powder (6 kg. Cap. IS: 15683)	25 Nos.
2.	**Mobile type:**	
	CO2 type (22.5 kg. Cap. IS: 2878)	1 Nos.
	Dry Chemical powder (50 kg. Cap. IS: 10658)	1 Nos.

k) One (1) number Monorail Electric Hoist of minimum five (5) ton capacity for main fire water pump house.

l) All pylons required for transformers, bus reactors, inter connecting transformers etc. shall be anchored to soak pit base slab of individual transformer / shunt reactor, paved area outside soak pit, etc. using anchor fasteners of adequate capacity. Subsequent to fixing the pylons, lower part of pylon which would be within filled up gravel portion shall be encased with concrete by Contractor for corrosion protection.

m) Supply of Mandatory spares as specified.

NOTE: 1) Bidder to refer Annexure-II, Part-B for major Technical Data.

2) Any other system which is not mentioned above but required as per TAC/NFPA/IS:3034/OISD for fire detection and protection system of WTE plant, the same shall be indicated by the bidder in their proposal.

3.00.00 AIR CONDITIONING SYSTEM

The scope includes Design, Engineering, Supply, Construction, Erection, Testing and Commissioning works for Complete Air conditioning system of all the buildings which are in the scope of bidder as detailed out:

a) **Air-conditioning system for Central control Room**

There shall be one (1) central, air cooled chiller (scroll/screw type) with AHU to cater to the A/C requirement of the areas identified for main plant areas like Central control room, control equipment rooms, UPS/Battery charger rooms, and programmer room, etc.

b) Cassette and Hi-wall split air conditioners shall be provided for Various Auxiliary control room building like weigh bridge control room, CEMS room and SWAS room, administration building and various office building etc.(if the AC load is up to 15 TR, otherwise type of AC equipment shall be as per design criteria mentioned in technical requirement at Part –B.

c) Any other buildings not mentioned above but required Air-conditioning during detailed engineering shall be in bidder's scope.

d) Supply of Mandatory spares as specified.

e) For Air conditioning system, the Contractor shall provide all Instrumentation systems, accessories and associated equipment, which are included in Contractor's scope, in a fully operational condition acceptable to the Employer. Further, air conditioning system shall be operated from DDCMIS system being provided by Contractor. The Contractor shall also provide all material, equipment and services which may not be specifically stated in the specifications but are required for completeness of the equipment/systems furnished by the Contractor and for meeting the intent and requirements of these specifications.

4.00.00 VENTILATION SYSTEM

The scope includes Design, Engineering, Supply, Construction, Erection, Testing and Commissioning works for Complete Ventilation system of all the buildings which are in the scope of bidder as detailed out:

a) **Turbine hall, Boiler House and associated areas**

i) Adequate number of evaporative type Air washer units (of metallic construction-modular type) suitable capacity, with all accessories, DIDW centrifugal fans, circulating water pumps, etc. as detailed out in technical specification shall be provided.

ii) The Ventilation of turbine hall /Boiler House is further assisted by means of roof extractor/exhaust located suitably. The number and capacity of these roof extractor shall be selected in such a way that, it extracts approx. 60% of total discharge of air washer units. This will maintain a positive pressure within turbine hall and thus stop ingress of dusty outside air within the building.

iii) HT/LT Switchgear room and cable galleries of TG hall/Boiler area etc shall also be ventilated by evaporative type Modular Air washer and/or Mechanical dry ventilation to suit the healthiness of MCC/ cable gallery.

b) **Miscellaneous areas:** All other areas like pump houses, MCC rooms and switchgear rooms, Canteen, and other building (as applicable) etc. shall be ventilated by a combination of roof exhauster's/supply/exhaust fans and fresh air in-take / back draft louvers. For ventilation of Battery rooms and Oil rooms, flame proof motor shall be used.

c) Supply of Mandatory spares as specified.

d) Any additional items required to make the system complete.

f) For Ventilation system, the Contractor shall provide all Instrumentation systems, accessories and associated equipment, which are included in Contractor's scope, in a fully operational condition acceptable to the Employer. Further, Ventillation system shall be operated from DDCMIS system being provided by Contractor. The Contractor shall also provide all material, equipment and services which may not be specifically stated in the specifications but are required for completeness of the equipment/systems furnished by the Contractor and for meeting the intent and requirements of these specifications.

5.00.00 Vacuum System

The Bidder shall supply a Vacuum system that shall allow for the cleaning of the facility on a regular basis during normal operation. The location of the unit should allow for easy maintenance and for gathering of the material for disposal.

A network of piping shall be agreed in advance to the location of suction points the pipe sizes should also allow for the use of a vacuum truck to be attached this is to allow for the use of

the vacuum truck during shutdown periods where the fixed pipe can be utilized. Bends in the pipe shall be rubber to prevent erosion and keep noise to a minimum

300mm air ducting is also to be installed to allow for the attachment of an air filtration unit that is to be used during shutdown operations of sand blasting. This duct will run from the ground level to the top of the building with connection points for flexible hosing. It is expected that one will be required in the boiler area and one in the flue gas area.

SUB-SECTION–IIA-10

CHEMICAL LAB EQUIPMENTS

Chemical Lab Equipment

1.00.00 **SCOPE OF SUPPLY**

Provision of complete set of chemical lab equipment required for all types of sampling and testing as per global practice in a waste to energy plant shall be in the scope of bidder. Bidder shall furnish the detailed list of all required lab equipment along with bid.

SUB-SECTION–IIA-11

NOT USED

SUB-SECTION–IIA-12

WASTE AND ASH CRANE

WASTE FEED CRANE & BOTTOM ASH CRANE

1.00.00 SCOPE OF SUPPLY

The work shall consist of mechanical, and electrical work and equipment, all associated structural and architectural works, Control and Instrumentation equipment, mechanical services and pipe work and electrical services associated with the following:-

(a.) Waste Feed crane- overhead travelling crane that shall be used to mix, relocate and transfer/feed the waste

(b.) Bottom ash/Slag crane

1.01.00 WASTE FEED CRANE

Two (2) nos Waste Feeding Crane system shall be provided to carry out following functions:-

- To charge the feed hoppers of the furnace
- To re-piling and mixing of the received waste with in feed hopper
- To keep the waste dumping areas clear
- To weighing the waste feed rates.

One (1) Grab unit (other than mandatory spares) to be supplied and shall be kept as ready spare at convenient location within the range of waste feeding crane system area.

Waste feed Crane shall consist the following features:-

- Dedicated Hydraulic system for each Waste Crane.
- Shall operate in full automatic mode and should be also be capable to operate semi-automatic or remote or manual mode.
- Operator's cabin/cockpit/pulpit shall be enclosed and well positioned (functionally & ergonomically) and shall equip with air-conditioned & air purification system.
- Shall be capable to carry-out required motions (Hoisting, Trolley movement, Long travel, Grab & un-grab etc) to carry out above stated function continuously (24 Hrs, 7 days a week).
- Maintenance bay with adequate opening shall be provided at both side of the waste pit. Crane shall have proper accessibility and easy changeability of components in maintenance point of view.
- Shall be provided with all required protections and interlocks.

1.02.00 BOTTOM ASH CRANE

One (1) nos Bottom Ash Crane system shall be provided to carry out following functions:-

- To load bottom ash/slag from bottom ash pit/bunker to Truck for further transport.
- To mixing of the bottom ash with in pit/bunker if required.
- To keep the bottom ash pit/bunker area clear

One (1) Grab unit (other than mandatory spares) to be supplied and shall be kept as ready spare at convenient location within the range of Bottom ash crane system area.

Bottom ash Crane shall consist the following features:-

- Grab system shall be capable to hold, carry and shifting bottom ash (with the maximum designed moisture content) to the Truck without spillage/leakage.
- Shall operate semi-automatic or remote or manual mode.
- Operator's cabin shall be well located to carry out the required function and shall equip with air-conditioned system.
- Shall be capable to carry-out required motions (Hoisting, Trolley movement, Long travel, Grab & un-grab etc) to carry out above stated function as and when required, covering all areas of the pit/bunker up to the Truck.
- Maintenance bay shall be provided at convenient location of Bottom ash disposal area. Crane shall have proper accessibility and easy changeability of components in maintenance point of view.
- Shall be provided with all required protections and interlocks.

SUB-SECTION–IIA-13

ASH HANDLING SYSTEM

SLAG & ASH HANDLING SYSTEM

1.00.00 SCOPE OF SUPPLY

1.01.01 The scope of work comprises turnkey supply, erection and commissioning of complete mechanical, electrical C&I and associated civil & structural works of Slag and ash handling system for 2 x 350 TPD, WTEP plant as specified and defined in this specification. The scope of work also includes supply and erection of dry fly ash storage silos..

1.01.02 The scope of work shall include the design, engineering, manufacture, shop fabrication, assembly, testing and inspection at manufacturer's work, type testing wherever applicable, packing, ocean shipment, marine insurance, custom clearance, port clearance and handling, inland transportation, inland transit insurance, delivery at site, unloading, handling, storage and in plant transportation at site, complete services of erection including erection supervision and site testing, inspection, all associated civil, structural and architectural works including painting, insurance during, storage, erection and commissioning, performance testing and initial operation of the Slag & Ash Handling system facilities of the 2x 350 TPD WTEP , as defined in this specification.

1.01.03 The equipment and materials to be supplied by the Contractor shall form a fully comprehensive Slag & Ash handling system. The equipment and services as detailed in all sections of the bidding documents and as shown on the tender drawings shall be within the scope of supply of the Contractor. Any items though not specifically mentioned but which are required to make the plant complete in all respects for its safe, efficient, reliable and trouble free operation shall also included, and the same shall be supplied and erected by the Contractor, unless they are specifically excluded.

1.01.04 The work shall consist of mechanical and electrical work and equipment, all associated structural and architectural works, Control and Instrumentation equipment, mechanical services and pipe work and electrical services associated with this Slag & Ash handling system, the principal features of this system being:

(a.) A Slag / bottom ash extraction, conveying and storage system for the slag/ bottom ash generated in the 1st pass.

(b.) A Boiler Ash conveying system for ash generated in 2nd, 3rd, 4th or lateral pass (as applicable) and transported to the bottom ash pit/bunker or Fly ash silo.

(c.) A dry fly ash transportation and storage system for the fly ash collected in ESP/ Bag Filter/Flue Gas treatment Hoppers to Silos

1.02.00 BOTTOM ASH / SLAG HANDLING SYSTEM

Scope under this specification for bottom ash/slag handling system extends from the extraction of bottom ash/slag to conveying and disposal up to the slag pit/Bunker consisting of: -

(a) TWO (2) NOS. BOTTOM ASH / SLAG EXTRACTOR PER UNIT

The burnt-out waste slag falls through the slag chute into the Wet Bottom Slag Extractor. There the slag plunges into a water bath, is quenched and then discharged either by means of a pushing shield (hydraulically operated) or by the wet chain conveyor (apron plate type). The slag extractor shall essentially consist of the following:

i) A trough construction and discharging hood (lined with wearing plates).

ii) A hydraulic drive (cylinder, shaft and lever) with pushing shield or Mechanical wet chain Conveyor (apron plate type) with Idler, drive, plate belt for transporting the bottom ash out of water bath.

iii) A compensator shall be provided between the grate ash/slag extractor and ash fall shaft.

iv) The water bath that ensures an air seal between the incinerator and the environment. The water level in water bath shall be regulated via a water chamber/cabinet located outside of extractor with an integrated overflow system, automatic water level and temperature monitoring system.

v) Manual gate valves shall be provided for emptying of the water of the slag extractor.

vi) Suitable air Fans shall be provided so that vapours arising from the bottom ashes/slag leaving the ash extractor shall be ventilated back into the Slag chute by a continuously running air fan. Ducts shall be made of acid resistant plastic material.

vii) Side door shall be provided to empty slag extractor in case of standstill operation. Proper maintenance opening with platform shall be provided.

viii) Automatic Lubrication unit shall be provided for all bearing zones/ lubrication points.

