TELANGANA STATE POWER
GENERATION CORPORATION LIMITED
(TSGENCO)

1X800 MW TSGENCO KOTHAGUDAM
TPS STAGE –VII,PALONCHA

VOLUME – II – B

TECHNICAL SPECIFICATION
FOR

VENTILATION SYSTEM

SPECIFICATION NO.:PE-TS-410-554-A001 Rev. 01

BHARAT HEAVY ELECTRICALS LIMITED

POWER SECTOR

PROJECT ENGINEERING MANAGEMENT

NOIDA, INDIA

VIVEK KUMAR SA Khan Praveen Kishore

VOLUME – IIB

VOLUME-III

SECTION-A

INTENT OF SPECIFICATION

1.0 INTENT OF SPECIFICATION

1.1 The specification covers design, engineering, manufacture, supply / procurement, inspection and testing at vendor's / sub vendor's / manufacturer's works, painting, forwarding, proper packing and shipment and delivery at site, unloading, handling & transportation, storage, preservation , security / safety at site , Erection & Commissioning, minor civil & structural (as applicable) works as required on FOR site basis, Performance and guarantee testing / performance testing and handing over to BHEL's customer of **VENTILATION SYSTEM** as per details in different sections / volumes of this specification for **1X800 MW KOTHAGUDEM TPS** at KOTHAGUDEM, TELANGA.

1.2 The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil 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. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve the contractor of the responsibility of providing such facilities to complete the supply, erection and commissioning, performance and guarantee/demonstration testing of **VENTILATION SYSTEM.**

1.3 It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgement is not in full accordance herewith.

1.4 The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing.

1.5 The general term and conditions, instructions to tenderers and other attachment referred to elsewhere are made part of the tender specification. The equipment materials and works covered by this specification is subject to compliance to all attachments referred to in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.

1.6 While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under Vol-III of the specification **within 10 days of receipt of tender documents.** In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser / Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to their notice either by the bidder or by purchaser/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.

1.7 The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions.

1.8 Deviations, if any, should be very clearly brought out clause by clause along with cost of withdrawal in the enclosed schedule (in Vol – III); otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification. If no cost of withdrawal is given against the deviation, it will be presumed that deviation can be withdrawn without any cost to BHEL/its customer.

1.9 In the event of any conflict between the requirements of two clauses of this specification documents or requirements of different codes and standards specified, Section - C shall prevail over section – D, however more stringent requirement as per the interpretation of the owner shall apply.

1.10 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.

1.11 For definition of word like Contractor, bidder, supplier, vendor, Customer/ Purchaser / Employer, consultant, please referred relevant clause(s) of GCC.

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PROJECT SYNOPSIS AND GENERAL INFORMATION

CONTENT

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PROJECT SYNOPSIS AND GENERAL INFORMATION

1.00.00 INTRODUCTION

The proposed 1x800 MW Kothagudem Thermal Power Station (KTPS), Stage-VII, Unit-12 would be set up by Telangana State Power Corporation Ltd. (TSGENCO) at Kothagudem, Telangana. The proposed Power Plant will be installed adjacent to the existing D colony of Kothagudem Thermal Power Station, at Kothagudem.

The Bidder shall acquaint himself by a visit to the site, if felt necessary, with the conditions prevailing at site before submission of the bid. The information given here in under is for general guidance and shall not be contractually binding on the Owner. All relevant site data /information as may be necessary shall have to be obtained /collected by the Bidder.

2.00.00 APPROACH TO SITE

Site is located in the existing D Colony of Kothagudem Thermal Power Station, which is at a distance 30 km from temple town of Bhadrachalam and 300 km from Hyderabad by road. The Nearest railway station is Bhadrachalam Road (Known as Kothagudem) at a distance of 12 km. Kothagudem- Bhadrachalam National Highway branches off to the power station site near village Paloncha.

3.00.00 LAND

Land is primarily required for the main plant & auxiliaries (BTG) and balance of plant (BOP) like ash handling, coal storage, cooling tower, switchyard etc., which is available within the existing plant boundary.

The existing colony is to be dismantled, and the land of about 137 acres will be used for the main plant building, water facilities, switchyard, coal handling etc. The raw water reservoir will be located adjacent to the existing raw water reservoirs.

230 acres of land required for Ash Dyke will be procured. Land is available for staff colony, which is to be constructed by the EPC contractor.

4.00.00 SOURCE OF COAL

100% Imported and Blended coal (50% imported + 50% indigenous) will be used. Indigenous coal shall be sourced from Suliyari coal mines, Madhya Pradesh.

5.00.00 SOURCE OF WATER

Source of water (total quantity of water is 2192 m^3/hr) is Godavari River near Burgampahad & water will be pumped through existing GRP pipe line (of length approx. 26 km).

6.00.00 ASH DISPOSAL AREA

Ash shall be dumped in the ash dump area which will be about 9 km from plant. The ash dyke area of 230 acres is adequate for 1x800 MW unit as per MOEF norms.

7.00.00 SALIENT DESIGN DATA

7.01.00 Meteorological data of site is given below:-

Elevation above MSL	:	89 m
Monthly highest temperature	:	44.9 ºC
Monthly lowest temperature.	:	12.9 ºC
Rainfall		
Average.	:	1031 mm
Max.	:	100 mm/ hr
Mean Wind speed	:	44 m/sec
Relative Humidity		
Max	:	82%
Min	:	35%
Seismic Zone	:	Zone-III as per IS- 1893 (Part-IV)

[Climatological data of Khammam is attached for reference].

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TELANGANA STATE POWER GENERATION CORPORATION LIMITED

Office of the
Chief Engineer/Civil
Thermal, Vidyut Soudha
HYDERABAD – 500 082.

U.O to Chief Engineer/TPC.

Sub: Kothagudem Thermal Power Station Stage VII (1x800MW) – Inputs for M/s BHEL regarding Climatology and meteorology data for designing of Air Conditioning System and ventilation system - Data furnished – Reg.

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The details of Climatology and meteorology data for designing of Air Conditioning System and ventilation system is as follows for KTPS Stage VII (1x800 MW).

		Summer	Monsoon	Winter
Dry Bulb Temperature (°C)	I	29.0 (Min)	27.4 (Min)	22.4 (Min)
	II	37.1 (Max)	31.0 (Max)	29.1 (Max)
Wet Bulb Temperature (°C)	I	24.2 (Min)	24.9 (Min)	20.1 (Min)
	II	24.0 (Max)	25.7 (Max)	21.6 (Max)

This is furnished for taking further necessary action.

9/4/2015

CHIEF ENGINEER/CIVIL/THERMAL

To
The Chief Engineer/TPC,
TSGENCO, Vidyut Soudha,
Hyderabad-82.

U.O.No. CE/Civil/Thermal/ KTPSD//F.KTPS Stage VII/ D.No:23 /2015-16, Dt.09-04–2015.

Chief Engineer / TPC
INWARD No.....396.....
10 APR 2015
SE/TPC
DE / Tech
CE/TPC

SECTION: C1

SPECIFIC TECHNICAL REQUIREMENT

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1. FUNCTION

1.1.1 The purpose of the system is to provide Ventilation for different areas of Kothagudem (1 X 800 MW) under the scope of BHEL.

2. SYSTEM DESCRIPTION

2.1 Areas being ventilated through wet ventilation system

2.1.1 The Ventilation System is provided in the following locations within the Power House by Air washers. Coursing of air in desired direction / areas shall be made by using roof extractors.

TG bay (ground, mezzanine and operating floor), HP/LP heater area, condenser area, Boiler feed pump area Oil cooler area

MCC Rooms.

Cable Spreader Rooms

Switchgear Rooms

Battery Charger Rooms

2.1.2 Cooled and filtered air from Air Washer Unit shall be distributed by means of ducting to the TG building near various heat sources like turbo-generator, condenser, Boiler feed pump HP & LP heaters etc. The hot air from the hall shall be exhausted by means of roof extractors. The quantity of air exhausted shall be kept lower than the quantity of air supplied in such a way that a little overpressure is maintained inside the hall. This will reduce infiltration of outside hot and dusty air.

