

**MAHARASTRA STATE POWER GENERATION CO. LTD.
(MAHAGENCO)**



1 X 660 MW BHUSAWAL TPS

TECHNICAL SPECIFICATION

FOR

VENTILATION SYSTEM

SPECIFICATION NO.: - PE-TS-415-554-A001 (REV0)



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
POWER PROJECT ENGINEERING INSTITUTE BUILDING
SECTOR-16A, PLOT NO.-25, NOIDA, INDIA**



TITLE:
**TECHNICAL SPECIFICATINS FOR
VENTILATION SYSTEM**

SPECIFICATION No: PE-TS-415-554-A001

SECTION

REV. 00

SHEET : 1 OF 2

CONTENTS

This Technical specification consists of two sections:

SECTION - I

SUB- SECTIONS	TITLE	Page No
Sub-Section-A	INTENT OF SPECIFICATION	5 - 7
Sub-Section-B	PROJECT INFORMATION WITH WIND AND SEISMIC DESIGN CRITERIA	8 - 18
Sub-Section-C	TECHNICAL SPECIFICATIONS	
Sub Section-C1	SPECIFIC TECHNICAL REQUIREMENT	20 - 40
Sub Section-C2	CUSTOMER SPECIFICATION	
C2 - A	TECHNICAL REQUIREMENT	41 - 101
C2 - B	PROJECT SPECIFIC GENERAL REQUIREMENTS INCLUDING: GENERAL TECHNICAL REQUIREMENT FUNCTIONAL / PERFROMANCE / DEMONSTRATION / GUARANTEE TESTS QUALITY ASSURANCE DRAWINGS / DOCUMENTS SUBMISSION PROCEDURE PACKING PROCEDURE PROJECT MANAGEMENT AND SITE SERVICES	102 -232
C2 - C	PAINTING SPECIFICATIONS	
Sub Section-C3	TECHNICAL SPECIFICATION (ELECTRICAL PORTION)	233 - 280
Sub Section-C4	TECHNICAL SPECIFICATION (C&I PORTION)	281 - 484
Sub Section-D	STANDARD TECHNICAL SPECIFICATIONS	485 - 534
Sub Section-E	ANNEXURE-I LIST OF MAKES OF SUB-VENDOR ITEMS	535 - 541
	ANNEXURE-II MANDATORY SPARE LIST	542
	ANNEXURE-III PAINTING & COLOUR SCHEME	543
	ANNEXURE-IV LIST OF TOOLS & TACKLES	544
	ANNEXURE-V DRAWINGS / DOCUMENTS SUBMISSION PROCEDURE	545
	ANNEXURE-VI MASTER DRAWING LIST WITH SCHEDULE OF SUBMISSION	546 - 549
	ANNEXURE-VII FORMAT FOR OPERATION AND MAINTENANCE MANUAL	550 - 553
	ANNEXURE-VIII SITE STORAGE AND PRESERVATION	554 - 560
	ANNEXURE-IX PACKING PROCEDURE	570



TITLE:
**TECHNICAL SPECIFICATINS FOR
VENTILATION SYSTEM**

SPECIFICATION No: PE-TS-415-554-A001

SECTION

REV. 00

SHEET : 2 OF 2

SECTION - II

SUB SECTIONS	TITLE	Page No
Sub Section-1	INSPECTION AND TESTING WITH STANDARD QUALITY PLAN	572 - 582
Sub Section-2	LIST OF DOCUMENTS TO BE SUBMITTED WITH BID	583
Sub Section-3	COMPLIANCE CUM CONFIRMATION CERTIFICATE	584 - 585
Sub Section-4	PRE BID CLARIFICATION SCHEDULE	586
Sub Section-5	DEVIATION SHEET (COST OF WITHDRAWAL)	587
Sub Section-6	GUARANTEED POWER CONSUMPTION	588 - 594
Sub Section-7	DRAWINGS (PID/ MECHANICAL LAYOUT DRAWINGS SHOWING LOCATION OF EQUIPMENT/PLOT PLAN)	595 - 602