(b) TWO(2) NOS.SUBMERGED GRATE LEAK CONVEYOR PER UNIT

Fine bottom ash/ riddling which is falling through the grate/hoppers shall be removed and transported by suitable Submerged Conveyor (Drag Chain type or equivalent) which in turn transport fine ash via the hoppers / chutes to the bottom ash/ slag extractor. Submerged conveyor shall have following features:-

i) The water level in the conveyor shall ensure cooling of the riddling and seals the furnace from the environment.

ii) The water level shall be controlled by process water feed into the grate. The water injection shall be capable of avoiding building-up of a floating layer.

iii) For cleaning, control and maintenance purpose appropriate openings with proper access shall be installed on the conveyor.

iv) Automatic Lubrication unit shall be provided for all bearing zones/ lubrication points.

(c) ONE (01) NUMBER BOTTOM ASH PIT / BUNKER (COMMON FOR BOTH SLAG EXTRACTOR) PER UNIT

Bottom ash shall be conveyed from Slag Extractor to the underground slag pit or over ground slag Bunker. Bottom ash shall be transported from slag extractor to underground pit or over ground Bunker by using Gravity or by using suitable mechanical conveyor. Coarse Boiler ash (2nd/3rd pass, as applicable) shall also be conveyed along with Bottom ash to underground pit or over ground Bunker.

Bottom ash /slag shall be stored into the below ground pit or over ground Bunker.
Storage capacity of the Pit / Bunker shall be minimum 48 Hrs Bottom ash generation assuming that plant is operating in 350 TPD with worst (GCV) waste feeding condition and generating maximum possible ash.

Bottom ash/ slag from the Pit/Bunker shall be loaded to the Truck for onward disposal/utilization by Bottom ash crane, specified elsewhere in the Technical Specification.

1.03.00 BOILER ASH (2nd, 3rd & 4th pass ash, as applicable) REMOVAL AND CONVEYING- ONE (01) LOT

(i) Boiler ash shall be removed, conveyed and transported to Fly ash Silo by Mechanical Conveyors or combination of Mechanical and pneumatic conveyors.

The boiler ash (2nd, 3rd & 4th pass as applicable) shall be mechanically collected and conveyed by series of Mechanical Conveyors (screw conveyors or equivalent). The ash shall be further transported to Fly Ash Silo by Pneumatic Conveying system. Boiler Ash removal and conveying system shall consists of following:-

- Series of screw conveyors for collection and transport of Boiler ash.

- Required number of double gate valve at upstream of screw conveyors shall be provided to ensure the pressure separation between flue gas and ambient condition.

- Expansion joints shall be provided in the conveying system wherever applicable.

-Grinding/crushing system for crushing of ash agglomerate in order to ensure max. particle size for transportation by Pneumatic transport system.

- The pneumatic transport system shall consist of a buffer hopper each complete with associated system i.e. supporting steel structures, platforms, stairs, aeration system, collector along with bag filter etc (as applicable) for intermediate ash storage for pneumatic conveying system.

- Otherwise, Boiler ash collected from various passes shall also be transported up to Fly Ash silo by suitable mechanical conveyors only throughout the Boiler ash conveying system.

Alternatively,

(ii) Coarse boiler ash (2nd/3rd pass, as applicable) shall be conveyed into the bottom ash/slag extractor inlet chute. Boiler coarse ash thus shall be transported along with bottom ash to bottom ash pit/bunker.

1.04.00 DRY FLY ASH TRANSPORTATION AND STORAGE SYSTEM-ONE (01) LOT

Fly ash collected in ESP / Bag Filter / Flue Gas treatment Hoppers shall be transported to Fly Ash silo by Pneumatic conveying or by suitable Mechanical Conveying system. Boiler ash from Intermediate/ Buffer hopper shall also be transported along with Fly Ash up to Fly Ash silo either by Pneumatic conveying or by suitable Mechanical conveying system.

Scope under this specification for dry fly ash transportation and storage system consists of:-

1.04.01 For Pneumatic conveying-

Material feed valve/ pump tanks/air locks valves (as applicable) along with necessary isolation valves below each ESP / Bag Filter / Flue Gas treatment Hoppers.

Fly ash transportation main Pipes (100 % stand-by) along with fittings from ESP/Bag Filter area to main storage silos and from Boiler ash Buffer hopper to Fly ash storage silo including platforms, access stairs and other associated supporting steel structure and other accessories as required.

Required number of pneumatic system (100 % stand-by) prime mover – Root Blower/ Compressor or Vacuum Pumps (as the case may be) including accessories.

1.04.02 For Mechanical conveying-

Suitable Mechanical conveyors or Bucket elevators (100 % standby wherever feasible) along with necessary drives, couplings etc up to Fly ash Silo.

Conveyors/elevators shall be equipped with all interlock & protection devices, safety arrangement and shall be free from dust hazards.

Conveying system shall have proper accessibility and easy changeability of components from maintenance point of view.

1.04.03 One (1) no. Dry ash structural steel silo per unit for dry fly ash storage complete with an aeration system, dust separators and all other accessories as required. The silos shall be complete with all fittings, accessories and supporting steel structures, access staircases, platforms, as required for safe and reliable operation and maintenance of dry fly ash storage system.

Fly ash storage Silo shall consist of the following:-

Target box and vent filter assembly along with pulse jetting arrangement, fan units etc. and other accessories

Isolation valves below storage silo.

One (1) Ash conditioner unit along with drive motor, rotary feeder, along with associated pumps, water piping and valves, for loading the conditioned fly ash into trucks.

One (1) Dry fly ash unloaders (telescopic chutes) along with rotary feeders and other accessories for loading Dry Fly ash into closed truck/tanker.

2.00.01 **Design and Engineering of Slag & Ash Handling System**

a) The Bidder will be responsible for design and engineering of complete Slag and Ash Handling system and integrate with other systems to achieve safe, efficient and trouble free operation of the system.

b) The contractor will furnish various Design and Engineering documents for the approval of Owner as per the mutually agreed list and schedule at the time of award of the contract. The following is a brief list of major data/drawings required to be furnished by the contractor while executing the contract.

(i) Detailed piping and Instrument flow diagrams for various systems/sub-systems showing all the equipment, piping, valves, instruments, etc. These diagrams shall also indicate pipe OD x Thk, material, pipe class, pipe /valve / equipment tag number, operating parameters, etc.

(ii) Detailed system design and equipment sizing/selection, pressure drop calculations, water balance diagrams, equipment datasheets etc.

(iii) General arrangement and cross-sectional views of plant and equipment, equipment and piping layouts.

(iv) Analysis and design, design drawings, layout drawings, underground facilities (if any) etc. for all structural works including buffer hopper (if any), bottom ash pit, Ash Silo etc.

(v) Detailed system operation and control write-ups, logic diagrams, electrical schematic and wiring diagrams, programming information/settings for electronic hardware/electronic assemblies control system hardware details, etc.

(vii) Detailed Instrumentation schedules data sheets and Installation drawings, etc.

(viii) Cable routing/layout drawings and cable schedules.

(ix) GA of switchgear and control panels, Junction Boxes,

(x) Performance and Guarantee test procedures

(xi) O&M manual

(xii) System commissioning procedure

2.00.02 **Lifting lugs, eye bolts, etc.**

Each equipment shall be provided with suitable lifting attachments, supports, lifting lugs, eye bolts, etc. to facilitate maintenance.

2.00.03 The Contractor's supply shall also include all miscellaneous items eg. first fill of lubricants, special tools and tackles etc. that are necessary to ensure safe and reliable operation of the plant during start up, continuous running, shut down and emergency conditions, even if these are not explicitly mentioned in this specification.

3.00.00 **CONTROL SYSTEM**

The Slag and Ash handling plant shall be controlled through microprocessor based Distributed Digital Control Monitoring and Information System (DDCMIS) as specified elsewhere in the Technical Specification.

Provisions for manual and local operation of each sub-system or equipment shall be provided.

SUB-SECTION–IIA-14

NOT USED

SUB-SECTION–IIA-15

LP DOSING AND OXYGENATED TREATMENT SYSTEM

LP DOSING AND OXYGENATED TREATMENT SYSTEM

1.00.00 **SCOPE:**

Complete Boiler Feed water chemical dosing (both AVT & Oxygenated treatment – As per vendors proven practice) system complete with dosing pumps, tanks, associated pipings, supports, fittings, valves and instrumentation etc. as specified elsewhere in the specification.

SUB-SECTION–IIA-16

ELEVATORS, CRANE & HOIST

ELEVATORS, CRANES AND HOISTS

1.00.00 **ELEVATOR**

1.01.00 **Passenger Elevator for integral TG Building/control Room & Goods elevator.**

(i) One (1) nos. panoramic type passenger elevator with five glass panels on rear side having capacity of 08 persons (500 kg.), for TG cum Service building (for TG building & Main control room integral with crane operator).

(ii) One (1) nos. Boiler elevator having a capacity of 3000 kg

1.01.01 The scope shall include all items / accessories, service along with all electrical equipment etc. required to meet all design, installation, operation, safety, protection and other requirements of IS: 14665 (latest edition) (all parts), 'Lift' and service lifts'. This scope shall include all items / devices needed to comply with the requirements indicated elsewhere in the specification. The scope shall include but not limited to the following:

(a) 1 No. fireman's switch for each elevator.

(b) Machinery supporting Beam.

1.01.02 The location of passenger Elevators shall be designed such that single passenger elevator meets the requirement of TG building, main control room (integral with crane operator room).

1.01.03 Complete erection, testing and commissioning including all testing and commissioning materials, consumables and other tools and tackles required for erection.

1.01.04 To obtain necessary local administration permits / approvals and make arrangements for inspection and tests required thereby.

2.00.00 CRANE & HOIST

2.01.00 Suitable EOT Crane/HOT crane/monorail beams with hoists/chain pulley blocks of adequate capacity, to meet the erection and maintenance requirements are to be provided by the vendors for the various equipment/areas. Some of the areas/equipment not covered by TG hall EOT crane are indicated below. For balance areas/equipment, not listed herein, the requirements of Technical Specification shall be followed.

(a) Feed water heaters & deaerator.

(b) Various pumps & Heat Exchangers.

(c) Air cooled Condenser water boxes (front & rear), vacuum pumps, control fluid room etc.

(d) Auxiliary cooling water pumps and DM cooling water pumps of ECW systems and Plate heat exchangers (if applicable).

(e) Central lube oil system room.

(f) Any other equipment.