2.1.3 The supply air quantity is supplied from Four (4) nos. Packaged type AWU for TG Building of unit 12- 2 nos. being located outside A-Row of TG building at 0.0 floor and 2 nos. being placed on B-C bay at 29.5M floor level, such division and location area decided to achieve effective air distribution with less amount of ductwork and less pressure drop in fans.

2.1.4 The Air Washer Units will primarily serve TG hall and the electrical areas like MCC Room, Switchgear Room, and Cable Spreader Room. The washed air supplied to MCC / Switchgear/Cable Spreader Rooms shall be exhausted outside through Back Draft Dampers. Fire dampers are provided in the supply air ducting leading to all electrical rooms (MCC, Switchgear etc.)

2.1.5 The supplied air in the lower level of TG hall after taking the heat load of TG bay rises through different openings to the upper floors and is then finally exhausted (60-65% of total supplied by Air washers) by means of roof exhausters placed over the roof of TG Hall. Some quantity of air leaks out through various leakage areas thus maintaining slight positive pressure inside w.r.t. outside.

These being package type of air washers placed, outside, exposed to ambient and hence shall be designed accordingly.

The location of air washer as described above may change 'DDE'.

2.2 The ventilation philosophy in various areas shall be as under:

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S.No.	Area	Type of Ventilation
1.	TG Hall & Cable Spreader room	Ventilation with Air washer & mechanical exhaust from roof extractor units. Motorized Fire dampers will be provided in the supply air ducting of Cable Spreader room
2.	Electrical Rooms (M.C.C. room, Switchgear room in TG Building)	Ventilation with Air washer & exhaust through gravity damper. Motorized Fire dampers will be provided in the supply air ducting
3.	Toilets, pantries.	Mechanical ventilation with propeller type exhaust fan.
4.	Battery and battery charger room	Negative pressurization by means of axial flow exhaust having spark proof construction fans with flameproof motors.
5.	Elevator Machine room	Supply air through axial fan filter unit and exhaust through gravity damper.
6.	Non AC areas of ESP control (MCC/switch gear room)	Ventilation with UAF & exhaust through gravity damper. Motorized Fire dampers will be provided in the supply air ducting
7.	Fuel Oil Unloading and Pressuring Pump House	Wall-mounted axial flow exhaust fans (with fusible ling type fire dampers) and air entry through wall mounted manually operated louvers.
8.	CW Pumps House	Supply air by wall-mounted axial flow fans exhaust through louvres.
9.	AC Plant Equipment Areas	Mechanical Exhaust by means of axial flow exhaust fans.
10	SWAS Room (Non AC Area)	Supply air through axial fan filter unit and exhaust through gravity damper.
11	Oil rooms	Wall mounted exhaust fans
12	Condensate	Mechanical exhaust by means of axial flow

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	polishing plant	exhaust fans
13	Compressor house	Pressurized ventilation with wall mounted fan filter units and air exhaust through Back Draft Dampers.
14	CW Treatment Plant	Wall mounted exhaust fans for the Chlorination area. Fresh air will enter the Building through wall mounted louvers. For the associated Electrical MCC Room, Pressurised ventilation with wall mounted fan filter units and air exhaust through Back Draft Dampers.
15	CW treatment plant	Supply air through axial fan filter unit and exhaust through Back Draft Dampers. .
16	DM Plant building	Mechanical exhaust by means of axial flow exhaust fans
17	DM, service and potable water pump house	Mechanical exhaust by means of axial flow exhaust fans
18	Chemical House	Mechanical exhaust by means of axial flow exhaust fans
19	Clarified water pump house	Supply air by wall-mounted axial flow fans exhaust through louvres.
20	Centrifuge building	Mechanical exhaust by means of axial flow exhaust fans
21	Stores	Wall mounted exhaust fan and fresh air entry through inlet louvers.
22	Coal Conveyor Tripper Floor of the Mill Bay	RE exhaust fan and fresh air entry through inlet louvers.
23	Service Building	Toilets, Pantries, Store and MCC Room(If applicable)

2.2.1 Ventilation of any other area in BHEL scope, which is not covered above, shall also be provided with mechanical ventilation. Details of all the buildings along with quantity of fans etc would be provided in a separate document title 'Fan schedule' during detail engineering.

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3. DESIGN CRITERIA:

System Design Criteria:

3.1.1 The outside design conditions considered are as follows:-

	Summer	Monsoon	Winter
DBT (°C)	42.6	30.9	20.8
WBT (°C)	26.6	25.8	18.4

3.1.2 The inside design conditions:-

i) For all evaporative cooled areas, the air quantity shall be calculated based on following

a) Air quantity as per calculation based on air change method

OR

b) Air quantity shall also be calculated such that the inside temperature is restricted to 5^0 C below outside DBT during peak summer. This temperature will prevail upto roof level, where from the hot air will be exhausted out by means of Roof Exhausters / Wall mounted Exhaust Fans / Louvers / BDD.

3.1.3 Higher of the air quantity obtained by two methods above shall be selected.

ii) For wet ventilation system in Power house & ESP, Following air change shall be considered.

- TG Hall 6
- Cable Spreader 5
- MCC/ Switchgear 15
- ESP (Cable Spreader) 5
- ESP (MCC/ Switchgear) 15

iii) For mechanical dry ventilated area, the air quantity shall be calculated based on the following air changes -

a) Cable spreader room 5
b) Pump houses 10
c) Electrical Room like M.C.C. Room, Switchgear room Of Auxiliary Building 15

d) Battery Room areas 20
e) Oil room 20
f) Toilets 20
g) CPU 15
h) Compressor house 15

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3.1.4 All equipment shall be designed for continuous duty.

3.1.5 Fire Dampers (Motorised type electrically operated) shall be provided in at the duct / Fan opening of Switch Gear Room. The operation of these automatic dampers shall be interlocked suitably with the Air-washer Local control panel.

3.1.6 The ducting shall be sized to have constant friction drop along its length with air velocity in the ducts normally not exceeding 12 m/sec. for ventilation system. However the air velocity shall be increased more than 12 m/sec., in case of neck formation / transmission piece not exceeding one meter of length.

3.1.7 In dry type forced (mechanical) Ventilation System where the ambient air is drawn and distributed inside the building/room and then exhausted, the average design condition inside the space to be ventilated is to be restricted about 3°C higher than the ambient (outside) dry-bulb temperature. Relative humidity will depend upon moisture content of ambient air. Higher of the air quantities obtained by the Air Change Method and Heat Load Calculation Method shall be selected.

3.1.8 For other areas, air changes shall be maintained as per specification clause no. 5.02.05

3.1.9 Fire dampers shall be provided fusible link type for Oil room

4. EQUIPMENT AND SERVICES TO BE PROVIDED FOR VENTILATION SYSTEM. :

4.1 Air-WASHERS

Four (4) Nos. Packaged type Air washer units (AWU) each having a capacity of 2,80,000 M3/Hr with 85 mmwc static pressure for each T.G. building Unit 12. Hence, total of 4 nos. air washers each of 2,80,000 M3/Hr capacity shall be provided.

Each air washer comprises of:

4.1.1 Two (2) no. (2 x50% duty) Centrifugal fan backward inclined, DIDW Type, complete with electric drive motor, drive Pulleys, V-belt, belt guards, slide rails and other accessories etc. and filter back wash arrangement.

Cushy foot mounting, removable drain plug and other accessories as per Clause No. 3.01.01 of the tender specification.

4.1.2 Two (2) nos. (2 x 100 % duty) Back pull out / Horizontal Split Casing type centrifugal pumps for circulation of water shall be considered. Pump suction shall be provided with pot strainer with by-pass valves, inlet and outlet pressure gauge and filter back wash arrangement.