**1 X 660 MW BHUSAWAL TPS
VENTILATION SYSTEM**

SPECIFICATION No: PE-TS-415-554-A001

SECTION: I

REV. 00

SECTION - I



**1 X 660 MW BHUSAWAL TPS
VENTILATION SYSTEM
INTENT OF SPECIFICATION**

SPECIFICATION No: PE-TS-415-554-A001

SECTION : I

Sub Section: A

REV. 00

SHEET 1 OF 3

SECTION-I

SUB-SECTION-A

INTENT OF SPECIFICATION

	1 X 660 MW BHUSAWAL TPS VENTILATION SYSTEM INTENT OF SPECIFICATION	SPECIFICATION No: PE-TS-415-554-A001	
		SECTION : I	
		Sub Section: A	
		REV. 00	
		SHEET 2 OF 3	

1.0 INTENT OF SPECIFICATION

- 1.1 The specification covers Design (i.e. Preparation and submission of drawing /documents including “As Built” drawings and O&M manuals), engineering, manufacture, fabrication, assembly, inspection / testing at vendor's & sub-vendor's works, painting, maintenance tools & tackles (as applicable), fill of lubricants & consumables till COD, mandatory spares along with spares for erection, start up and commissioning as required, forwarding, proper packing, shipment and delivery at site, unloading, handling, transportation & storage at site, in-site transportation, assembly, erection & commissioning, final painting at site, minor civil work, trial run at site, carrying out Performance guarantee / Functional / Demonstration tests at site (As applicable), training of customer/client O&M staff (Bidder / Sub-contractor works as per spec) and handover in flawless condition of the package to the end customer complete with all accessories for the total scope defined as per BHEL NIT & tender technical specification as specified above, amendment & agreements till placement of order for **1X660 MW BHUSAWAL TPS in Dipnagar near Bhusawal, Maharashtra.**
- 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 highest 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. Similarly, the extent of supply also includes all items required for completion of the system and not withstanding that they may have been omitted in drawings / specifications or schedules.
- 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 X 660 MW BHUSAWAL TPS VENTILATION SYSTEM INTENT OF SPECIFICATION	SPECIFICATION No: PE-TS-415-554-A001	
		SECTION : I	
		Sub Section: A	
		REV. 00	
		SHEET 3 OF 3	

- 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 SEC-II 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 Sec – II); 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, Sub-Section - C shall prevail over Sub-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 refer relevant clause of NIT.