The above requirement is indicative only; the requirement given in the respective chapter is to be adhered to.

2.01.01 Suitable EOT Crane/HOT crane/monorail beams with hoists/chain pulley blocks of adequate capacity, to meet the erection and maintenance requirements are to be provided by the vendors for the various equipment/areas, those weight are exceeding 250 kg.

SUB-SECTION–IIA-17

NOT USED

SUB-SECTION–IIB

ELECTRICAL SYSTEM / EQUIPMENTS

1.00.00 **SCOPE**

The Bidder scope shall include design, engineering, manufacture, type testing, inspection & shop testing at supplier's works, packing, forwarding to site including customs clearance/ port clearance (if required), receipt and unloading, inplant transportation, handling and storage (preservation & conservation of equipment) at site, erection including associated civil and structural works, testing and commissioning of the Electrical equipment/ system and works indicated for the complete plant as indicated in this chapter. The Electrical scope shall be as described briefly in the following clauses but not limited to it. The scope shall be read in conjunction with Tender SLD

1.01.00 **Generator and Auxiliary System**

1.01.01 Generator complete in all respects including stator, rotor, bearings, couplings, terminal pads with palms and all its associated supervisory and instrumentation system.

1.01.02 Complete cooling systems as applicable including the necessary piping and pipe supports, valves, necessary tanks, pumps, motors, heat exchangers, strainers, measuring system along with the control panel.

1.01.03 Complete excitation system with the DAVR, de-excitation equipment, cable and all necessary control, annunciation and monitoring equipment mounted on suitable panels.

1.02.00 **Transformers**

S.No.	Equipment Name	Rating/Parameters	Quantity
1.	**POWER TRANSFORMERS**		
i)	Generator Transformers	as per system requirement	1 Nos.
ii)	Auxiliary Transformer	as per system requirement	
2.	NGR	As per system requirement	
3.	SPARE OIL	As specified	5% of total Volume for all Transformers.

1.03.00 **SWITCHGEAR**

1.03.01 **MV SWITCHGEARS**

The scope shall include MV Switchgear boards as required. All the Switchboards (each section) shall have 02 nos. of spares(either (2) nos transformer or motor feeder, or (1) no. transformer and (1) no. motor feeder).

1.03.02 **LV SWITCHGEARS AND LV BUSDUCTS**

The scope of work includes the following for feeding all the LV Loads of the power plant as required. The major LT Switchgear shall include the following:

415 Volt Switchgears

415 Volt Motor Control Centers

415 Volt AC Distribution Boards

220 V DC/110 V DC/48 V DC Distribution Boards as required

415 Volt AC Fuse Boards

220 Volt DC/110 V DC Fuse Boards

Local Motor Starters, Local Push Button Stations, Telescopic Trolley for Breaker Handling, Welding / Lighting Transformers (As applicable)

LV Bus ducts (As applicable)

All switchgear, Motor Control Centers (MCCs) & AC/DC distribution boards, etc. shall have at least 20% or minimum two (whichever is higher) fully equipped switch-fuse modules of each rating as spares, uniformly distributed over different vertical sections. In addition, all switchgears, MCCs, AC/DC boards, etc., shall have as spares at least twenty (20%) per cent of starter modules/MCCB module or at least one module (whichever is higher) of each physical size, equipped for the rating of the largest auxiliary fed from that size of module.

1.04.00 **DC System**

Battery and Battery Charger

Lead acid plante type/ Nickel Cadmium batteries and Float cum boost chargers shall be in the scope of the contractor, as per system requirement.

1.05.00 **MOTORS**

Motors along with couplings and coupling guards for all rotating auxiliaries covered under this package.

1.06.00 **Cabling**

Following shall be in the scope of the contractor for the complete plant, building, equipment and switchyard system etc. including interplant areas.

(a.) Laying of HT power, LT power and control cables.

(b.) Cable trays and fittings, along with support system.

(c.) Cable glands and lugs.

(d.) Straight-through jointing kits for HT XLPE power cable, LT power and control cables.

(e.) Cable termination kits for HT XLPE power cables.

(f.) Welding receptacles.

(g.) Trefoil cable clamps.

(h.) Junction boxes.

(i.) Galvanised steel pipes/ HDPE/ Hume pipes/ PVC pipes

(j.) Miscellaneous items like M.S. sections etc. as required

(k.) Fire proof cable penetration sealing system of Type-A and Type-B for cable galleries, cable exits etc.

(k.) In addition to other drawings, Contractor shall also prepare complete equipment layout drawings, lighting layout drawings including cable tray layout, routing, Power and control cable schedules etc.

(l) Control interconnection charts shall also be prepared by bidder.

1.07.00 CABLES

HT & LT Power cables, control & instrumentation cables and any special cables along with necessary termination, lugs and glands for the completeness of the system required for connection between different equipment/devices in Bidder's scope.

1.08.00 Earthing and Lightning Protection

Below ground and above ground earthing mat / Grounding and lightning protection for the complete buildings and equipments in the bidder's scope.

1.09.00 Station Lighting

Station lighting system for the plant, buildings and equipment in the bidder's scope. Lighting fixtures complete with LED lamps & accessories, Lighting Panels, Receptacles, Switch boxes. Conduits. Lighting Wires, Ceiling fans with regulators, Lighting poles. Lighting masts, Earth wires and rods, Junction boxes, Battery operated automatic self contained lighting fixture, Maintenance ladders as required are included in the bidder's scope.

1.10.00 DG SET

Minimum One (1) No. Diesel Generator set along with acoustic enclosure of stationary type suitable for outdoor installation to be provided.

1.11.00 Generator Busduct with associated auxiliary equipment

Metal enclosed, phase segregated and natural air cooled.

Generator Busduct shall be provided for Interconnection between generator and generator transformer, Connected to VT and surge protection (SP) cubicles, VT and lightning arrester (LA) cubicles, Neutral grounding cubicle as per system requirements.

1.12.00 Control Philosophy for plant Electrical System

Control of all MV & LT breakers shall be provided from DCS with suitable ECD (Electrical Control Desk) and/or Soft HMI. The details of the same are specified in relevant sections of Control and Instrumentation.

1.13.00 **CONSTRUCTION POWER**

Bidder shall make his own arrangement to meet the construction power requirement of the project.

1.14.06 **Following shall be provided for Control & Protection of MV system and Generator.**

a) Protection system shall be provided with Numerical relays.

b) Complete protection system in all respect including auxiliary systems.

c) AC & DC power supply system for entire HV system Bay equipments.

a) Panel mounted Protection Units (PU) for Generator, Generator Transformers

b) All protections for MV systems

c) ABT based –TOD metering, 0.2S Accuracy class as per Discom Specification as indicated in Electrical Single line Diagram

d) ABT based energy metering system as indicated in protection SLDs and dummy panels for mounting owner supplied meters.

e) One dynamic relay test kit.

f) Protection panels for Gen, GT

g) All networking accessories and workstations as per requirement

h) Recommended relay setting files for owners review and approval.

1.15.00 Local control panels as indicated in relevant chapter.

1.16.00 **Variable Frequency Drive (VFD)**

The VFD system shall be provided for the equipment drive motors as envisaged in relevant portions of the specifications for equipment. Complete VFD system alongwith associated electrical equipment such as transformer, Switchgear panels, Cables etc. as required shall be provided. The system shall be either Voltage Source Inverter (VSI) or Current Source Inverter (CSI) type. Contractor shall provide air conditioned room for VFD system.

1.17.00 **PAINTING FOR ELECTRICAL EQUIPMENT**

Unless explicitly stated in relevant chapters of the specification, the painting of all electrical equipment shall be as follows:

Epoxy based with suitable additives. The thickness of finish coat shall be minimum 50 microns (minimum total DFT shall be 100 microns). However in case electrostatic process of painting is offered for any electrical equipment, minimum paint thickness of 50 microns shall be acceptable for finish coat. Paint shade shall be as per technical specification.

1.18.00 **TYPE TEST**

Contractor shall meet the requirements of type tests on electrical equipments as stipulated in relevant chapters of technical specifications.

SUB-SECTION–IIC

CONTROL AND INSTRUMENTATION

CONTROL AND INSTRUMENTATION SYSTEM

1.00.00 GENERAL

1.00.01 The Contractor shall provide Independent Control & Instrumentation system for control, monitoring and operation of associated drives and auxiliaries in Waste to Energy plant system including it's associated systems e.g. Combustion stsem,Turbogenerator,waste handling , residual handling water treatment and other systems being provided under the contract, in all regimes of operation in safe and most efficient manner. The Contractor shall provide all systems, equipment, accessories and associated equipment, which are included in Contractor's scope, in a fully operational condition acceptable to the Employer.

1.00.02 The Contractor shall provide all material, equipment and services which may not be specifically stated in the specifications but are required for completeness of the equipment/systems furnished by the Contractor and for meeting the intent and requirements of these specifications. The work shall be consistent with modern Waste energy based power plant practices and shall be in compliance with all applicable codes, standards, guidelines and safety requirements in force on the date of award of the contract.

1.00.03 The Contractor shall also provide all the instruments along with cables, JB etc. for equipments / drives and services which may not be specifically stated in this specifications but are required for completeness of the plant Control system shall be furnished by the Contractor and for meeting the intent and requirements of these specifications.

1.00.04 The Bidder's scope shall include design, manufacture, engineering, inspection & testing at supplier's works, packing, forwarding to site, unloading, erection, testing, commissioning and Operation & maintenance of 5 years including spares from date of completion of facilities. The following clauses describe the brief scope of supplies. Scope shall be as described briefly in the following clauses but not limited to it. The Functional technical specifications are stipulated under Part - B, Section-VI of the specification as well as in various other Parts of the Technical Specifications .However Bidder to ensure the functionality & operability of the complete system in all regimes of operation.

2.00.00 **DISTRIBUTED DIGITAL CONTROL, MONITORING & INFORMATION SYSTEM (DDCMIS)**

The contractor shall provide a common DDCMIS based latest state of art microprocessor based control system complying subsection IIIC-02 DDCMIS Part-B, Section VI for the Complete plant/ Equipment & systems being provided by them as indicated below,

2.00.01 **SG system**: Boiler combustion system, SCAPH, SADC, AUX PRDS, soot blower secondary fuel gas system, Gram feeder control, Grate control, NOx control system etc.

The BMS shall comply with the requirements stipulated in NFPA 85.Further, any specific requirements regarding type of control system for tripping of Boiler (e.g. Fail safe system), shall be provided if the same is required as per standard practice of Manufacturer of Boiler & relevant regulations.

2.00.02 **TG system** :steam turbine & generator protection system including generator mechanical protection system, Governing system,EHC,oil system Vacuum system , Air cooled condenser control system ,Turbine bypass control system ,MDBFP and it's auxiliaries OLCS & CLCS controls. Miscellaneous turbine related startup shutdown, drain vent controls etc.

The type of control system for turbine protections and Governing system including over speed protection shall be as per TG supplier standard & proven practice for similar turbines.

Electrical breakers: all the Electrical breakers of the plant shall be controlled from DDCMIs.