4.1.3 A spray nozzle system consisting of two banks spray system each connected to individual headers, flow regulating valves (Globe valve at Pump outlet) for controlling flow to spray header. Nozzles shall be of stainless steel, pressure drop across nozzle shall be 1.4 - 2.4 Kg./sq.cm.

4.1.4 ~~Distribution plate and~~ moisture eliminators of die-extruded pvc construction.

4.1.5 Automatically cleanable type Stainless Steel mesh Filters complete with SS / Aluminium frame continuously flooded with water by double bank of spray header with Stainless Steel water spray nozzles spraying water over the filters in the direction of airflow. Other Bank of Spray Header with SS Spray Nozzles will spray water opposite to the direction of air flow.

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One more spray header with stainless steel water spray nozzles spraying the water opposing the air flow.

4.1.6 Air filters (SS-316) complete with fixing Aluminum frame.

4.1.7 Intake louver with frame & screen (of GI Construction).

4.1.8 All valves, pipes, nuts & bolts, pipe hangers, supports, internal fittings and supports including ball float valves for makeup water connection, Low-level Switch with Alarm, quick- fill connection with valve, drain piping with valve up to the nearest drain point and overflow connection with siphon.

4.1.9 Inspection door and marine lights with ladder for different section and cat walks as required.

4.1.10 Drain pipe with siphon, marine light in each section.

4.1.11 No masonry Room shall be provided for the Air washer units including its accessories. All accessories including centrifugal Fans shall be placed inside a sheet metal casing. However, the water circulating pump sets shall be located outside this AWU casing.

Refer to clause 6.03.00 & 3.01.04 and other relevant clauses of section C2-A, customer specifications.

4.1.12 Efficiency of centrifugal fan and pump shall not be less than 70%.

4.1.13 Electrical feeder suitable for following motor rating shall be provided for Air washer equipment. Vendor to ensure that motor rating is not more than the rating mentioned below.

Sr. no.	Items	Motor rating (Kw)
1.	Centrifugal fan (140000 CMH / 85 mmWC SP)	55
2.	Centrifugal pump (280 CMH / 30 m head)	45

4.2 UAF

One (1) Nos. Sheet metal type Unitary Air Filtration system (UAF) having capacity of 90,000 CMH at 60 mmwc static pressure for ESP building shall be placed at roof of each ESP bldg.

One (1) no. UAF comprises of:

4.2.1 One (1) No. (1X100%) Centrifugal fan backward inclined, SISW type, complete with electric drive motor, drive Pulleys, V-belt, cushy foot type mounting, belt guards, slide rails, removable drain plug and other accessories etc. Both inside and outside of surfaces of all parts of the fans shall be spray galvanized.

4.2.2 Fresh air intake louver with bird screen of GI construction.

4.2.3 Two (2) Nos. (2 x100 % duty) Centrifugal mono-bloc pumps for circulation of water. Pump system shall be provided with pot strainer with by-pass valves, inlet and outlet pressure gauge with isolating cock, fitting and accessories, complete with makeup water plumbing with hangers/supports, float valve, internal fittings and

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supports, over flow connection and drain connection with valve and siphon and filter back wash arrangement.

4.2.4 Automatically cleanable type Stainless Steel mesh Filters complete with SS / Aluminium frame continuously flooded with water by one bank of spray header with Stainless Steel water spray nozzles spraying water over the filters in the direction of airflow.

4.2.5 Moisture eliminator sets of die-extruded PVC construction.

4.2.6 GI sheet metal casing with inspection window, ladder and catwalk, water tank, flexible connection piece with tank.

4.2.7 moisture eliminators.

4.2.8 UAF chamber of sheet metal (2mm MS) construction with 3mm thick MS tank etc. Both the casing & the water tank shall be of epoxy painted from inside & outside and shall be complete with all valves, pipes, nuts and bolts, pipe hangers, supports, internal fittings and supports, suction pipe connection with coarse strainer, Low Level switch with alarm, make-up water connection with ball float valve, overflow connection with siphon, drain connection with valve, quick fill connection with valve etc.

Refer to clause 6.04.00 & 3.01.05 and other relevant clauses of section C2-A, customer specifications.

4.2.9 Intake louver with frame & screen (of GI Construction)

4.2.10 Inspection door with ladder, marine light and cat walk in the spray chamber

4.2.11 Air pressure breaker valve, Siphon, etc.

4.2.12 Efficiency of centrifugal fan and pump shall not be less than 70%.

4.1.13 Electrical feeder suitable for following motor rating shall be provided for UAF equipment. Vendor to ensure that motor rating is not more than the rating mentioned below.

Sr. no.	Items	Motor rating (Kw)
1.	Centrifugal fan (90000 CMH / 60 mm WC SP)	18.5
2.	Centrifugal mono block pump (90 CMH / 30 m head)	11

4.3 Centrifugal flow fan units

Each centrifugal fan shall be complete with

4.3.1 Fan impeller (backward curved) with casing with removable drain plug, Steel Frame / Supporting Structures, as required.

4.3.2 Electric drive motor.

4.3.3 Drive Pulleys, V-belt, belt guards, slide rails Cushy Foot type Mountings etc.

4.3.4 Dampers and flexible connection with matching flanges.

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4.3.5 Vibration isolators, foundation bolts and nuts.

4.3.6 Rain Protection canopy for drive motor for outdoor.

4.3.7 Refer to clause 6.02.00 & 3.01.01 and other relevant clauses of section C2-A, customer specifications.

4.4 Wall mounted axial flow fan

Each wall mounted axial flow fan shall be complete with

4.4.1 Fan impeller & casing/short duct as required.

4.4.2 Electric drive motor with coupling if any, including motor brackets.

4.4.3 Inlet cone and grouting framework, if any.

4.4.4 Rain protection cowl with bird-screen (of GI Construction).

4.4.5 All supply air axial flow fans shall be provided with pre-filters (and also fine filters for MCC/switchgear room).

4.4.6 Refer to clause 6.02.00 & 3.01.02 and other relevant clauses of section C2-A, customer specifications.

4.4.7 100% standby fans shall be provided for the Battery Room. Each fan shall have Fusible Link type Fire Damper.

4.4.8 Bifurcated type exhaust fan with fusible link type fire dampers shall be provided for battery room / oil rooms.

4.4.9 “The air discharge from the Battery Room shall be taken to a high, level (around 1M above TG Building Roof Level) through an exhaust duct (MS Epoxy painted). In case routing of such exhaust duct is not feasible, the steel parts in a radius of around 5M from the discharge end of the Battery Room Exhaust Fans shall have to be painted with acid resistant epoxy resin based paint.

4.5 Roof Extractor unit

Each wall roof extractor unit shall be complete with

4.5.1 Fan wheel, electric drive motor with motor coupling if any and motor bracket.

4.5.2 Short duct mounting/axial fan casing having inspection door and base

4.5.3 Grouting framework & foundation bolts including screen at bottom.

4.5.4 Rain protection cowl with bird-screen (provided with roof – hood with limit switch) .

4.5.5 Vibration Isolators and all other accessories shall be provided as per Specification requirement.

4.5.6 Refer to clause 6.02.00 & 3.01.03 and other relevant clauses of section C2-A, customer specifications.

4.6 Ductwork

4.6.1 GSS supply air ducting (as per IS 655) fabricated with GSS sheet (as per IS 277) having zinc coating of 180 g/sqm. The ducting shall be complete with vanes,

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splitters, dampers, hangers, supports, anchor bolts, sealing components, gaskets etc.

4.6.2 MS grilles & diffuser made of MS powder coated extruded Aluminium..

4.6.3 Manually adjustable/back draft type/Gravity type exhaust air dampers.

4.6.4 Fire Dampers (Motorised type Electrically operated) shall be provided with open and close status limit switches).

4.6.5 Thermal insulation on the ducting which is exposed to the atmosphere with 13 mm thick Aluminium Foil faced closed cell elastomeric Nitrile Rubber (of density min. 40 kg/Cu.m) / XLPE (of density min. 33 Kg/Cu.M) or equal having a thermal conductivity not exceeding 0.035W/MK. The insulation shall have self-extinguishing and non-dripping properties against fire attack.