**1x660 MW BHUSAWAL TPS
VENTILATION SYSTEM
PROJECT INFORMATION WITH WIND AND
SEISMIC DESIGN CRITERIA**

SPECIFICATION No: PE-TS-415-554-A001

SECTION : I

Sub Section : B

REV. 00

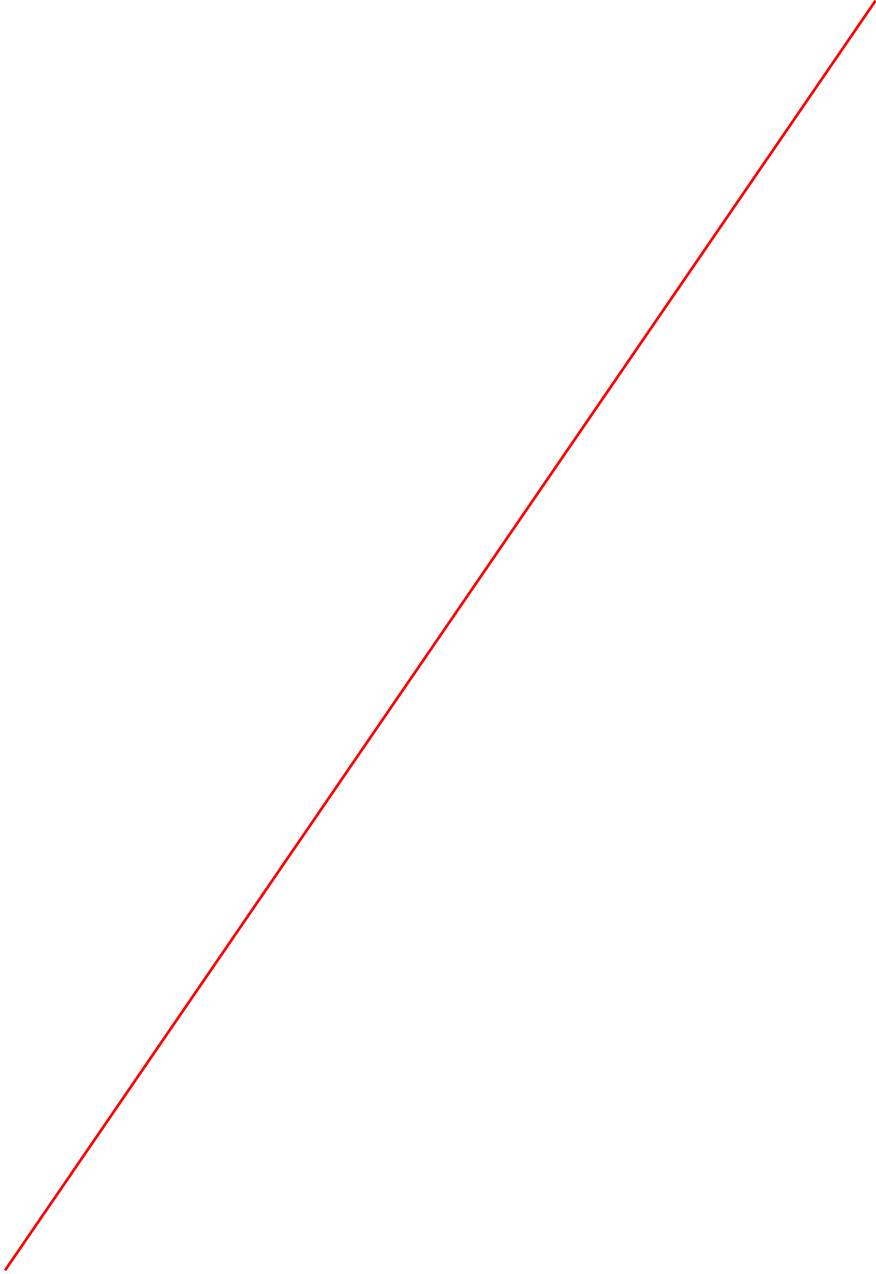
SECTION: I

SUB-SECTION: B

**PROJECT INFORMATION WITH WIND AND SEISMIC DESIGN
CRITERIA**

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 2
REV: R0	MASTER SPECIFICATIONS	Page 15 of 555