2.00.03 **BOP systems**: ---

a) Ash/residual handling

i) Bottom ash /slag extractor system

ii) Residual silo system

iii) Lime handling and activated carbon handling system

b) Flue gas treatment system: Evaporation cooler and fabric filter.

c) Water treatment/filtration/UF/RO plant/service water/waste water treatment /effluent treatment, Leachate treatment system/chemical treatment (as defined in Mechanical section of the specification).

d) Dosing system as applicable.

e) Compressors

f) Fire detection & protection system:

2.00.04 **Waste crane handling system**: the operating system for both cranes handling waste shall be fully automatic along with weigh measurement of waste & integration of measurement along with provision of MANUAL operation. To enable this,

Contractor to provide fully automatic intelligent system as defined in Mechanical sections. If contractor's standard & proven practice is to use PLC for this system, the same can be provided .In such case, Contractor to furnish documents establishing standard practice. This system shall be integrated with Unit DDCMIS.

2.00.05 **Weigh Bridge for waste vehicles**: The weigh bridge for measurement of at the Entry & exit of the Waste carrying vehicles for Waste energy plant .This system shall be capable of logging all the details as well as transmitting the waste data and number of Vehicles to the Unit DDCMIS for display & report generation .

2.01.00 The Control system to be provided for this project shall be as follows:

UNIT DDCMIS: the DDCMIS for complete plant shall comprise of following systems: --

i) SG system

ii) TG system & Electrical Breakers

iii) BOP system

The contractor shall have integrated SOE & HART of 1ms resolution.

Remote I/Os may be considered for water treatment system, flue gas treatment system if it is a standard & proven practice of contractor & the same will be finalized during detail engineering.

For compressors, if their controls are from PLCs integral to Compressors are being provided by Contractor, then in that case the ON/OFF operation of these compressors from DDCMIS. Further, the suitable Soft connectivity of this PLC will be ensured with DDCMIS so that operating parameters are available in DDCMIS.

For Fire detection & protection system, Bidder shall provide control system as defined in sub-section IIA-09, Plant Utility of the specifications. Location for operation for above will be central control room.

2.02.00 **HMIPIS**: HMIPIS configured around latest state of art with server /workstation with architecture supporting OPC /TCP/IP protocols, etc. shall be provided. Unified HMI is to be provided for complete Plant DDCMIS (i.e. SG, TG&BOP system) .LVS with its work station (independent of OWS) and graphic processors to dynamically display plant data/mimics/alarms and other process information shall be provided. The large video screens shall have additional features to work in association with multiple numbers of plant cameras also to be supplied under this package.

Three numbers of workstation with 22'' TFT monitors, KVM switch , 2 numbers of Programming stations, Redundant servers ,three no's of LaserJet (A4)printer ,

shall be provided along with three(3) numbers of large video screens (LVS) complying specification part-B shall be provided.

Data communication system:- System Bus connecting Control System and HMIPIS and other bus systems for connecting various systems/subsystems of DDCMIS as well as within systems/sub-systems of DDCMIS Refer IIIC-02, Part-B for details. All the bus systems shall be redundant except for backplane buses which may be non-redundant.

The annunciation system shall be built as a part of the control system of the DDCMIS.

2.03.00 System programming, diagnostics & documentation facility: The programmer station shall be provided for configuration /tuning/structuring of control system and program development /modification of HMIPIS for complete DDCMIS. The diagnostic system shall have elaborate diagnostics facility giving details of fault in I/O modules, other modules and cabinets and on OWS / LVS in form of display and text messages

2.04.00 Master slave clock system : One Geo-positionary satellite (GPS) based Master Clock in redundant configuration and slave clocks for the unit and common areas shall be provided with suitable equipment including antenna, receiver and associated electronics to receive synchronization signals from GPS. The master clock shall synchronize DDCMIS other DDCMIS subsystems at suitable intervals to maintain uniform time throughout the power station.

2.05.00 Power supply: Redundant power packs/ supplies for powering the systems described above in system cabinets with necessary auctioneering and distribution.

2.06.00 Cabinets: DDCMIS cabinets shall be provided housing electronic modules and power pack supplies of system, marshaling & relays. etc.

2.07.00 HMIPIS Cabinet- for mounting network components & power supply distribution equipment for HMIPIS shall be provided.

2.08.00 Electrical hardware cabinet(ECP) shall be provided for items required for synchronization (like auxiliary PTs and synchronizing check relay and guard relay as well as other auxiliary relays etc. as specified elsewhere and as applicable).

3.00.00 **GENERAL INSTRUMENTATION PHILOSOPHY**:

In order to have reliable measurement with extensive diagnostics the contractor shall provide analogue instruments for measurement of all parameters unless due to very specific reasons it is not possible to provide such instruments. In such instances Contractor can provide switches /instruments as per standard practice, but the same will be acceptable only after Contractor establishes the justifiable reason. Further, the measurements which are used in protection of SG, TG & their major auxiliaries and that in critical control loops shall be triple redundant (e.g. Drum level ,main

steam pressure ,feed water , main steam temperature, furnace temperature, furnace pressure , combustion air etc.).

Considering above philosophy and following aspects all required instruments, meeting specification requirement defined at cl. 4.00.00 and 5.00.00 and Part-B shall be provided.

(a) Instruments required for complete plant, as required for remote operation from Control ROOM as well as other requirements defined in specification elsewhere, shall be provided.

(b) Instruments integral to equipment/in process, required for control, monitoring and operation of the equipment / plant systems shall be provided to meet the actual system requirements and meeting redundancy and other requirements specified under technical specifications subject to Employer's approval.

4.00.00 MEASURING INSTRUMENTS

The following shall be provided as a minimum, meeting specification requirements of Sub-section - MEAS INST of Part-B, Section-VI of Technical Specification.

4.01.00 Primary instruments like thermocouples & RTDs along with temperature transmitters, pressure/diff. pressure/temperature/flow & gauges, flow sensing elements (orifice plates, flow nozzles etc), Flue Gas flow transmitter, vibration measurement.

For vibration measurements and protection minimum 2 number (X and Y direction) sensors per bearing shall be provided.

4.02.00 CONTINUOUS EMISSION MONITORING SYSTEM (CEMS)

A) CEMS comprising of analyzers and associated items for measurement of SOx, NOx, CO, CO2, Mercury, Hcl, HF, total Organic carbon (TOC), H2O,O2, Particulate Emission (dust density/ stack opacity) monitor, Stack Flue Gas Ultrasonic Flow Meter, stack temperature measurement any other analyzer required as per Statuary regulations shall be provided for each unit by the Contractor for stack emission monitoring.

LIST OF FLUE GAS EMISSION ANALYSERS

S. No.	DESCRIPTION	ZONE	REMARK
1	SOx ANALYSER	CHIMNEY	
2	NOx ANALYSER AT CHIMNEY	CHIMNEY	
3	CO2 ANALYSER	CHIMNEY	

4	CO ANALYSER	CHIMNEY	
5	OPACITY ANALYSER AT CHIMNEY	CHIMNEY	
6	Mercury	CHIMNEY	
7	HCl	CHIMNEY	
8	HF	CHIMNEY	
9	H2O	CHIMNEY	
10	TOC	CHIMNEY	
11	Oxygen Analyzer	CHIMNEY	
12	Flowmeter (Ultrasonic Time of Transit Type	CHIMNEY	

Notes:- 1) SOx, NOx, CO2 and CO,HCL,Hf,O2 analyzer are shown separately for the purpose of input only, otherwise SOX, NOX, CO2 and CO,HCL,HF,etc. analyzer may be supplied as a single unit/ Combined Unit (s) meeting specification requirement.

CEMS, instruments shall be provided with provision for bidirectional connectivity over Modbus/RS-232/RS-485 with Employer's central cloud server for real time data monitoring, remote diagnostics & remote calibration checks, etc., complying with **Solid waste management rules, 2016 GEZZATTE** notification **Govt of India April 2016** or the latest regulatory requirement prevailing at the time of award of the contract. Analyzers shall be provided with dual Modbus port, one port for connection with Contractor's DDCMIS & other port for connecting Employer's Cloud server. All necessary software & support required at instrument end shall be provided by the Contractor. Necessary details like scheme, register addresses of analyzer, etc. shall also be provided by the Contractor for implementation of above.

For CEMS - In addition to above requirement, 4-20 mA connectivity to DDCMIS shall be provided by the Contractor.

4.03.00 **AMBIENT AIR QUALITY MONITORING SYSTEM(AAQMS)**

02 Air ambient quality monitoring system are to be installed in up-wind & downwind direction. The system/analyzer shall comply to specification part-B.

1	**Ambient air quality monitoring system(AAQMS)**		**Quantity common for all units**
(a-1)	SOX, NOX, CO, O3 ANALYSER , Multi gas Calibration system, PC based Data logger for individual AAQMS stations, UPS		2sets

(a-2)	Mercury Analyser		1 set
(b)	Suspended Particulate Monitors		4 sets
(c)	Sampling Inlet Heads		2 sets (PM 10, PM 2.5 AND TSP)
(d)	PC Based Data Logger For Central Station With A4 Laser Printer Along With UPS		1 set
(e)	Meteorological sensors- Wind speed sensor, wind direction sensor, air temp sensor, relative humidity sensor, solar radiation sensor, rain gauge		1 set
(f)	Meteorological Mast		1 set
(g)	Sample Handling System Including Compressed Air For Purging.		2 sets
(h)	Connectivity From Central AAQMS Station To Individual Stations		1 LOT
(i)	Window A/C For AAQMS Stations (1.5 Tons Each)		4 nos.

4.04.00 **EFFULENT TREATMENT PLANT ANALYSERS**:

Contractor shall provide all the required analyzers for parameters required as per CPCB/SPCB guidelines (pH, conductivity, COD, BOD, TSS, OIW, TEMP, FLOW METER, ETC.) meeting specification requirement specification part-B, Measuring instruments. Further, these will be connected to DDCMIS for display of measurement data by contractor.

5.00.00 SPECIAL INSTRUMENTS:

The following shall be provided as a minimum, meeting specification requirements of Sub-section - SPECIAL INSTRUMENTS of Part-B, Section-VI of Technical Specification.

a) Waste Weigh Measurement Bridge.

b) Crane waste weight measurements system.

c) Flame monitoring (scanner) system

d) Gram feeder control & instrumentation

e) Acoustic Pyrometers

f) Flame viewing system.

g) Turbine supervisory system & vibration for HT drives.

h) Speed measurement for turbine system

I) Load Transducers.

J) Auto synchronizer

k) not used

L) Furnace temperature measurement :S-type thermocouples shall be provided for furnace temperature measurement This S type thermocouple shall be protected with gas tight ceramic tubes, a secondary tube of porcelain and silicon carbide or metal outer tubes, as conditions required finalized during detail engineering.

m) Level measurement for waste hopper: level sensors based on microwave or equivalent proven technology for waste hopper level measurement shall be provided. The same shall be finalized during detail engineering. Number of sensors shall be as per process requirement.

6.00.00 POWER SUPPLY SYSTEM:- Contractor shall provide 230 VAC UPS of suitable capacity for the intended application including CEMS, CCTV, PA system, Flame camera, SWAS, Acoustic pyrometer, Turbine supervisory system, Crane handling system ,weigh bridge etc. Based on the option opted for Control system by Bidder meeting the requirements of Technical Specifications as per, Part B of specifications.