4.6.6 Refer to clause 6.08.00 and other relevant clauses of section C2-A, customer specifications.

4.7 Water Pump Sets

Each circulating water pump set for air washer shall comprise of the following

4.7.1 Centrifugal pump Horizontal split casing / Back Pull out type of adequate capacity to match the system requirement for Air washer & Mono Block type Centrifugal Pump of adequate capacity to match the system requirement for AW & UAF.

4.7.2 One no. adequately sized TEFC sq. cage induction motor suitable for 415V, 3 phase, 50 Hz AC supply.

4.7.3 One no. Pot type strainer at inlet complete with screen, drain arrangement etc.

4.7.4 150 mm dia. Dial Type pressure gauges one each at suction & discharge side of the pump set.

4.7.5 Gate valve, one each at suction and Globe valve, one each at discharge side of the pump set.

4.7.6 One no. non-return (check) valve at discharge side of each pump set .

4.7.7 One set of base plate, coupling, coupling guard, anti-vibration mountings, foundation bolts etc.

4.7.8 Each circulating water pump set for UAF shall comprise of the following

4.7.9 Mono Block type Centrifugal Pump of adequate capacity to match the system requirement for UAF.

4.7.10 One no. Pot type strainer at inlet complete with screen, drain arrangement etc.

4.7.11 150 mm dia. Dial Type pressure gauges one each at suction & discharge side of the pump set.

4.7.12 Gate valve, one each at suction and Globe valve, one each at discharge side of the pump set.

4.7.13 One no. non-return (check) valve at discharge side of each pump set .

4.7.14 One set of base plate, anti-vibration mountings, foundation bolts etc.

4.7.15 Refer to clause 6.05.00 and other relevant clauses of section C2-A, customer specifications.

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5.0 SPECIFIC REQUIREMENTS:-

5.1 The system shall be design to maintain specified inside design conditions during peak summer under design outdoor condition.

5.2 All ventilation system shall operate on 100% fresh air.

5.3 The air washer shall have minimum 90% saturation efficiency and UAF shall have 60% saturation efficiency.

5.4 Ventilation ducts shall be provided with motorized type fire dampers at the supply duct in electrical area like MCC / Switch gear room/ cable spreader room in power house building, as well as Electrical areas of ESP/VFD Building which will close in case of fire. Fire Damper shall have fire rating minimum 120 minutes.

5.5 Air Velocity through different system equipment should be maintained as follows:

- Intake Louvers (including those of AWU/UAF Units): 1.5m/s through face area (Max.)
- Exhaust Louver: 2m/s through face area (Max.)
- Volume Control dampers: 10m/s through face area (Max.)
- Back Draft dampers: 5m/s through face area (Max.)
- Moisture eliminators: 2.5m/s through face area (Max.)
- Supply Air Grills/Diffusers: 6m/s through face area (Max.)

5.6 The name plate rating of all motors at 50deg C shall have at least 10% margin over the input power requirement of the driven equipment at rated duty point.

5.7 Design margin shall be maintained as follows:

For fan a) Head-20% b) Flow-20%

For Pump a) Head-20% b) Flow-15%

5.8 RE / wall mounted fans shall be selected so as to have motor rating and wall / slab opening as under:

1.	Roof extractor units with 15 mmwc static pressure.		
	Capacity	Motor rating	Roof / Slab opening
a.	50,000 CMH	5.5 KW	1320mm
b.	40,000 CMH	5.5 KW	1320mm
c.	20,000 CMH	2.2 KW	1140mm
2	Axial flow supply fans with 30 mmwc static pressure.		
	Capacity	Motor rating	Wall opening

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a.	10,000 CMH	2.2 KW	800mmx800mm
b.	7,500 CMH	1.5 KW	700mmx700mm
c.	6,000 CMH	1.1 KW	600mmx600mm
d.	4,000 CMH	0.75 KW	500mmx500mm
3	Axial flow supply fans with 20 mmwc static pressure.		
	Capacity	Motor rating	Wall opening
a.	10,000 CMH	1.5 KW	800mmx800mm
b.	7,500 CMH	1.1 KW	700mmx700mm
c.	6,000 CMH	1.1 KW	600mmx600mm
d.	4,000 CMH	0.75 KW	600mmx600mm
4	Axial flow exhaust fans (Bifurcated type) with 15 mmwc static pressure.		
	Capacity	Motor rating	Wall opening
a.	15,000 CMH	2.2 KW	900mmx900mm
b.	10,000 CMH	1.5 KW	800mmx800mm
c.	7,500 CMH	1.1 KW	700mmx700mm
d.	2,000 CMH	0.55 KW	500mmx500mm
5	Axial flow exhaust fans with 10 mmwc static pressure.		
	Capacity	Motor rating	Wall opening
a.	15,000 CMH	1.1 KW	900mmx900mm
b.	10,000 CMH	0.75 KW	800mmx800mm
c.	7,500 CMH	0.55 KW	700mmx700mm
d.	6,000 CMH	0.55 KW	600mmx600mm
e.	2,000 CMH	0.37 KW	500mmx500mm
6	Exhaust fan (propeller type) with 5 mmwc static pressure.		

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	Capacity	Motor rating	Wall opening
a.	1200 CMH	100 W	300 mm circular

6.0 MATERIALS OF CONSTRUCTION

FOR ALL THE EQUIPMENT THE SAME SHALL BE IN LINE WITH THE TENDER DOCUMENT.

6.1 CENTRIFUGAL FAN

6.1.1 Fan Scroll: Heavy Gauge MS (IS-2062 Gr.B) with Galvanized.

6.1.2 Fan Casing (side plates & stiffeners): Mild Steel Sheets/plate to IS: 2062 Gr.B / IS: 1079 /Eq. The minimum thickness of casing shall be 3.15 mm.

6.1.3 Impeller: M.S. sheet/plate (IS-2062 Gr.B)

6.1.4 Impeller hub: Mild Steel

6.1.5 Impeller back plate blade & shroud: Mild Steel to IS: 2062 Gr.B.

6.1.6 Shaft: EN - 8 or eqv.

6.1.7 Fan Supports, frames and structure: Mild Steel (IS-2062 Gr.B)

6.1.8 Flexible connection at outlet/inlet: Fire resistant type plastic impregnated canvas with M.S. flange and cleats (3 mm thick).

6.1.9 V Belt (matched sets): ISI marked (Reinforced rubber section to (IS: 4776)

6.1.10 V Pulley: Cast Iron multi-groove to Gr-20 as per IS: 210.

6.1.11 Slide rails: M.S./C.I.

6.1.12 Connection pieces: G.I. according to supplier's design.

6.1.13 Bolts & nuts: Galvanized / MS (Epoxy painted).

6.1.14 Vibration isolating cushy foot mountings, foundation bolts and nuts etc.

6.1.15 Dampers: Heavy Gauge MS (IS-2062 Gr.B).

6.2 AXIAL FAN

6.2.1 Casing : M.S. sheet – 3 mm thk for fan dia upto 750 mm, 5mm thick for fan dia of 750 mm and above as per IS:1079 / IS:2062 Gr.B

6.2.2 Impeller: Cast Aluminium. (Alloy A-6M, IS-617)

6.2.3 Hub: As per manufacturer std. (AL- LM6)

6.2.4 Support frame and structure: M.S. of adequate thickness (Galvanized / painted) IS-2062 Gr.B.

6.2.5 Neoprene rubber pads: As required.

6.2.6 Coned inlet for wall exhausters / supply fans: MS (IS-2062 Gr.B)

6.2.7 Supporting frame for mounting: Required.

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6.2.8 Protective screen at inlet: Yes (Min 14 SWG Galvanized wire knitted in 1" square mesh).

6.2.9 Rain Protection Cowl: Aluminium or hot dip galvanised after fabrication from MS.

6.2.10 Mounting flange on casing: At inlet and outlet.

6.2.11 Painting / protecting coating – All the MS parts shall be galvanised or protected with three coats of epoxy paint.