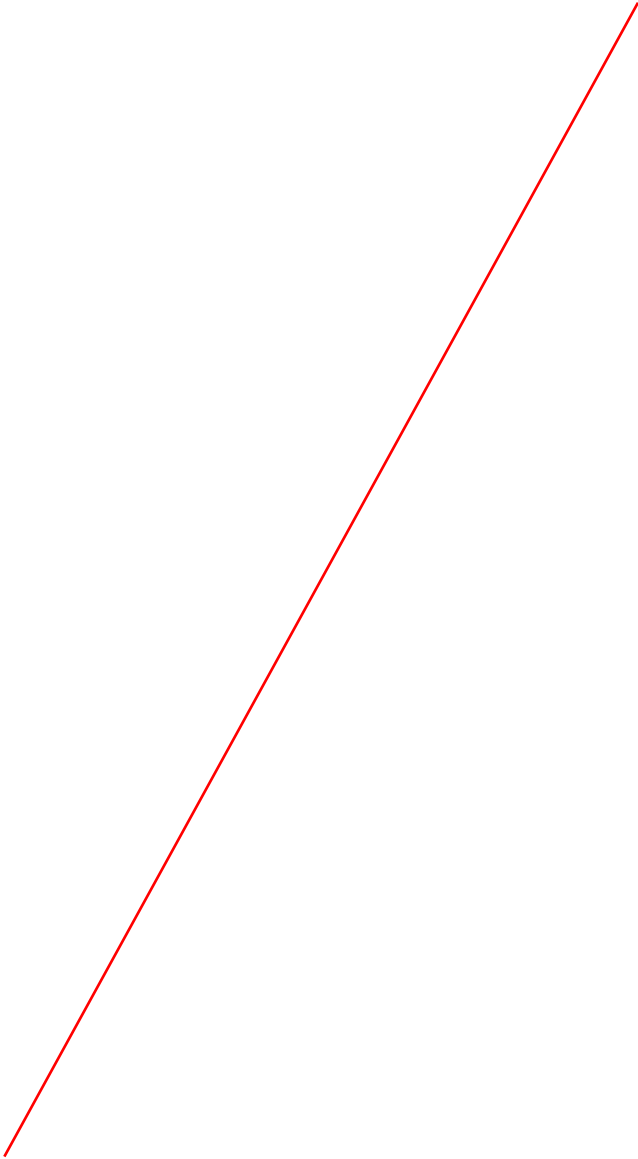
VOLUME II
SECTION – 2
GENERAL PROJECT INFORMATION

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 2
REV: R0	MASTER SPECIFICATIONS	Page 16 of 555
		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 2
REV: R0	MASTER SPECIFICATIONS	Page 17 of 555

CONTENTS

<u>CLAUSE NO.</u>	<u>DESCRIPTION</u>
1.0	INTRODUCTION
2.0	APPROACH TO SITE
3.0	LAND
4.0	SOURCE OF COAL
5.0	SOURCE OF WATER
6.0	ASH DISPOSAL AREA
7.0	PROJECT INFORMATION

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 2
REV: R0	MASTER SPECIFICATIONS	Page 18 of 555
		

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 2
REV: R0	MASTER SPECIFICATIONS	Page 19 of 555
1.0 <u>INTRODUCTION</u> The proposed 1x 660 MW Bhusawal Thermal Power Project will be set up by Maharashtra State Power Generation Co. Ltd. (MAHAGENCO) in Dipnagar near Bhusawal, Maharashtra, India. 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 herein 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. 2.0 <u>APPROACH TO SITE</u> Deepnagar is well connected by rail and road. By road, it is about 8 Km from Bhusawal city. Nearest railway station is at Bhusawal. The nearest Airport is at Aurangabad. The nearest sea port is at Mumbai. The site is located on the Mumbai-Nagpur Highway. 3.0 <u>LAND</u> Bhusawal Thermal Power Plant is already having 1x62.5 MW + 2x210 MW Units and Two (2) Units of 500 MW each are under execution stage. About 108.94 Hectares of land is acquired by MAHAGENCO near existing TPS. It is proposed to install 1x 660 MW unit on this land. 4.0 <u>SOURCE OF COAL</u> Indian coal would be sourced from Machaakata coal blocks in Orissa state. The Coal will be received at Plant site directly by rail. The coal from the railway wagons would be unloaded by means of wagon tippers and will be either bunkered or stacked in the stock pile at site. 5.0 <u>SOURCE OF WATER</u> The main source of water is considered Ozerkheda Reservoir which is located at around 18 km from plant site.		

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section – 2
REV: R0	MASTER SPECIFICATIONS		Page 20 of 555
6.0	<u>ASH DISPOSAL AREA</u>		
The ash generated from 1 x 660 MW unit shall be disposed off in slurry form to the existing Ash Pond located at Velhala, approx. 12 Km from the site.			
7.0	<u>PROJECT INFORMATION</u>		
7.1	Client / Owner	:	Maharashtra State Power Generation Co. Ltd.
7.2	Consultant	:	Procon Engineers, Navi Mumbai (Division of Nimoto Consulting Engineers Pvt. Ltd.)
7.3	Project Title	:	BHUSAWAL T.P.S. UNIT – 6 : 1X660 MW
7.4	Location	:	Dipnagar, Near Bhusawal, Maharashtra, India
7.5	Nearest railway station	:	Bhusawal
7.6	Nearest Airport	:	Aurangabad
7.7	Nearest Harbour	:	Mumbai
7.8	Access Roads	:	NH 6 (Mumbai-Nagpur Highway)
7.9	Elevation above MSL	:	210 M
7.10	Longitude/latitude	:	75°51'10" East /21° 02' 30" North
7.11	Seismic Zone	:	Zone III as per IS:1893
7.12	<u>AMBIENT TEMPERATURE</u>		
7.12.1	Mean of daily maximum temperature	:	48.25 °C (during May)
7.12.2	Mean of daily minimum temperature	:	18 °C (during January)
7.12.3	Highest temperature recorded	:	48.7°C