For control system, Bidder can use microprocessor based 24 V DC Modular two sets, each set containing 1x100 % intelligent modular 24 V DC power supply charger system or may use 230 V AC UPS power supply. Further, these supplies shall be fed through panel mounted 230 V AC To 24 DC or 24 V DC to 24 V DC power supply convertors in control cabinets. Bidder shall provide power supply distribution panels/cabinets/boxes for sub distribution of DC/Main UPS/Utility feeders on as required basis. The power supply distribution box shall include change over circuitry, switch fuse units, MCBs, terminal blocks etc. suitable for application.

7.00.00 PROCESS CONNECTION & PIPING

Process connection & piping, all impulse piping, pneumatic piping/tubing, valves, valve manifolds, fittings and all other accessories shall be provided on as required basis for proper installation & completeness of impulse piping system .the piping

shall be of same material as of Main pipe. Air supply system, as stipulated under Sub-section PCP, Part-B, Section-VI of Technical Specification.

8.00.00 INSTRUMENTATION CABLES, C & I SYSTEM, POWER SUPPLY DISTRIBUTION CABLES & CABLE SUB-TRAYS

a) All instrumentation cables (twisted & shielded, FRLS PVC insulated and sheathed), data highway / fiber optical cables including prefabricated cables (with plug-in connectors), shall be provided by Contractor on as required basis.

b) All power supply distribution cables for equipment / systems devices in contractor's scope shall be provided by the contractor. All these cables shall be FRLS & as per IS-1554 Part – I latest edition.

c) Above cables shall be provided along with necessary laying & termination accessories, hardware etc. meeting requirements specified under Sub-section INST CABLE, Part -B, Section-VI of Technical Specification. All sub trays along with supporting, connecting hardware etc. required for laying of instrumentation, control, power and other cables etc. up to main cable trays are under Bidders scope.

d) Junction boxes with requisite terminals shall be provided on as required basis.

9.00.00 CONTROL VALVES & ACTUATORS

Control valves, actuators and accessories, shall be provided on as required basis for meeting requirements specified under Sub-section CONTROL VALVE, Part-B, and Section-VI of Technical Specification. Specially designed valves/trims to prevent cavitations and limit noise and control outlet velocity, shall be provided.

Microprocessor Based Electronic Positioner is to be provided on as required basis with all the Control valves and all control dampers being provided by the contractor.

10.00.00 CONTROL DESK & FURNITURE:--

The control desk will be provided in central control room with provisions of back up push buttons & Emergency push buttons for Steam generator & Turbogenerator. Further the desk shall be capable to accommodate minimum 6 nos of OWS TFT monitors, 2 number telephone sets & 2 PA handsets.

CCR/Crane system/ CEMS/ Weigh Bridge Room furniture, system suitable for all HMI equipment's specified in the specification. However, the exact will be finalized during detail engineering.

The Complete wiring / cabling from field devices to panels / MCC and vice versa including conduits / trays / fixtures etc. shall be in bidder's scope.

11**.00.00** **IP Based PUBLIC ADDRESS SYSTEM** : public address system including call stations loudspeakers ,network switches servers , PA management software & other application software(s) interconnecting cables etc. shall be provided complying Part-B of specifications as per quantities Below:---

Description	Quantity	Type of station
Weigh bridge area	1	A
Crane handling system CR	1	B
Compressor house	1	A
Water treatment plant	1	B
Near ID fan /chimney area	1	A
Boiler zero meter /Bottom ash per boiler	1	A
Boiler firing floor /per boiler	1	A
Boiler SNCR area /per boiler	1	A
Boiler drum /per boiler	1	A
Turbine zero meter	1	A
Ash Silo	1	A
Flue gas treatment area	1	A
Switchgear Room	1	B
CER /CCR ON UCD	2	B
TG HALL	1	A
Other location as decided during detail engineering	2	A
Other location as decided during detail engineering	2	B

12.00.00 **CLOSED CIRCUIT TELEVISION SYSTEM (CCTV):** CCTVs system shall be provided along with Redundant camera database servers & video management system which will be capable and connected with LVS being provided by Contractor. **Further, Contractor shall provide one sets of Industrial grade wall Mounted MIN 40" LCD panel along with its workstation shall be provided for display of all the cameras.**

Description	quantity	Remark
Weigh bridge area	2	HD fixed
Crane handling system	3	High definition camera with motorized zoom lens,housing,PAN& TILT MECHANISM
Tipping hall	2	High definition camera with motorized zoom lens,housing,PAN& TILT MECHANISM
Residual silo	1	HD fixed
Bottom ash /per boiler	1	High definition camera with motorized zoom lens,housing,PAN& TILT MECHANISM
Firing floor /per bolier	1	High definition camera with motorized zoom lens,housing,PAN& TILT MECHANISM
Grate area /per boiler	2	High definition camera with motorized zoom lens,housing,PAN& TILT MECHANISM
Central control room	1	High definition camera with motorized zoom lens,housing,PAN& TILT MECHANISM
Water treatment plant	1	HD fixed

TG hall	1	High definition camera with motorized zoom lens,housing,PAN& TILT MECHANISM
Transformer yard	1	High definition camera with motorized zoom lens,housing,PAN& TILT MECHANISM
Waste yard	2	High definition camera with motorized zoom lens,housing,PAN& TILT MECHANISM
Other locations (As decided during detail engineering)	4	HD fixed

12.01.00 COMMON IP BASED NETWORK FOR PA SYSTEM & CCTV：

Common IP based network for IP based PA system & IP based CCTV system involving common components viz.network switches, network media, power supplies may be acceptable subject to Employer's approval during detail engineering.

13.00.00 TYPE TEST REQUIREMENT

The type tests to be conducted for C&I systems & equipments shall be as detailed out in Sub-Section-C-06 Type Test Requirements, Part-B, Section-VI of Technical Specification.

14.00.00 **STEAM WATER ANALYSIS SYSTEM (SWAS):**

The following shall be provided as a minimum meeting specification requirements stipulated under part-B Sample piping, primary& secondary coolers, chillers etc. Complete with sampling pumps, gauges, switches valves etc. Analyzers as indicated in table below as well as any other analyzer as required and recommended by Contractor or OEM. The analyzers shall be hooked up with DDCMIS for display of measurement values.

Sample	Measurement

DRUM /per boiler	PH,silica,conductivity
Main steam /per boiler	PH,silica,conductivity
Feed water /per boiler	PH, conductivity, Dissolve oxygen
Hot well	Conductivity, Dissolve oxygen

15.00.00 **ELECTRIC ACTUATORS**

Non-Intrusive Hardwired Electric actuators with integral starters along with associated accessories etc shall be supplied on as required basis for Valves / Dampers to meet the functional and the other specification requirements. All the signals of actuator shall be connected hardwired to control system.

For non-intrusive actuators 5 Nos. configuration/ diagnostic tool (if applicable) shall be provided in this package.

For detail specifications, refer Part B.

For erection and commissioning of specified actuators, qualified and experienced engineers of actuator manufacturer shall be deputed at site.

16.00.0 **FIRE DETECTION SYSTEM**: --- Automatic fire detection & protection system for entire plant are to be provided as defined in other mechanical subsection of the specifications. Further, methane detectors are to be provided in Tipping hall & Waste pit area hooked up with Fire protection system.

17.00.00 **CENTRAL CONTROL ROOM / CER/PROGRAMMER ROOM/CRANE HANDLING CONTROL ROOM**

a) The contractor shall provide modern state of art Common control room for the project. The Control room shall be capable to accommodate Operator desk /LVS with minimum 6 operating stations. Further**,** The Crane handling system operation shall be carried out from CCR so that the Crane handling system is visible from CR glass partitioned wall. The exact layout will be finalized during detail engineering.

b) the control equipment ROOM adjacent to Control ROOM with one glass partitioned wall shall be provided to accommodate all Control system panels along with Crane handling system control panels, Turbovisery system ,CCTV ,PA system panels ,Master clock system and any system being provided by Contractor.

c) Programming Room , A suitable room adjacent to control room /CER with glass portioned from Control room will be provided to accommodate servers for control system, network panels, CCTV PC,& servers CEMS PC, PA system PC ,Acoustic pyrometer PCs., PI system PC etc.

d) UPS, Battery, charger & Battery (as applicable) Room shall be located below main control Room. DC/AC distribution boards, as applicable.

e) CEMS Monitoring ROOM: Air conditioned ROOM shall be provided for CEMS system near chimney for analyzer system.

f) SWAS ROOM: Air conditioned SWAS room shall be provided accommodating all the analyzers, wet panel including secondary coolers, if required being provided by Contractor.

g) Weigh measurement Room at Plant ENTRY/EXIT of vehicles: To accommodate Weigh measurement system along with system for logging of weight measurement of waste, suitable Room shall be provided.

For designing Central control room, CER, Programming room, the contractor shall follow guidelines provided in part–B of specifications.

18.00.00 **Grounding System**

Suitable electronic grounding is to be provided by the contractor for all C&I equipment's/panels/desk in the scope of the contractor. The exact scheme shall be as finalized during detailed engineering.

19.00.00 **MAINTENANCE AND CALIBRATION EQUIPMENT**

Maintenance and Calibration equipments/devices of proven type, for maintenance & calibration of instruments shall be provided as a minimum by the Contractor. The Contractor shall be responsible for supplying all accessories and any necessary additional tools as required for proper maintenance and calibration of the installed C&I devices/systems

20.00.00 TOOLS & TACKLES

The Contractor shall furnish a complete new set of all special tools and tackles of reputed make and model which are required for erection, ease in maintenance to have minimum down time, testing and calibration of all the equipment and systems to be provided by the Contractor under this specification for C&I systems.

SUB-SECTION–IID

CIVIL WORKS

1.0 **CIVIL, STRUCTURAL & ARCHITECTURAL WORKS**

1.00.0 **SCOPE OF WORK**

The scope of civil, structural and architectural works shall include detailed geotechnical investigation, site clearance, preparation of design documents and drawings and construction of all civil, structural and architectural works including supply of all construction materials for all buildings, equipment and facilities for the project. The nature of work generally involves detailed geotechnical investigation, earthwork in excavation in all types of soil, rock, de-watering, piling, backfilling around completed structures, plinth filling, disposal of surplus Excavated material, concreting including reinforcement and form work, masonry work, plastering, painting, un-insulated / sandwiched insulated metal wall cladding, roofing and flooring including permanent steel decking, false ceiling, under deck and over deck insulation, fabrication of all structures at factory, pre assembly of fabricated structures at factory, transportation of pre-fabricated structures and erection of steel structures (with bolted field connections) and miscellaneous steel works (i.e. steel staircase, cable supports, pipe supports, ladders, walkways, railing, chequered plate/grating floors, inserts etc.), painting of structures, area paving including drainage and sewerage, gravel filling, providing pre-cast covers, damp proofing, roof water proofing, anti-weed treatment, roads, drainage, final grading and site clearance before handing over and any other item of work required for completion of all systems under the scope of work complete. The scope of Bidder for civil, structural and architectural works as defined above shall include but not be limited to the following buildings/ areas/ systems along with their foundations, super structures and finishes complete:

1.Topographical Survey

2. Geotechnical Investigation

3. Infrastructure Works

(i) Dismantling of existing facilities including foundation as required and disposal of scrap/debris.