6.3 ROOF EXTRACTOR UNIT

6.3.1 Casing/cowl/hood: (Spray / hot galvanised M.S. Sheet to IS: 2062 Gr.B (Short duct casing).

6.3.2 Impeller: Cast Aluminum alloy to A-6M, IS-617.

6.3.3 Support frame and structure: M.S of adequate thickness (IS-2062 Gr.B).

6.4 AIR WASHER

6.4.1 Moisture Eliminators plates: 100% virgin PVC die-extruded construction of minimum finished thickness of 2 mm.

6.4.2 Moisture Eliminator Frame: 22 SWG GI sheets and GI angle of adequate strength. ft sleeve: EN - 8 or eqv.

6.4.3 Tank: Black MS for sheet metal Air washer (5mm) thk (Epoxy paint both inside and outside of tank). Min depth -800mm

6.4.4 Piping: MS Heavy class (Galvanized) to IS: 1239 Part I or IS: 3589 depending on size.

6.4.5 Suction Screen for Water: Brass (40 mesh size 2 nos for each air washer)

6.4.6 Spray and flooding nozzles: SS

6.5 UNITARY AIR FILTERATION

6.5.1 Eliminators plates: 100% virgin PVC die-extruded construction of minimum finished thickness of 2 mm.

6.5.2 Tank: M.S. 3mm thick (Epoxy Paint) both inside and outside of tank.

6.5.3 Casing: M.S. 2mm thick (Spray galvanised or two coats of epoxy paint).

6.5.4 Piping: MS Heavy class Galvanised to IS: 1239 Part I / IS 3589 depending on size.

6.5.5 Suction Screen Water: Brass.

6.5.6 Spray and flooding nozzles: SS.

6.5.7 Banks: Single bank type (along the air flow), spraying water over the filters.

6.6 AIR FILTERS

6.6.1 PRE FILTER

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6.6.2 Filter Media: Fibrous material (extruded polyethylene) or felt filter: Dry types with element of 5 ply construction for fabric type.

6.6.3 Efficiency: Average arrestance of 65-80% when tested in accordance with BS: 6540 / ASHRAE – 52-76.

6.6.4 Allowable pressure drop: Initial pressure drop – Not to exceed 5.0 mm WC at rated flow. Final pressure drops- Up to 7.5 mm WC.

6.6.5 Frame Work 18 G GSS. Filter mounting frame shall be GI angle iron frame of adequate thickness.

6.6.6 Size – 610 x 610 mm (Approx.)

6.6.7 SS FILTER (for Air washer / UAF units) The filters shall be washable/cleanable type construction of SS 316 wire netting with three or more layers of wire mesh of different mesh sizes stitched together and held in a SS / Al frame of adequate thickness but not less than 18 SWG for Al and 20 SWG for SS suitable for long use in an industrial plant. The filter when flooded shall have a filtration efficiency of 90% down to 10 microns. The filter mat shall be weaved with SS wire of 0.16mm diameter providing an aperture of max 0.025mm

6.7 FINE FILTER

6.7.1 Filter Media: Synthetic non-woven for fresh air pressurization (MCC).

6.7.2 Efficiency Average arrestance of 80-90% when tested in accordance with BS: 6540 / ASHRAE – 52-76

6.7.3 Allowable pressure drop: For HDPE (SNW) -6 mm WG during clean condition & 12 mm WG during dirty condition.

6.7.4 Frame Work: 18 G GSS.

6.7.5 Size -610 x 610 mm (Approx.)

6.7.6 The filter media shall be of High Density Polyethylene (HDPE) or equivalent and shall have efficiency not less than 85% down to particle size of 10 microns.

6.7.7 The filter media shall be sandwiched in between two galvanized wire netting arrangement in a uniformly corrugated form to increase the surface area.

6.7.8 The filter shall be fixed in GI angle iron frames of adequate thickness suitable for long use in an industrial plant.

6.8 WATER FILTER FOR UAF

6.8.1 As per clause no. 6.6.7.

6.9 **VALVES**:

6.9.1 Valves shall have full sizes port and suitable for horizontal and as well as vertical installation.

6.9.2 Valves for regulating duty shall be of globe type suitable for controlling throughout its lift.

6.9.3 Gate, Globe and stop check valves shall have bonnet back seat to facilitate easy replacement of packing with the valves in service.

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6.9.4 All safety / relief valves shall be so constructed that the failure of any part does not obstruct the free discharge.

6.9.5 Manual gear operators be provided for valves of size 250 NB and above.

6.9.6 All valves with rising stem shall have position indicators.

6.9.7 All valves shall be provided with locking arrangement.

6.9.8 All water line valves shall be of cast iron body for sizes 65 NB and above conforming to IS: 780 and Gun metal construction for sizes less than 65 NB conforming to IS: 778. Cast iron parts shall conform to IS: 210 Gr. FG 220.

6.10 CENTRIFUGAL PUMP

6.10.1 Impeller: Bronze as per Grade IS: 318 Grade 2

6.10.2 Pump shaft: SS 316

6.10.3 Casing: 2% Ni Cast iron to IS: 210 GR. FG-260.

6.10.4 Wearing ring: Bronze Grade IS: 318 GR-2.

6.10.5 Shaft Sleeve: SS 316.

6.10.6 Base plate: Carbon steel as per the IS-2062 Gr.B.

6.10.7 Bolt and nuts: M.S. (Epoxy painted / Galvanised).

6.10.8 Type of seal: Mechanical

6.10.9 Pump motor coupling: Pin & bush type.

7.0 CONTROL PHILOSOPHY

7.1.1 Common PLC for Air-Conditioning and Ventilation System is being provided and scope of supply for common PLC shall be in Air-conditioning supplier scope. PLC based controls in the ventilation system is provided only for the air washers of the powerhouse building and UAF for ESP control building.

7.1.2 Supply air fans, exhaust air fans / roof extractor units of each area shall be provided with their local starter panel.

8. ACCEPTANCE TEST

8.1 Temperature test at the out let of Air washer & UAF. Both DB and WB temperature shall be measured by measured by sling psychrometer which will have accuracy of +/-0.5% with aleast count of 0.5 degC. This will be carried out for 24 hrs continuously and readings will be taken every one hours interval. Standby equipment should be changed over during these 24 hours. This test shall be carried out during summer. The format for recording the readings is enclosed at Annexure IV.

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The following measurements are also to be done prior to the acceptance of the plant by the client:

01. Air Quantity measurement to be taken at the Inlet Louver to establish the Equipment capacity in line with the specification requirement.
02. Power consumption to be measured for each equipment to establish the total Guaranteed Power consumption.
03. Measurement of Noise and Vibration for different Equipment.
04. Establishment of the saturation efficiency for all the Air Washer and Unitary Air Filtration Units.

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9. GENERAL

1) Basis of design, all calculations including heat load calculations for summer seasons, equipment selection criterion, layout drawings/ schemes/G.A. dwg and documents like data sheet/ technical particulars etc. Are subject to Customer approval during detail engineering stage.

2) Vendor to furnish characteristic curves for all major equipment offered indicating duty point during detailed engineering.

3) Vendor to include the Back wash arrangement of pot strainer with gate valve, piping etc for the Air Washer.

4) Vendor to include level gauge & level switch for each Air-washer tank for alarm & trip of the pumps. Also include one no. Pressure switch for each air washer pump

5) All drawings and documents shall be computer based.

6) All commissioning spares & consumables for trouble free operation shall be provided.

7) Quality Requirements in the Technical Specification are indicating minimum requirements for inspection and testing. Vendor shall note that quality plan is subject to Customer & BHEL-

10. approval during detail engineering stage. Standard QP format is enclosed in the technical specification.

8) Indicative list of makes is enclosed as per Annexure-I however these equipments / items shall be subject to Customer & BHEL approval during detail engineering Stage.