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section – 2
REV: R0	MASTER SPECIFICATIONS		Page 21 of 555
7.12.4	Lowest temperature recorded	: 13°C	
7.13	Wet bulb temperature	: 27°C (Maximum)	
7.14	Rainfall	: 112 mm average annually	
7.15	Wind Speed	: 0 to 39 Km/hr	
7.16	Wind direction	: East North East to West South West	
	<u>ELECTRICAL</u>		
7.17	<u>MAIN POWER SOURCE FROM GRID</u>		
7.17.1	Rated Voltage	: 400kV	
7.17.2	Voltage variation	: ± 10 %	
7.17.3	Frequency Variation	: ± 5 %	
7.17.4	Rated Short Circuit Level	: 50 kA, Three Phase Symmetrical	
7.18	<u>AUXILIARY POWER SUPPLY</u>		
	Auxiliary electrical equipment shall be suitable for operation on the following supply system:		
7.18.1	Motors above 1000 kW & other Power devices	: 11kV, 3Ph, 3wire, 50Hz system	
7.18.2	Motors below 1000 kW & above 160kW & other power devices	: 3.3kV, 3 ph, 3 wire 50 Hz, Non Effectively earthed	
7.18.3	Motors upto 160 kW & other power devices	: 415V, 3 ph, 4 wire 50 Hz	
7.18.4	Motor Starting Methods	: Direct on Line	
7.18.5	(a) Lighting fixtures, Space heaters, and single Phase motors	: 240V, 1 phase, 50 Hz Supply through suitably rated transformers to limit the short circuit level to 9kA – 1 sec.	

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 2
REV: R0	MASTER SPECIFICATIONS	Page 22 of 555
(b) Control & : 240V, 1 Phase, 50 Hz from UPS Instrumentation		
7.18.6	Short circuit levels of 11kV, 3.3 kV and 415V system equipments The equipment shall be suitable for the following short circuit levels	
	(a) 11kV Switchgears : 44 kA/3 sec	
	(b) 3.3kV Switchgears : 40 kA/3sec	
	(c) 415V PCC/ : 50 kA/1sec PMCC/ MCC	
	(d) Lighting : 9 kA/1sec Distribution Boards & 240V A.C. supply	
7.18.7	Auxiliary DC supply The auxiliary DC supply will be used for control, indication & protection, Turbine lube oil system, AVR, Emergency DC lighting of power plant and Control & Instrumentation etc.	
	(a) Voltage : (i) 220V DC for utility purpose (ii) 24V DC for Control and Instrumentation	
	(b) Voltage variation : + 10 %, - 15 %	
7.18.8	Emergency power supply	
	(a) Purpose : (i) Standby power to normal incomer of emergency MCC (ii) Alternate power source to Fire water Pumps	
	(b) Rated voltage and frequency : 415 V, 3 phase, 3 wire, 50 Hz.	

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 2
REV: R0	MASTER SPECIFICATIONS	Page 23 of 555
7.18.9	UPS power supply (a) Purpose : (i) Vital process loads (ii) Critical lighting (iii) Control and Instrumentation (iv) Office for LAN power supply/Server etc. (b) Rated Voltage : 415V, 3 ph, neutral/240V single phase, 50Hz	
7.19	The variation in voltage and frequency may be $\pm 10\%$ and $\pm 5\%$ respectively. The combined voltage and frequency variation may be $\pm 10\%$. All devices shall be suitable for continuous operation over the entire range of voltage variation without any change in their performance	
7.20	Power socket shall be 415V AC, 50 Hz, 4 pin 32/63 Amps. Power socket outlets for portable tools, hand lamps etc shall be 240 volts, single phase, 3 pin, metal clad industrial type	
7.21	All electrical equipment shall be designed for the following ambient conditions (a) Maximum ambient temperature : 50°C (b) Minimum Ambient temperature : 13°C	