(ii) Site clearance & Disposal including cutting of shrubs and trees (girth less than 30 centimeters)

(iii) Site levelling of total plant area as per Plot Plan

(iv) Fencing/Boundary wall around the plant area

4. Foundations for all buildings/area/systems including machine foundations

5. All civil structural , Architectural, works including underground facilities like drainage, sewerage, trenches, earthing mat/grounding for the main plant area covering the following:

i. Waste Receipt hall & waste pit including grab crane
ii. Boiler and its auxiliaries,
iii. Steam Turbine, Generator and its auxiliaries
iv. Air cooled Condenser
v. Auxiliary Cooling Tower
vi. Generator Transformer
vii. Auxiliary Transformer
viii. 11 kV/66 kV switchyard
ix. Residual handling plant
x. BFP's & Fans
xi. All auxiliary pumps and motors, other miscellaneous equipment foundations
xii. Water Treatment Plant equipment
xiii. Effluent treatment plant
xiv. STG hall including Control Room
xv. Administration & Canteen Building
xvi. Security cum time office
xvii. Weigh Bridge control room
xviii. Guests reception, canteen, Model room, Safety gadget hall, Conference halls, office space/ cabins, Kitchen, dining area/hall etc.

6. Exhaust Stack/Chimney

7. Storage Tanks
(i) Water Tank - Raw water cum firewater reservoir
(ii) Any other RCC tanks

8. Roads & Drains within the plant area and connection of the drains to main drain for disposal of storm water.

9. Separate drainage system for plant effluent upto effluent treatment plant.

10. Sewerage system and Sewerage Treatment Plant

11. Landscaping

12. Any other building/facility required for completion of all systems.

13. All steel structures shall be fabricated in factory, transported and erected at site. All factory fabricated structures shall have bolted field connections.

14. Submission of Plant Design Memorandum for Civil, Structural & Architectural works and getting approval of the same from the Employer prior to Design.

15. All foundations & Building design and drawings shall be got vetted by reputed engineering institutes like IIT (Indian Institute of Technology) / NIT (National Institute of Technology)/SERC (CSIR-Structural Engineering Research Centre) and a certificate for the same to be submitted by the Contractor after the award along with drawings and documents.

Civil, structural and architectural works though not explicitly mentioned in the above list but required for the completion of the various systems of the package shall also be in the scope of the bidder.

2.00.0 CONSTRUCTION FACILITIES

The following are in the Bidder's scope of work pertaining to construction facilities in this package.

1. Construction Water

   Construction water shall be arranged during all stages of construction.

2. Construction power

   Scope of supply of construction power is specified in Electrical section of Technical specification.

3. Drinking water & Service water facility and toilets at work site for Bidder's construction workers and other personnel.

4. Providing first aid facilities at the construction / erection sites, workshops, laboratories, fabrication, pre-assembly & storage yard, Offices and other places of work as per the requirement.

5. Use of ash and ash based products

   In line with Gazette Notification on Ash Utilization issued by Ministry of Environment & Forest and its amendments, Bidder shall use ash and ash based products in all construction. He shall furnish a compliance report along with all details of use of ash and ash based products along with each bill. The above requirements shall be applicable to his sub-vendors also and Contractor shall be responsible for enforcing the same on his sub-vendors.

SUB-SECTION–IIE

NOT USED

SUB-SECTION–IIF

NOT USED

SUB-SECTION–III

TERMINAL POINTS & EXCLUSIONS

TERMINAL POINTS

The terminal points identified herein below shall be read in conjunction with the tender drawings, scope of supply and technical specifications of various systems.

1.01.00 CIVIL

Terminal point for road outside the gate complex/ gate shall be as shown in GLP.

1.02.01 Mechanical

a) Arrangement for supply of sufficient quantity of RDF and ensuring regular supply of the RDF to site, based on prior information in writing.

b) Raw water intake location is marked in GLP. Raw water shall be drawn from intake location for waste to energy plant.

c) Vapour absorption machines (Aproximate capacity of 10,000 TR shall be in the scope of NTPC, However, the contractor shall provide a earmark a suitable space for the machines, cooling towers for vapor absorption machines. However bidder shall provide the extraction steam pipe line up to that space.

d) A suitable area to be left for VAM plant which would require approx. 35m x35 m area for housing VAM machines and adjacent 60m X 12m area allocated for cooling towers for VAM machine.

1.03.00 ELECTRICAL

As per Electrical Single Line Diagram

CONSTRUCTION POWER

Bidder shall make his own arrangement to meet the construction power requirement of the project.

2.00.00 **EXCLUSIONS**

2.01.00 **CIVIL**

Approach roads from highway outside the plant boundary.

2.02.00 **Electrical**

	NIL
2.03.0	**Mechanical**
	Supply of RDF
2.4.0	**C & I**
	Plant Performance Analysis, Diagnosis and Optimization (PADO) software system

SUB-SECTION–IV

FUNCTIONAL GUARANTEES

FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES FOR SHORTFALL IN PERFORMANCE AND GUARANTEE TESTS

The term "Performance Guarantees" wherever appears in this Sub-Section shall have the same meaning and shall be synonymous to "Functional Guarantees". Similarly the term "Performance Tests" wherever appears in this Sub-Section shall have the same meaning and shall be synonymous to "Guarantee Test(s)".

1.00.00 **PERFORMANCE GUARANTEES**

1.00.01 **General Requirements**

a) The Contractor shall guarantee that the equipment offered shall meet the ratings and performance requirements stipulated for various equipment covered in these specifications.

b) The guaranteed performance parameters furnished by the bidder in his offer, shall be without any tolerance values whatsoever and all margins required for instrument inaccuracies and other uncertainties shall be deemed to have been included in the guaranteed figures.

c) The Contractor shall conduct performance test and demonstrate all the guarantees covered herein, during performance guarantee/acceptance test. The various tests which are to be carried out during performance guarantee/acceptance test are listed in this Sub-section. The guarantee tests shall be conducted by the Contractor at site in presence of Employer on each unit individually.

d) All costs associated with the tests including cost associated with the supply, calibration, installation and removal of the test instrumentation shall be included in the bid price.

e) It is the responsibility of the contractor to perform the Performance Guarantee/Acceptance test as specified in this subsection. The performance tests will be performed using only the normal number of Employer supplied operating staff. Contractor, vendor or other subcontractor personnel shall only be used for instructional purposes or data collection. At all times during the Performance Tests the emissions and effluents from the Plant shall not exceed the Guaranteed Emission and Effluent Limits.

f) The Contractor shall make the plant ready for the performance guarantee tests.

g) All instruments required for performance testing shall be of the type and accuracy required by the code and prior to the test, the contractor shall get these instruments calibrated in an independent test Institute approved by the Employer. All test instrumentation required for performance tests shall be supplied by the contractor and shall be retained by him upon satisfactory completion of all such tests at site. All calibration procedures and standards shall be subjected to the approval of the Employer. The protecting tubes, pressure connections and other test connections required for conducting guarantee test shall conform to the relevant codes.

h) Tools and tackles, thermowells (both screwed and welded) instruments/devices

including flow devices, matching flanges, impulse piping & valves etc. and any special equipment, required for the successful completion of the tests, shall be provided by the contractor free of cost.

i) The Performance / Acceptance test shall be carried out as per the agreed procedure. The PG test procedure including demonstration tests shall be submitted within 90 days of the date of Notification of Award and finalization of the PG test procedure shall be done within 180 days from the date of Notification of Award. After the conductance of Performance test, the contractor shall submit the test evaluation report of Performance test results to Employer promptly but not later than one months from the date of conductance of Performance test. However, preliminary test reports shall be submitted to the Employer after completing each test run.

The P&G test procedures shall be submitted for equipments/ system & subsystem under Contractor's scope for all Guarantees under category I, II & III as mentioned below, as per latest International codes / standard including correction curves, meeting the specification requirements along with sample calculations & detailed activity plan of preparation (including test instrumentation), conductance and evaluation of Guarantees.

j) The contractor shall submit for Employer's approval the detailed Performance Test procedure containing the following:

a) Object of the test.
b) Various guaranteed parameters & tests as per contract.
c) Method of conductance of test and test code.
d) Duration of test, frequency of readings & number of test runs.
e) Method of calculation.
f) Correction curves.
g) Instrument list consisting of range, accuracy, least count, and location of instruments.
h) Scheme showing measurement points.
i) Sample calculation.
j) Acceptance criteria.
k) Any other information required for conducting the test.

k) In case during performance guarantee tests it is found that the equipment/system has failed to meet the guarantees, the Contractor shall carry out all necessary modifications and/or replacements to make the equipment/system comply with the guaranteed requirements at no extra cost to the Employer and re-conduct the performance guarantee test(s) with Employer's consent. However if the specified performance guarantee(s) are still not met but are achieved within the Acceptable Shortfall Limit specified at clause 1.01.02 of this subsection, Employer will accept the equipment/system/plant after levying liquidated damages as per clause 1.01.02 of this sub-section. If, however, the demonstrated guarantee(s) continue to be more than the stipulated Acceptable Shortfall Limit, even after the above modifications/replacements within ninety (90) days or a reasonable period allowed by the Employer, after the tests have been completed, the Employer will have the right to either of the following:

i) **For Category-I Guarantees**

Reject the equipment/system/plant and recover from the Contractor the payments already made

OR

Accept the equipment/system/plant after levying Liquidated Damages as specified hereunder. The liquidated damages, for shortfall in performance indicated in clause 1.01.02 for this sub-section are on per unit basis and shall be levied separately for each unit, except for the rate indicated for auxiliary power consumption for station auxiliaries which is on station basis. The liquidated damages shall be prorated for the fractional parts of the deficiencies. The performance guarantees coming under this category shall be called `Category - I' Guarantees.

ii) **For Category-II Guarantees**

Reject the equipment/plant/system and recover from the Contractor the payments already made. The performance guarantees under this category shall be called 'Category - II ' Guarantees. Conformance to the performance requirements under Category -II is mandatory.

iii) **For Category-III Guarantees**

Reject the equipment / system/plant & recover from the Contractor the payments already made.

OR

Accept the equipment/system after assessing the deficiency in respect of the various ratings, performance parameters and capabilities and recover from the contract price an amount equivalent to the damages as determined by the EMPLOYER. Such damages shall, however be limited to the cost of replacement of the equipment(s) / system(s) replacement of which shall remove the deficiency so as to achieve the guarantee performance. These parameters/capacities shall be termed as category - III, guarantees.

2.00.00 PERFORMANCE GUARANTEE/ ACCEPTANCE TEST

2.01.01 **TEST INTERRUPTIONS**

In the event of a test interruption resulting from an Event of Force Majeure or Employer-Caused-Delay, Contractor shall be entitled to relief as provided in the contract, provided that the interrupted Performance Test must be started again and test data that were collected during the interrupted test must be ignored.

2.02.00 **TURBINE GENERATOR PERFORMANCE/ ACCEPTANCE TEST**

2.02.01 Performance test for the turbine generator set will be conducted in accordance with the latest edition of ASME PTC-6. Such test shall be binding on the parties to the contract to determine compliance with the guaranteed gross power output corresponding to the conditions stipulated under Sub-section- A-06 (Turbine Generator and Auxiliaries), Part-B section VI. Power consumed by the auxiliaries shall be measured during the performance / Acceptance Test. Wherever the measurement is not possible, design values of power consumption by an auxiliary shall be considered.