9) Inserts or any support arrangement for fixing ducting, fans, piping etc. shall not be provided by BHEL. Necessary supports may be taken from nearest structure / walls / roofs / floors etc. by Vendor.

10) Fixing frame works for diffusers and grilles in the scope of Vendor.

11) Anchor fastener shall be used by vendor for fixing duct pipes etc. wherever applicable.

12) Necessary supports and structures / frames etc. as required for supporting the duct / piping / equipments etc. as lump-sum basis is in the scope of Vendor and no unit rates shall be applicable for these items.

13) Drain piping within room up to the drain point to be provided by the Vendor.

14) Vendor to furnish schedule of power and control cables. Vendor to furnish cable termination details interconnection drawings etc. during detail engineering stage.

15) The tools and machine required for erection of equipment shall be arranged by Vendor.

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16) Tools & tackles as required for regular maintenance shall be supplied by Vendor.

17) Instruments required for performance testing of various equipment / system of the package shall be arranged by Vendor at site.

18) Instrument for testing shall be calibrated by Ventilation plant supplier before taking up testing.

19) Temperature gauges shall be provided with thermo wells and fixing arrangement.

20) Pressure gauges shall have provision for air venting. Three way valves shall be used which shall have air venting provision.

21) Matching sockets / stubs (weld type) for flow switches and other instruments shall be supplied.

22) Bidders shall guarantee to maintain specified inside design conditions during summer, monsoon and winter and also even if the internal equipment load varies from 100% to 25%.

23) Besides the system performance as above, bidder shall guarantee major technical parameters of various equipments as per design basis / details furnished.

24) The guarantee tests shall cover but not limited to the following rated parameters for smooth operation of ventilation system.

- Design dry bulb temperature and relative humidity of conditioned air, Auxiliary power consumption, Vibration and noise level etc.

- Performance test of the Ventilation system shall be carried out at site after proper installation. The site test shall include performance testing of equipment for 72 continuous hours in summer or monsoon and 24 continuous hours in winter. Bidder, as may be required to carry out site tests shall arrange all instruments, tools etc.

- All calibrated instruments to be used for the tests at manufacturer's works/site shall be arranged by the bidder. Any Electrical/C&I items and accessories like junction box, glands etc. shall be included by vendor in his scope. Only those items shall be provide free of cost which are categorically listed in the Electrical scope sheet of technical specification.

  11.

25) Motorized fire damper will be installed at supply air duct in electrical areas like MCC / Switchgear room / cable spreader room etc. in power house building and ESP building. Fire damper will close on receiving fire signal from fire protection system and shall also be possible manually from remote control panel. Also respective Air washers / UAFs shall trip on receiving fire signal from fire protection system.

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26) Vendor to furnish drawings / documents as per the drgs. /documents submission schedule given in the contract.

27) Each motor terminal box shall be provided with cable gland and lugs for the size and type of power and control cable of respective motor.

28) All electrical equipment shall be suitable for the power supply fault levels and other climatic conditions indicated in project information / synopsis enclosed.

29) The bidder's proposal shall be for equipment in accordance with the Tech. Specification.

30) Tender drawings enclosed form the part of specification and the bidder shall check the space requirements.

31) Bidder should suitably group the signals coming from various instrument etc. and the same shall terminate in local JB, from Local JB common cable to PLC / panel / MCC shall be selected. Any Electrical / C&I items and accessories like junction box, glands etc. shall be included by vendor in his scope. Only those items shall be provided free of cost which are categorically listed in the Electrical scope sheet of technical specification.

32) Feeder for a combination of fire dampers / valves etc. shall be derived from respective control panel by bidder. Distribution through junction box / distribution board shall be in bidders' scope and shall have provision for isolation of individual fire damper / valves. Suitable transformer shall be provided by bidder (if required) to derive the power input.

33) In the event of any conflict between the requirements of two clauses of this specification documents or requirements of different codes and standards specified, the more stringent requirement as per the interpretation of the owner shall apply.

34) Bidder to note that BHEL reserve the right for drg/doc submission through web based Document Management System. Bidder would be provided access to the DMS for drg/doc approval and adequate training for the same. Bidder to ensure proper net connectivity at their end.

35) Quality requirements in the Technical specification are minimum requirements for inspection and testing. Vendor to note that quality plans are subject to Customer approval during detail engineering stage. Standard QP format is enclosed in the technical specification.

36) The drawings/ documents submitted by vendor shall be complete in all respects with revised drawing submitted incorporating all comments. Any incomplete drawing submitted shall be treated as non- submission with delays attributable to vendor's account. For any clarification/discussion required to complete the drawings, the bidder shall himself depute his personal to BHEL / Customer's place any number of

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time as per the requirement for across the table discussions/ finalizations/ submissions of drawings.

37) All openings required in brick wall for installing the axial supply and exhaust fans, propeller fans, duct opening, louvers and damper openings etc shall be done by vendor. Grouting of fans along with anchor fasteners shall also be done by vendor. The openings shall be finished properly. In case openings are done once the wall have been painted, repainting, to match with the existing wall paint shall also be done by the vendor. Sealing of duct opening, grouting of foundation / foundation bolts etc. including special type of grouting like GPX2 etc. are in the scope of Ventilation system vendor.

38) Flat, platform type RCC / PCC foundation shall be provided for installing Air washer / UAF and UAF fan / pumps etc. Vendor shall fix the equipment using proper anchor fasteners to secure the equipment and obtain parameter related to vibration and noise.

39) Bidder to note that the P&ID shows only the bare minimum requirement of valves and instruments. Any instrumentation & valves as required for the completion of the system in line with technical specification shall be provided by bidder during detailed engineering without any commercial implication.

40) Final coat of paint on all the equipment's / item covered under the package shall be done at the time of handing over of package

10. EXCLUSIONS

Items of works listed below are excluded from scope of the Ventilation plant supplier.

10.1 Construction of Air washer plant room, foundations for Ventilation equipments (air washer, centrifugal fan, RE Unit only).

10.2 Slab cut out for running ducts, pipes, cables, grilles/dampers. Underground masonry trenches and masonry risers.

10.3 Provision of drain traps / points.

10.4 For Electrical scope, refer Electrical scope matrix sheet.

10.5 Lighting of Air washer plant rooms /areas.

10.6 Lifting & handling arrangement in Air washer plant for maintenance purpose.

10.7 Structure for running the ventilation ducting header outside 'A'- Row, however required inputs shall be provided by the vendor.

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SECTION: C2-A

CUSTOMER SPECIFICATION

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TECHNICAL SPECIFICATION
FOR
VENTILATION SYSTEM

CONTENTS

VENTILATION SYSTEM

1.00.00 **INTRODUCTION**

1.01.00 The purpose of the system is to provide ventilation for different areas of 1X800 MW Supercritical Thermal Power Plant (Stage –VII, Unit #12 at Kothagudem Thermal Power Station, Telangana) to achieve the following :-

i) Acceptable working environment.

ii) Scavenging out structural heat gain and heat load from various equipment, hot pipes, lighting etc.

iii) Dilution of air polluted due to generation of obnoxious & hazardous gaseous/aerosol contaminants like acid/chemical fumes, dusts etc.