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 10
REV: R0	MASTER SPECIFICATIONS	Page 453 of 555

ANNEXURE – B

CLARIFIED WATER & FILTERED WATER ANALYSIS

1.0 WATER QUALITY AT CLARIFIER OUTLET

- (a) Residual Chlorine : 0.1 ppm as Cl₂
- (b) Iron Content : < 0.1 ppm as Fe
- (c) Turbidity : < 15 NTU

2.0 WATER QUALITY AT GRAVITY FILTER OUTLET

- (a) Turbidity : < 2 NTU
- (b) Organic Content : Nil



**1x660MW BHUSAWAL TPS
VENTILATION SYSTEM
TECHNICAL SPECIFICATION**

SPECIFICATION No: PE-TS-415-554-A001

SECTION : I

Sub Section : C

REV. 00

SECTION: I

SUB SECTION: C

TECHNICAL SPECIFICATIONS

	1x660MW BHUSAWAL TPS VENTILATION SYSTEM		SPECIFICATION No: PE-TS-415-554-A001	
			SECTION : I	
	SPECIFIC TECHNICAL REQUIREMENT		SUB-SECTION : C 1	
			REV. 00	
SECTION: I SUB-SECTION: C 1 SPECIFIC TECHNICAL REQUIREMENT				

	1x660MW BHUSAWAL TPS VENTILATION SYSTEM SPECIFIC TECHNICAL REQUIREMENT	SPECIFICATION No: PE-TS-415-554-A001	
		SECTION : I	
		SUB-SECTION : C 1	
		REV. 00	

1.

INTRODUCTION

1.1

The purpose of the system is to provide Ventilation system for different areas of 1 X 660 MW, BHUSAWAL TPS under the scope of this tender.

2.

SYSTEM DESCRIPTION

2.1

The Ventilation System is provided in the following locations within the Turbine Building by Air washers. Coursing of air in desired direction / areas shall be made by using roof extractors and wall mounted supply/exhaust fan.

• Complete TG building.

• MCC, Switchgear rooms and cable spreader rooms

a

Total 4 Nos. Air washers shall be provided. Each air washer shall have 2 X 50% capacity Centrifugal Fans. The tentative location of these air washers shall be as under:

b

2 Nos. Air Washer each of 2,50,000 CMH capacity shall be placed in Air washer room above DG house outside A row of power house. 2 Nos. Air Washer each of 2,50,000 CMH capacity shall be placed in Air washer room at 24 M in BC bay of power house

2.1.3

13 numbers Roof Extractor units each of capacity 50,000 CMH for TG hall shall be provided on the TG Hall roof.

2.2

Ventilation system in ESP Control Room (Non air conditioned areas) shall be provided by 2 nos. UAF (Unitary Air filtration) (2x100 %) each of capacity 80,000 CMH. Each UAF shall have 2 X 50% capacity Centrifugal Fans, each of capacity 40,000 CMH. These UAF shall be placed in open at Roof level.

2.3

Dry type Mechanical ventilation shall be provided for following areas:

• Battery room of Power house and other Auxiliary building

• AC plant room in Power house

• Non AC area of SWAS room

• Oil room of power house

• Toilets and pantry of power house and other auxiliary building

• Non AC area of Service building

• Compressor house

• DG house

• CW pump house

• CW Ozonisation building

• Fuel oil transfer pump house

• Fuel oil pressurizing pump house

• Filtered water pump house (non DM)/ Clarified water pump house

	1x660MW BHUSAWAL TPS VENTILATION SYSTEM	SPECIFICATION No: PE-TS-415-554-A001	
		SECTION : I	
		SUB-SECTION : C 1	
		REV. 00	
SPECIFIC TECHNICAL REQUIREMENT			