2.02.02 The essential mandatory requirements for instruments, methods and precautions to be employed shall be in accordance with the requirements specified in the respective codes. All the necessary instruments (in duplicate) required for the tests shall be furnished by the contractor so as to meet the accuracies specified in the codes. Any advanced class instrument system such as those using electronic devices or mass flow technique shall be arranged by the contractor, if required. For determination of primary flow to the turbine, a calibrated low Beta-ratio throat-tap nozzle assembly including required machined straight lengths meeting the requirement of ASME PTC-6 shall be provided. The test procedures, Calibration Standards, Calibration procedures etc., shall be subject to Employer's approval. All the instruments including the flow nozzle shall be calibrated by the contractor before and after the test, in a reputed international institute as approved by the Employer. However, post test calibration of flow nozzle shall not be mandatory. These calibrations shall be performed in the presence of the Employer. All calibrations shall be made available prior to the test and calibration certificates in original submitted to Employer at least 15 days before conductance of the test for Employer's approval. The instruments shall be sealed after calibration by calibrating lab. The percentage calibration error/deviation should not be more than accuracy class of the instrument. Calibration low beta ratio throat tap nozzle assembly including flow straightner, upstream and downstream machined straight lengths, for main condensate flow measurements shall be as per ASME PTC6.

Secondary flow devices shall be calibrated flow nozzle/orifice plate as per ASME-PTC 19.5.

2.02.03 Corrections to the test results shall be applied as per the correction curves.

2.02.04 The performance guarantee test will be carried out after successful completion of initial operation. Ageing allowance will be given during evaluation of PG test results. Period of ageing shall be considered from the date of first synchronization to the date of conductance of PG test.

In calculating the above factor any period(s) during which the turbine has not been in operation at a stretch for more than a week shall not be considered.

2.02.05 The tests shall be arranged in a manner that the EMPLOYER's operation is not disrupted.

2.03.00 **TEST REPORTS**

The Contractor shall prepare test reports in which the methods followed, instrument readings, graphs, observations, final results obtained, etc., shall be recorded.

Four (4) hard copies and 2 soft copies on CD –ROM of each test report shall be submitted to Employer for Approval.

2.04.00 Performance Guarantee/ Acceptance Tests on the equipment / systems not covered in this Sub-section shall be carried out as per the procedure/ test codes/ specified in respective detailed specifications/ Sub-sections in Section-VI, Part-B.

3.00.00 **GUARANTEES UNDER CATEGORY - I**

3.01.01 The performance guarantees which attract liquidated damages and have evaluation credit (LD) are as follows:

1. Unit Heat rate:

Vendor should quote the Unit heat rate in their bids. The quoted heat rates shall not be more than 4200 kcal/kwhr at design ambient temperature of 40 Deg C. The bids quoting higher heat rate than 4200 kcal/kwhr shall be rejected. The bidder shall require to prove the quoted heat rate during PG test. Evaluation credits shall be given for better heat rates if supported by a document proving the credibility of the heat rate quoted by the bidder. The supporting documents may be the PG test results along with correction factor (used for the plant whose PG test results are being submitted) for any difference in ambient temperature.

Tests for Turbine Cycle Heat Rate and Efficiency of Steam Generator shall be conducted simultaneously but independently and Unit Heat Rate is to be computed as follows:

Unit Heat rate in kcal /kW hr as close as possible to design ambient temperature, at peak output (not less than 17.1 MW) , with zero extraction steam from internally controlled extraction for heating/ cooling.

$$= \frac{\text{TGHR (peak load)}}{\text{SG_EFF(peak load)}}$$

Where TGHR(peak load)= Heat rate of turbine cycle at quoted peak load but not less than 17.1 MW.

SG_EFF (peak load)= Combined Steam generator efficiency of both the steam generators at peak load but not less than 17.1 MW.

TURBINE CYCLE HEAT RATE

Turbine Cycle Heat Rate shall be calculated as follows & indicated in all computed heat balance diagrams:

TGHR(peak load)= (heat input to the turbine cycle through steam generator while running at peak load)/(Gross power output – Power consumption of integral turbine auxiliaries if they are separately driven by electric power)

Gross power output after deducting the power consumption by auxiliaries as listed below and the same shall not be less than 16.39 MW

(a) Power taken by Excitation system (KW) including transformer losses, as applicable for various guarantee points **in case of static excitation system is offered**. (The transformer losses at various points shall be based on factory test to be conducted).

(b) Power required for ventilation of oil and control fluid tanks, if ventilating fans are separately driven (KW).

(c) Power required for lubrication, if lubricating pumps are separately driven (KW).

(d) Power required for control fluid pumps, if control fluid pumps are separately driven (KW).

(e) Power required for hydrogen, seal oil auxiliaries, if separately driven (KW).

(f) Power required for stator water cooling system, if cooling pumps are driven separately (KW).

(g) Power required for Gland Steam Exhauster (GSC) if GSC Exhausters are separately driven (KW)

Steam Generator Efficiency:

Steam generator efficiency shall be calculated as per the requirements of BS EN 12952- 15:2003 (by loss method) and as per stipulations of Clause 1.01.03.03 of this Sub-Section.

Correction curves for heat rate/ output:

Correction for the quoted values shall be allowed only for the following:

1. Ambient temperature:
2. Fuel GCV variation
3. Moisture and hydrogen in Fuel/RDF

2. Auxiliary Power Consumption

The vendor shall need to supply the list of Auxiliary consumers considered for the guaranteed consumption. Vendor shall guarantee Maximum Aux. Power Consumption is 14% i.e. 2086 KW at Load Point D in the Firing Diagram (LP D)

Bidder shall furnish a list of equipment to be covered under Unit auxiliary system, which is to be considered under auxiliary power consumption. These are subject to Employer's approvals.

Bids guaranteeing/ offering higher Auxiliary Power Consumption than14 % at Load Point D in the Firing Diagram (LP D) shall run the risk of rejection. Further, bids offering better values for Auxiliary Power Consumption, than that specified in the technical specifications shall not be given any evaluation credit.

3. The Annual Operational Availability

The vendor shall guarantee the annual availability of the unit be not less than 85%.The availability shall be calculated at the end of second year of operation for the whole year of plant operation.
Availability shall be calculated as follows:

Annual operational availability
= (hours for which plant is available for full load operation in a year)/ (8760)

Notes:

I. The unit is considered to be available whenever it can be operated within the range defined by the Firing diagram (LP D – 1 – 2 – 3 – 4 – 5 – D) with 15 % margin on waste throughput and thermal load. (as per Annexure 1 of SUB SECTION-II, A-02 GRATE & FLUE GAS CLEANING, SECTION – VI, PART-A)

II. Operation and load interruptions for which the vendor is not responsible for is counted as operating time with full availability. Such events like
   a). Non availability of inputs such as raw water, Municipal solid waste.
   b). Failure of the electricity grid or interconnection (beyond bidders terminal point), which is not attributable to the vendor.
   c). Shutdowns requested by the local Government agencies, or other competent regulating organizations for reasons not attributable to the vendor.

Bids guaranteeing/ offering annual operational availability of the unit lower than 85% shall not be considered for evaluation and liable to be rejected. Further, bids offering better values for the annual operational availability, than that specified in the technical specifications shall not be given evaluation credit.

3.01.02 **AMOUNT OF LIQUIDATED DAMAGES AND BID EVALUATION FACTORS APPLICABLE FOR CATEGORY-I GUARANTEES**

If the performance guarantee(s) specified at clause 3.01.01 are not met by the Contractor

even after the modifications and/or replacements mentioned at clause 1.00.01 of this Sub-section but are achieved within the stipulated Acceptable Shortfall Limit as indicated in this clause, Employer will accept the equipment/system/plant after levying liquidated damages as indicated here under, however, if the demonstrated guarantee(s) continue to be more than the stipulated Acceptable Shortfall Limit, the Employer may at his discretion reject the equipment/system and recover the payment already made or accept the equipment/system only after levying liquidated damages against the Contractor, at the rates listed herein, and such liquidated damages shall be deducted from the Contract Price:

LIQUIDATED DAMAGES

S. No	Guarantee	Rate of Liquidated Damages (LD)	Acceptable Shortfall limit
1.	For each kcal/kwhr of deficiency in Unit heat rate with extraction steam from internally regulated extraction points for meeting external demand closed, and rated ambient temperature with RDF of design GCV, hydrogen content and moisture. Plant operating at its peak load capacity	INR **1844174/- (Eighteen lakhs forty four thousand one hundred seventy four only)**	(-) up to 2.0% of the guaranteed value but not more than 4200 kcal/ kg
2.	For increase in Station auxiliary power consumption comprising of all station Auxiliaries required for continuous station operation at 17.1 MW (i.e. 115% rated load of all the units).	**INR 519835/-** **(Five lakhs nineteen thousand eight hundred and thirty five only)**	20.86 kW more than 2086 kW (guaranteed maximum Auxiliary Power Consumption)
3	For each 0.1 percentage point fall in the specified plant availability in a year	**INR 7745531/-** **(Seventy Seven lakh seventy forty five thousand five hundred and thirty one only)**	Up to 1% point below the specified plant availability in a year.

NOTE:

i) Each of the liquidated damages specified above shall be independent and these liquidated damages shall be levied concurrently as applicable.

ii) If the contract currency is other than INR, then the liquidated damages shall be in equivalent amount in contract currency based on Bill selling exchange rate of State Bank of India prevailing on the date of award of contract.

iii) All these liquidated damages for short fall in performance shall be deducted from the contract price as detailed in accompanying General Conditions of Contract (GCC)/ Special Conditions of Contract (SCC)

iv) Contractor's aggregate liability to pay liquidated damages for failure to attain the functional guarantee shall not exceed twenty five percent (25%) of the Contract Price.

Bidder shall furnish a list of equipment to be covered under Unit auxiliary system, which is to be considered under auxiliary power consumption. These are subject to Employer's approvals.

BID EVALUATION FACTOR

Bid prices shall be adjusted using the bid evaluation factor for heat rate provided in the table below. Adjusted price shall be calculated as follows:
Adjusted Price= quoted price+ BID evaluation factor for heat rate x (difference in heat rate from the minimum heat rate quoted by any of the bidder)

S. No	Guarantee	Rate Bid evaluation factor
1.	For each kcal/kwhr of deficiency in Unit heat rate with extraction steam from internally regulated extraction points for meeting external demand closed, and rated ambient temperature with RDF of design GCV, hydrogen content and moisture. Plant operating at its peak load capacity	**INR 917808/- (Rupees Nine lakh seventeen thousand eight hundred and eight only)**

GUARANTEES UNDER CATEGORY – II

3.02.00 **The Performance Guarantees, conformance to which are mandatory are as follows:**

1. Emission Performance

The vendor shall guarantee that maximum emission from the unit shall not be more than the tabulated as follows within the load range defined by the Firing Diagram (LP D – 1 – 2 – 3 – 4 – 5 – D) and also in the region provided as overload area.

The emission shall be measured during grate capacity test. The bidder shall furnish the methodology of measurement and demonstration of variations.