1.02.00 Evaporative Cooling System with Air Washer Units (AWU) shall be adopted for the ventilation of the following areas of Power House Building:

i) TG Hall

ii) MCC, Switchgear rooms and cable spreader rooms

iii) Battery Charger Rooms

1.03.00 Mechanical Dry Ventilation System with either Supply or Exhaust Fans shall be provided for the following areas of the Power House Building:

i) Battery Rooms

ii) Elevator Machine Rooms

iii) Toilets

1.04.00 Mechanical Dry Ventilation System with Exhaust Fans shall be provided for the following areas of Mill Bay:

i) Coal Conveyor Tripper floor

1.05.00 Similarly evaporative cooling system with Unitary Air Filtration Units (UAF) shall be provided for the ventilation system for the MCC / Switchgear Rooms and other non-AC areas of the following areas:

i) Non-AC areas of ESP Control Building

ii) Ash handling electrical / control building.

iii) CHP control building

1.05.00 Dry Ventilation System with either Supply or Exhaust Fans shall also be provided for the following Auxiliary Buildings:

a) DG and Compressor House
b) Ash slurry pump house
c) HFO & LDO forwarding pump house
d) CW treatment building
e) DM Plant building
f) DM, service and potable water pump house
g) Non-AC areas of Chemical House
h) CPU Regeneration Building
i) Switch yard control building
j) CW Pump House
k) AHP Compressor Building
l) Non-AC areas of Service Building
m) Silo Utility-cum-HCSD Pump House
n) Vacuum pump house
o) Ash water pump house
p) Clarified water pump house
q) Centrifuge building
r) Store Building

2.00.00 **SYSTEM DESCRIPTION**

2.01.00 Evaporative cooling system by adopting Air Washer Unit (AWU) is to be provided for the ventilation of Power House Building. Cooled and filtered air from Air Washer Units should be distributed by means of ducting to the TG building near various heat sources like turbo-generator, condenser, boiler feed pump, HP & LP heaters, oil coolers etc. The quantity of air exhausted should be kept lower than the quantity of air supplied (usually 60-65% of the supply air is exhausted) in such a way that a little over pressure is maintained inside the hall. This will reduce infiltration of outside hot and dusty air.

On the basis of net heat gain and assumed temperature rise, the supply air quantity for TG hall is to be worked out. This air quantity will be supplied from four (4) AWU - two (2) being placed on B-C bay at De-aerator floor and two (2) being located outside A row of Power House building. Such division and location area is decided to achieve effective air distribution with fewer amounts of duct work and less pressure drop in fans with no cross-over of ducting across A-B bay.

The Air Washer Units will primarily serve TG hall and the electrical areas like MCC Room, Switchgear Room and Cable Spreader Room. The washed air supplied to MCC / Switchgear / Cable Spreader Rooms will be exhausted outside through gravity dampers / exhaust fans (usually 60-65% of the supply air is exhausted to maintain a little overpressure inside the room). Fire dampers (Motorized) shall be provided in the supply air ducting / fans leading to all electrical rooms (MCC, Switchgear etc.).

The supplied air in the lower level of TG hall after taking the heat load of TG bay rises through different openings to the upper floors and is then finally exhausted by means of Roof extractors placed over the roof of TG Hall. Some quantity of air leaks out through various leakage areas due to the overpressure maintained inside the TG Hall.

All these Air Washer Units shall be of package type construction enclosed in sheet metal casing to avoid the problem of water seepage and also to reduce load on building structure. Sump of AWU to be made out of sheet metal / masonry construction with anti-corrosive paintings. All accessories (except water circulation pumps with drive motors, strainers and some portion of piping) shall be placed inside the AWU casing.

Roof extractors are to be provided with rain water protection cover.

While developing the layout, all fresh air ventilation louvers shall be considered 1000 mm from floor level and directed downwards at an angle. Ventilation fans on AB bay roof shall be kept staggered and shall not be near the centerline of turbo generator set.

2.02.00 Exhaust (pull type) ventilation system is adopted for the Battery Rooms by providing Bifurcated type axial flow exhaust fans (1R+1S) of spark proof construction and with flame proof motors and fusible link type fire dampers. In the event of failure of any of the battery room exhaust fans, the second fan will be put into operation to take care of the ventilation need of this Battery Room. All the parts of this system coming in contact with acid fumes shall be epoxy painted. The air discharge from the Battery Room shall be taken to a high level (around 1M above TG Building Roof Level) through an exhaust duct (MS Epoxy painted). In case routing of such exhaust duct is not feasible, the steel parts in a radius of around 5M from the discharge end of the Battery Room Exhaust Fans shall have to be painted with acid resistant epoxy resin based paint. Intake Air for the battery room shall be drawn from the adjacent TG hall through manually operated louver shutter provided in the Battery Room.

A negative pressure shall be maintained inside the Battery Room to prevent leakage of acid fumes and other hazardous gases outside the Battery Room.

2.03.00 Coal conveyor tripper floor of the Mill Bay shall be ventilated by means of Roof Extractors. Air intake louvers should be provided at lower level for air entry to the coal tripper floor.

2.04.00 Pressurized Ventilation system shall be provided for the Elevator Machine rooms with the help of wall mounted Fan-Filter Units. Air will be exhausted through Back Draft Dampers.

2.05.00 Exhaust Ventilation system shall be provided for the Toilets by installing wall mounted type exhaust fans. Air will enter the toilets through door grilles.

2.06.00 In the MCC/ switchgear room of ESP, AHP & CHP Control Building, washed and filtered air supply will be provided by the Unitary Air Filtration Unit due to the reasons that the this building is located in a very dusty zone and heat load of this Building is high.

2.07.00 Ventilation provision for Auxiliary Buildings in various locations shall be done as follows:

Sl. No.	Building	Ventilation System
1.	Electrical MCC/Switchgear areas of ESP Control Building.	Washed and filtered air supply from Unitary Air Filtration Unit (UAF) and exhausting it by back Draft Dampers.
2.	Electrical MCC/Switchgear areas of AHP Control Building.	Washed and filtered air supply from Unitary Air Filtration Unit (UAF) and exhausting it by back Draft Dampers.
3.	Electrical MCC/Switchgear areas of CHP Control Building.	Washed and filtered air supply from Unitary Air Filtration Unit (UAF) and exhausting it by back Draft Dampers.
4.	DG and Compressor Building	For DG area air entry through intake louvers for radiator cooling (in case of air cooled DG) will serve the purpose of ventilation. For water cooled DG, exhaust ventilation will be provided by wall mounted exhaust fans and air entry through inlet louvers. For Compressor area wall mounted Supply air Fan Filter Units and air exhaust through Back Draft Dampers. For the associated Electrical room, Pressurized ventilation with wall mounted fan filter units and air exhaust through back draft dampers.
5.	DM Plant building	Wall mounted Exhaust Fans for Plant area and Chemical Storage area and fresh air entry through Inlet Louvers.

6.	Ash Slurry Pump house	Wall mounted supply fans for the pump area. Hot air will be exhausted through wall mounted louvers. For the associated Electrical room, Pressurized ventilation with wall mounted fan filter units and air exhaust through back draft dampers.
7.	HFO & LDO Forwarding Pump house	For pump area, wall mounted Exhaust fans of spark proof construction with flame-proof motors and fusible link type fire dampers and fresh air entry through Inlet Louvers. For the associated Electrical room, Pressurized ventilation with wall mounted fan filter units and air exhaust through back draft dampers.
8.	CW Treatment Building	Wall mounted Exhaust Fans and fresh air entry through Inlet Louvers.
9.	DM, Service & Potable Water Pump House	Wall mounted supply fans for the pump area. Hot air will be exhausted through wall mounted louvers. For the associated Electrical room, Pressurized ventilation with wall mounted fan filter units and air exhaust through back draft dampers.
10.	Chemical House	Wall mounted Exhaust Fans for Plant area and fresh air entry through Inlet Louvers. For the associated Electrical room, Pressurized ventilation with wall mounted fan filter units and air exhaust through back draft dampers.
11.	CPU Regeneration Building	Wall mounted Exhaust Fans for Plant area and fresh air entry through Inlet Louvers.
12.	Switch Yard Control Building	For battery room, wall mounted Exhaust fans of spark proof construction with flame-proof motors and fusible link type fire dampers and fresh air entry through Inlet Louvers. For the associated Electrical room, Pressurized ventilation with wall mounted fan filter units and air exhaust through back draft dampers.