- RAW water and fire water pump house
- Store
- Electrical room of Auxiliary building
- Non AC area of Canteen building
- Non AC area of Time and security office
- Coal conveyor Tripper floor of mill bay
- Chemical lab
- Fire water booster pump house
- CPU regeneration building
- Non AC area of FGD control room
- Ball mill building
- Gypsum dewatering building
- RC pump house and oxidation blower room
- DMCW pump house (if applicable)

2.4

REFERENCE CODE AND STANDARDS (AS PER MAHAGENCO SPECIFICATION, CLAUSE NUMBER 2, PAGE 117-118 OF 171, VOLUME III-G, BID SPECIFICATION NUMBER DG/BSL U-6/2011/T-1

IS 325: Three phase induction motors

UL 555: FIRE DAMPERS

2.5

Any other area/building which has not been specifically mentioned above, requiring ventilation shall be provided with suitable ventilation system.

3.

DESIGN INPUT / CRITERIA

3.1.1

As per MAHAGENCO Specification, clause number 5.2.1 to 5.2.3, section-3, page 124-125 of 171, and Data Sheet A, page number 167-171 of 171, Volume III-G, bid specification number DG/BSL U-6/2011/T-1 as per details mentioned below:

3.1.1.1.

Design ambient condition for all ventilation system shall be as follows:

Design Temperature	Summer	Monsoon	Winter
DBT (Deg. C)	50	29.4	15.6
WBT (Deg. C)	27	27.2	11.1

	1x660MW BHUSAWAL TPS VENTILATION SYSTEM SPECIFIC TECHNICAL REQUIREMENT	SPECIFICATION No: PE-TS-415-554-A001	
		SECTION : I	
		SUB-SECTION : C 1	
		REV. 00	

3.1.1.2.

The number of air change per hour in mechanically ventilated area shall be as follows:

a) For all evaporative cooled areas
(including Electrical area with evaporative cooling) : 8

b) General area (including pump houses) : 20

c) Battery room : 30
Area where gaseous fumes/ vapours are generated

d) Switchgear/MCC rooms, pump houses, Toilet, pantry : 20

4.

BRIEF SCOPE

4.1

EQUIPMENT AND SERVICES TO BE PROVIDED FOR VENTILATION SYSTEM WITH DESIGN AND CONSTRUCTIONAL REQUIREMENT

4.1.1

Air washer

4.1.1.1.

As per MAHAGENCO Specification, clause number 6.3.1 (a), page 138-139 of 171 and clause no. 6.3.6 page 141-142 of 171, Volume III-G, bid specification number DG/BSL U-6/2011/T-1 and other relevant clause of tender specification.

4.1.2

UAF (Unitary air filter)

4.1.2.1.

As per MAHAGENCO Specification, clause number 6.3.1 (b), page 139 of 171, Volume III-G, bid specification number DG/BSL U-6/2011/T-1.

Unitary Air Filter Units internals coming in contact with moist air shall be provided with FRP lining. For fine finish of FRP surface, two coats of epoxy paint shall be applied. All inside and outside parts of the fans and the connection piece between fan and UAF unit shall be provided with FRP lining along with two coats of epoxy painting for fine finishing of FRP lining except the fan shaft which shall be epoxy painted.

4.1.3

Centrifugal and Axial flow fan units

4.1.3.1.

As per MAHAGENCO Specification, clause number 6.1.2.1, 6.1.2.2, 6.1.5, 6.1.6.1 to 6.1.6.3, Volume III-G, bid specification number DG/BSL U-6/2011/T-1.

4.1.4

ROOF EXTRACTOR UNIT:

As per MAHAGENCO Specification, clause number 6.1.2.3, Volume III-G, bid specification number DG/BSL U-6/2011/T-1. All roof exhauster shall be of direct driven axial flow type. Roof exhauster shall have multi-bladed impeller with a short duct casing while wall exhauster shall have coned inlet suitable

	1x660MW BHUSAWAL TPS VENTILATION SYSTEM	SPECIFICATION No: PE-TS-415-554-A001	
		SECTION : I	
		SUB-SECTION : C 1	
		REV. 00	
SPECIFIC TECHNICAL REQUIREMENT			

for free discharge of air into atmosphere. Necessary mesh shall be provided at inlet of fan to arrest any material falling down. For foundation bolt, Aluminium plate shall be provided locally at the bolting area to avoid moisture from entering the bolting area. All roof exhausters shall be provided with gravity operated type back draft damper.