Sl.No	Parameter	Unit	Emission value at 11 % vol O_2 Dry	Sampling average Time
1	Dust (particulates)	mg/Nm^3	25	Half hourly average
2	CO	mg/Nm^3	40	Half hourly average
3	NOx (NO and NO2 expressed as NO2)	mg/Nm^3	200	Half hourly average
4	SO_2	mg/Nm^3	100	Half hourly average
5	HCl	mg/Nm^3	25	Half hourly average
6	TOC	mg/Nm^3	10	Half hourly average
7	HF	mg/Nm^3	4	Half hourly average
8	Heavy metals Sb + As + Pb + Cr + Co + Cu + Mn + Ni + V + their compounds	mg/Nm^3	0.5	Half hour to 8 hours average
9	Hg and its components	mg/Nm^3	0.05	Half hour to 8 hours average
10	Cd+Th + their components	mg/Nm^3	0.05	Half hour to 8 hours average
11	Total Dioxins and Furans (TEQ)	ng/Nm^3	0.1	6 to 8 hours average

Note.- All values corrected to 11% oxygen on a dry basis

Notes

1. All concentrations are referred to dry gas at 11% $O_{2\ volume}$
2. STP: referring to standard conditions: $0^{O}C$, 101.3 kPa
3. Bidder has to arrange for the measurement of emissions (which cannot be measured online) like HF, Hg, Cd, Heavy metals, Dioxins and furans (TEQ) at a mutually agreed laboratory which will be subject to approval by NTPC.
4. All these values will be measured and shall confirm as per Indian SWM rule 2016 for emission.

Further, the bidder shall guarantee the following performance

Temperature in Secondary Combustion chamber conditions	min. 950°C / min 2 sec residence time
Slag & Bottom ash quality	TOC ≤ 3% or LOI ≤ 5%

Bids guaranteeing/offering maximum emission from the unit, which is more than the tabulated as above and not meeting the requirement within the load range defined by the

Firing Diagram (LP D – 1 – 2 – 3 – 4 – 5 – D) and also in the region provided as overload area, shall not be considered for evaluation and liable to be rejected.

GUARANTEES UNDER CATEGORY – III

3.03.00 The parameters/capabilities to be demonstrated for various systems/ equipment shall include but not be limited to the following:

3.03.01 **Noise**

All the plant, equipment and systems covered under this specification shall perform continuously without exceeding the noise level over the entire range of output and operating frequency specified in General Technical Requirement, Part-C Section-VI of the technical specifications. Noise level measurement shall be carried out using applicable and internationally acceptable standards. The measurement shall be carried out with a calibrated integrating sound level meter meeting the requirement of IEC 651 or BS 5969 or IS 9779.

Sound pressure shall be measured all around the equipment at a distance of 1.0 m horizontally from the nearest surface of any equipment/ machine and at a height of 1.5 m above the floor level in elevation.

A minimum of 6 points around each equipment shall be covered for measurement. Additional measurement points shall be considered based on the applicable standards and the size of the equipment. The measurement shall be done with slow response on the A - weighting scale. The average of A-weighted sound pressure level measurements expressed in decibels to a reference of 0.0002 micro bar shall not exceed the guaranteed value. Corrections for background noise shall be considered in line with the applicable standards. All the necessary data for determining these corrections, in line with the applicable standards, shall be collected during the tests.

3.03.02 The parameters/capabilities to be demonstrated for various systems/ equipment shall include but not be limited to the following:

(i) Waste Cranes: Over load tests, travel and hoist speed checks as per relevant Indian standards IS (latest edition).
(ii) Bottom ash Cranes, Monorails etc.: Over load test, Travel and speed checks, functional and performance tests as per relevant Indian standards IS (latest edition).

3.03.03 **Slag & Ash Handling system**

S. No	DESCRIPTION	PERFORMANCE GUARANTEE PARAMETERS	REMARKS
A.	Slag/Bottom ash system	Bottom ash/Slag removal to Bottom ash pit/Bunker by Metallic Conveyors/Slag Extractor	Continuous effective conveying system shall be established by no stagnation

		(Hydraulic type) Boiler ash (partly or fully) may also be conveyed along with bottom ash/slag	of Slag/Bottom Ash at any point in the system in the complete bottom ash handling system and with all interlocks, protections working satisfactorily
B.	Boiler ash handling system	Removal of Boiler ash by mechanical conveying system or pneumatic conveying system	The continuously effective removal and conveying of ash shall be established by no stagnation of Boiler ash at any point in the complete system and with all interlocks & protections working satisfactorily
C	ESP/Bag Filter hoppers ash conveying	The dry fly ash handling system consists of ESP/Bag Filter system hoppers and Boiler ash (as applicable) from various passes by means of a pressure or vacuum type conveying system or Mechanical conveyors.	The continuously effective conveying of ash shall be established by no stagnation of Fly ash at any point in the complete system and will all interlocks, protections working satisfactorily

3.03.04 **Steam extraction capacity for district heating/cooling/ industrial use:**

Vendor should demonstrate that the turbine has steam extraction capacity of up to 60% of the steam at upstream of the extraction point and can supply this steam at a pressure of 8 ata at the terminal point at various loads.

3.03.05 **Waste Throughput as per Firing Diagram**

Vendor shall guarantee the Continuous operation (throughput and load points) of the unit within the load range defined by the Firing Diagram (LP D – 1 – 2 – 3 – 4 – 5 – D) with the provision of margin of atleast 15 % for both waste throughput and thermal load beyond 100 % as overload area.

Bids guaranteeing/offering, those are not meeting the Continuous operation requirement (throughput and load points) of the unit within the load range defined by the Firing Diagram (LP D – 1 – 2 – 3 – 4 – 5 – D) with the provision of margin of atleast 15 % for both waste throughput and thermal load beyond 100 % as overload area, shall not be considered for evaluation and liable to be rejected.

3.03.05 **Gross Power Output**

Vendor shall guarantee continuous TG output of 17.1 MW unit load (i.e. 115% of name plate rating) under rated steam conditions, quoted condenser pressure with 0% make-up for GCV of RDF not less than 2500 kcal.

Notes:

I. Blow down shall be closed.
II. Steam extraction for heating/ cooling load shall be closed
III. Soot blowers shall not in operation.

a) Bidder to furnish correction curves for variation in environmental temperature, energy content in RDF, RDF quantity Vs gross power output.
b). Bidder to furnish relevant heat balance diagram for the guarantee conditions.

Bids guaranteeing/ offering TG output at generator terminal at lower than 17.1 MW unit load (i.e. 115% of rated acceptable load) shall run the risk of rejection. Further, bids offering better values for output at generator terminal, than 17.1 MW shall not be given any evaluation credit.

SUB-SECTION–V

ESSENTIAL DATA

1.00.00 The information in this chapter has been identified by the Employer as the essential, which is to be provided by the bidders along with the techno – commercial bid necessarily. Incase bidder does not fill these information, their techno – commercial bid may be considered as non responsive.

Sl.N0.	Description	Data to be filled by Bidder
SYSTEM INTERFACE DATA		
1. MECHANICAL DATA		
A)	**Turbine Generator**	
1.	Steam Generator output corresponding to BMCR flow under rated steam condition, turbine under VWO operation, rated condenser pressure, 0% make up.	Heat Balance Diagram
2.	VWO output under rated steam conditions at rated condenser pressure with 0% makeup.	Heat Balance Diagram
3.	Full load and different load condition under rated steam conditions at rated condenser pressure with 0% makeup.	Heat Balance Diagram
4.	Turbine Startup Curves for Cold, Warm and Hot startup.	Start up Curve
5.	Optimized condenser pressure corresponding V W O	
6.	Auxiliary Cooling Water (ACW) pump design flow & no of working pumps.	
B)	**STEAM GENERATOR**	
1.	Complete data indicated in Chapter-I (Essential Data Sheet), DM1, Module-II of Part-G of Section-VI. All data related to load points 1,2,3,4,5 and design load point.	
C)	**Water System**	
1.	Water Balance Diagram.	
2.	Plant Water Scheme.	
D)	**Material Handling**	
1.	Waste and Ash Balance Diagram	
2.	Ash flow diagram (bottom, fly ash)	
3.	Chemical handling flow diagram (lime, activated carbon, urea / ammonia etc.,)	
4.	Tipping Floor level, waste pit	
E)	**Layout**	
1.	Equipment layout drawings for various floors of Main Plant building.	
2.	Main Plant equipment Layout Plan at EL (+/-) 0.0 m.	
3.	Layout of aux. systems like fire water system, water treatment, leachate treatment, weigh bridge etc.,	
2. CIVIL DATA		
1.	General Layout Plan	
2.	Detailed Geotechnical Report	
3.	Rain fall data	
4.	Topographical survey Data	
3. ELECTRICAL DATA		
1.	Generator Parameter a) Rated Voltage b) Resistance & Reactance c) Time constants, capability curve, OCC / SCC curves	

2.	List of HT Motors a) BFP Motor / ID Fan b) Other HT Motors	
3.	List of L T Motors ratings	
4.	List of Emergency Loads (AC/DC)	
5.	Electrical Single Line Diagram for Aux. Power Distribution indicating major equipments and systems.	
4. **C&I DATA**		
GENERAL REQUIREMENTS		
1.	Reference list of comparable control and instrumentation packages furnished by the Bidder/C&I system Sub-Supplier.	
2.	Brief description regarding manufacturing facilities of the Bidder and DDCMIS manufacturer. (Please furnish details of floor area, number of engineers, workers, manufacturing facilities, special equipment for manufacture and testing etc.)	
3.	List of bought out items covered in his proposal along with names of sub-vendors.	
DISTRIBUTED DIGITAL CONTROL, MONITORING AND INFORMATION SYSTEM (DDCMIS) (BOP C&I SYSTEM/ SG C&I SYSTEM/TG C&I SYSTEM)		
4.	DDCMIS manufacturer's name	
5.	Make / Model No.	
6.	Place of manufacture	
7.	Detailed descriptions of Distributed Digital Control, Monitoring and Information System (DDCMIS) proposed by the Bidder covering all salient features of hardware, software, system configuration for each system/ sub-system testing, documentation, post commissioning support facilities, etc. including Functional Grouping System	
8.	Detailed description of unified HMIPIS along with write up, configuration & required hardware, software etc.	
9.	Complete details of Burner Management System / combustion control system	
10.	Complete Details of Turbine Protection System (TPS) & Turbine Governing System for Main Turbine	
11.	Typical interconnection philosophy diagram indicating signal routing from field to the control system cabinets along with the type of cables employed .	
12.	Control Rooms, Control Equipment Room, Remote IO Rooms	
13.	Location & layout of Major Control Rooms.	
14.	Layout of Control Equipment Rooms.	
15.	Locations of Remote IO Rooms.	
MAIN EQUIPMENT RELATED CONTROL & INSTRUMENTATION		
16.	Complete details of Turbine Supervisory system (TSS)	
17.	Complete details of BFP Turbine Supervisory Instruments	
18.	Complete details of Boiler Flame Monitoring System	
19.	Complete details of Electromatic safety valve (if applicable)	

20.	Complete details of Acoustic Pyrometer	
21.	Complete details of Furnace and Flame Viewing System	
22.	Complete details of Air Quality Monitoring System (AAQMS)	
23.	Complete details of Continuous Emission Monitoring System (CEMS).	