13.	Store Building	Wall mounted Exhaust Fans and fresh air entry through Inlet Louvers.
14.	CW Pump House	Wall mounted supply fans for the pump area. Hot air will be exhausted through wall mounted louvers. Alternatively, evaporative cooling system may be considered for pump area. For the associated Electrical room, Pressurized ventilation with wall mounted fan filter units and air exhaust through back draft dampers.
15.	AHP Compressor Building	For Compressor area wall mounted Supply air Fan Filter Units and air exhaust through back draft dampers. For the associated Electrical room, Pressurized ventilation with wall mounted fan filter units and air exhaust through back draft dampers.
16.	Service Building	For Electrical rooms, Pressurized ventilation with wall mounted fan filter units and air exhaust through back draft dampers. Exhaust Ventilation system shall be provided for the pantries by installing wall mounted type exhaust fans. Air will enter through door grilles / inlet louvers. Exhaust Ventilation system shall be provided for the stores by installing wall mounted type exhaust fans. Air will enter through door grilles / inlet louvers.
17.	Silo Utility cum HCSD Pump House	Wall mounted supply fans for the pump area. Hot air will be exhausted through wall mounted louvers. For Electrical rooms, Pressurized ventilation with wall mounted fan filter units and air exhaust through back draft dampers.
18.	Vacuum Pump House	Wall mounted supply fans for the pump area. Hot air will be exhausted through wall mounted louvers.
19.	Centrifuge Building	Wall mounted Exhaust Fans and fresh air entry through Inlet Louvers.

20.	Ash Water Pump house	Wall mounted supply fans for the pump area. Hot air will be exhausted through wall mounted louvers. For the associated Electrical room, Pressurized ventilation with wall mounted fan filter units and air exhaust through back draft dampers.
21.	Clarified Water Pump house	Wall mounted supply fans for the pump area. Hot air will be exhausted through wall mounted louvers. For battery room, wall mounted Exhaust fans of spark proof construction with flame-proof motors and fusible link type fire dampers and fresh air entry through Inlet Louvers. For the associated Electrical room, Pressurized ventilation with wall mounted fan filter units and air exhaust through back draft dampers.
22.	Toilets (For all areas)	Exhaust Ventilation system shall be provided for the Toilets by installing wall mounted type exhaust fans. Air will enter the toilets through door grilles.

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N.B. **Above requirement is tentative only based on the current Plot Plan. Final requirement of ventilation will be decided during detail engineering when the list of buildings will be finalized and layout drawing of each building will be frozen.**

2.08.00 In general, for a particular area / room ventilation equipment / systems shall be selected in multiple modules and therefore no idle stand-by equipment has been envisaged. However, for the Battery Rooms one idle stand-by fan unit shall be provided in consideration of their locations and hazardous spreading of acid fumes in case of failure of running fan.

3.00.00 **SCOPE OF SUPPLY**

3.01.00 **Equipment**

Equipment sizing is to be done on the basis of heat load and number of air changes. The higher of the sizes arising out of these requirements should be considered. Selection of fan duty conditions is to be supported by back-up calculations, to be enclosed with bid.

3.01.01 Centrifugal Fan unit each complete with:

a) Fan impeller (backward curved) with casing and supports and required steel frame / supporting structure, if any.

b) Electric drive motor of suitable rating considering at least 15% margin over the shaft power consumption.

c) Drive Pulleys, V-belt, belt guards, slide rails etc.

d) Dampers at fan outlet and flexible connection (Rubberized Canvas) with matching flanges.

e) Vibration isolators (rubber in shear type / neoprene rubber pad), foundation bolts and nuts.

f) Removable drain plug with the fan casing.

NB: These Centrifugal fans also cover those required for Air Washer and Unitary Air Filtration Units.

3.01.02 Wall mounted axial flow fans each complete with:

a) Fan impeller of cast alloy aluminium construction (LM-6 Grade) with blades of aerofoil design.

b) Electric drive motor of suitable rating considering at least 15% margin over the shaft power consumption including motor brackets.

c) Vibration Isolators.

d) Short duct (wherever required).

e) Coned inlet and grouting framework, if any.

f) Rain protection cowl with bird-screen made of GI, Foundation Bolts etc.

g) Dry filters including fixing framework for fan filter unit (wherever required).

h) Back draft dampers, wherever specified.

i) Protective wire netting inside the room, wherever required.

N.B. For Toilets, Pantries, Stores requiring small capacity fans, Propeller type fans are acceptable.

3.01.03 Roof mounted axial flow fan (Roof Extractor) each complete with:

a) Fan impeller of cast alloy aluminium construction (LM-6 Grade) with blades of aerofoil design.

b) Electric drive motor of suitable rating considering at least 15% margin over the shaft power consumption including motor brackets.

c) Vibration Isolators.

d) Short duct mounting (if required) having inspection door and base with proper water sealing arrangement.

e) Grouting Frame.

f) Fan casing of heavy gauge sheet steel construction.

g) Rain protection hood / cowl with bird screen and disconnection switch, foundation bolts etc.

3.01.04 Sheet metal type Air washer Units (AWU), each complete with:

a) Air Intake Louver with bird screen of GI construction.

b) Automatically cleanable water flooded stainless steel mesh filters cleaned by one bank of spray header with stainless steel water spray nozzles spraying water over the filter in the direction of air flow and one more bank of spray header with stainless steel water spray nozzles spraying water opposing the air flow.

c) Two numbers Horizontally Split casing / back pull-out type Centrifugal pump sets (one running and one standby) complete with drive motor for circulation of water through the above spray header banks and provided with pot type suction strainer with bypass valves, inlet and outlet pressure gauges and filter back wash arrangement.

d) Moisture eliminator sets of die-extruded PVC construction.

e) Inspection doors with ladder and marine lights for different sections and cat walks as required.

f) All valves, pipes with fittings, nuts and bolts, internal fittings and supports, including ball float valves for make-up water connection, quick-fill connection with valve, drain piping with valves up to the nearest drain point, and overflow connection with siphon.

g) Double inlet Double width Centrifugal fan with electric drive motor, drive pulleys, v-belt, belt guards, cushy foot mountings, removable drain plug and other accessories as required. Both inside and outside surfaces of all parts of the fan shall be spray galvanized. The fan with drive motor shall be placed inside casing of AWU.

h) Air washer casing shall be sheet steel fabricated construction with adequate stiffeners, bracings etc. (duly spray galvanized / painted with epoxy resin based paint from inside and outside) covering all components of the Air Washer Unit including Centrifugal Blowers, but excluding the water circulating pump sets.

Top Surface of the AWU shall be thermally insulated with 13 mm thick thermal insulation made of Aluminium foil faced closed cell elastomeric Nitrile Rubber (of density min. 40 Kg/CuM) / XLPE (of density min. 33 Kg/CUM) or equal having a thermal conductivity not exceeding 0.035W/MK. The insulation shall have self extinguishing & non-dripping properties against fire attack.

Air Washer Sump made of sheet metal construction / masonry construction and duly painted with epoxy resin based paint both from inside and outside. The sump shall be complete with make-up water connection with float valve, quick fill connection with isolating valve, drain connection with valve, overflow connection with siphon and coarse strainer chamber and low level switch.

NOTE: Bidder will indicate make up water requirement for the equipment offered by them.

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3.01.05 Unitary Air Filtration (UAF) units each consisting of:

a) Air Intake Louver with bird screen of GI construction.

b) Automatically cleanable type Stainless Steel mesh Filters complete with SS / Al. frame continuously flooded with water by one bank of spray header with stainless steel water spray nozzles spraying water over the filter in the direction of air flow.

c) Two (2) nos. (one no. working and one no. stand-by) Centrifugal mono-bloc pumps for circulation of water. Pump system shall be provided with pot strainer with by-pass valves, inlet and outlet pressure gauges and filter back wash arrangement.

d) Moisture eliminator sets of die-extruded PVC construction.

e) UAF chamber & sump shall be of sheet metal construction. Both the casing and water sump shall be duly spray galvanized / painted with epoxy resin based paint from inside and outside and shall be complete with all valves, pipes, nuts and bolts, pipe hangers, supports, internal fittings and supports, suction pipe connection with coarse strainer, make-up water connection with ball float valve, quick fill connection with isolating valve, drain connection with valve, overflow connection with siphon and low level switch.