RE unit fans shall consist of following accessories:

- a) Fan wheel, housing
- b) Electrical drive motor with coupling
- c) Mounting brackets
- d) Gravity operated backdraft damper
- e) Short duct mounting
- f) Grouting frame
- g) Disconnection switch etc.
- h) Hood shall be provided to protect from rain and other contingencies
- i) Anchor bolts, nuts, bolts and lose fittings
- j) Any other equipment / material necessary to ensure safe and satisfactory operation of each unit

4.1.5 Duct Work

4.1.5.1. As per MAHAGENCO Specification, clause number 6.5, Volume III-G, bid specification number DG/BSL U-6/2011/T-1.

All duct work shall be fabricated of galvanised steel sheets properly reinforced to prevent sagging, buckling or vibration. The interior of all duct shall be smooth and free from obstruction. All duct section shall be cross-broken. The air velocity in the duct shall be limited to 12 m/s.

4.1.6 Filter

4.1.6.1. As per MAHAGENCO Specification, clause number 6.2.1 to 6.2.5, Volume III-G, bid specification number DG/BSL U-6/2011/T-1.

4.1.7 Thermal insulation (only for duct directly exposed to sun)

4.1.7.1. As per MAHAGENCO Specification, clause number 6.5.6, Volume III-G, bid specification number DG/BSL U-6/2011/T-1.

	1x660MW BHUSAWAL TPS VENTILATION SYSTEM		SPECIFICATION No: PE-TS-415-554-A001	
			SECTION : I	
	SPECIFIC TECHNICAL REQUIREMENT		SUB-SECTION : C 1	
			REV. 00	

4.1.8 VENTILATION PHILOSOPY FOR DIFFERENT AREA (UNDER BHEL SCOPE)

Building/ Area	Ambient Air Temperature (°C)	Indoor Temperature		Humidity Control (% RH)	Minimum Design Ventilation rate (AC/H)	Filtration Efficiency (%)	Pressurisation	Redundancy	Noise Criteria
		Maximum °C	Minimum °C						
Steam Turbine Area									
below operating floor	Extreme	Evaporative cooling less than ambient Temp.	—	None	8	90% down To 10 micron	Slightly pressurised	Multiplicity	Background
Above operating floor	Extreme	Evaporative cooling less than ambient Temp.	—	None		Do	Do	Multiplicity	Background
Valve Stations, miscellaneous	Extreme	Ambient Temp. plus 5	—	None	20 or as per heat load whichever is higher	None	None	None	85 dB (A)
Elevator machine rooms	Normal	Ambient Temp. plus 3	—	None	As per heat load	90% down to 10 microns	Positive	None	85 dB (A)
Electrical Equipment									
CW-ACW and F.O heating & Pressurizing Pump Houses	Normal	Ambient Temp. plus 3	—	None	20	None	None	None	85 dB (A)
Coal Conveyor tripper floor	Normal	Ambient Temp. plus 3	—	None	30	None	None	None	85 dB (A)
Locker rooms and toilets	Extreme	Ambient Temp. plus 5	-	None	20	None	None	None	Background
Mechanical equipment									



**1x660MW BHUSAWAL TPS
VENTILATION SYSTEM**

SPECIFIC TECHNICAL REQUIREMENT

SPECIFICATION No: PE-TS-415-554-A001

SECTION : I

SUB-SECTION : C 1

REV. 00

Pumps, compressor etc.	Extreme	Ambient Temp. plus 3	—	None	20 or as per heat load whichever is higher	None	None	Multiplicity	Background
Enclosed switchgear equipment areas	Extreme	Ambient Temp. plus 3	—	none	20 or as per heat load whichever is higher	90% down to 10 microns	Positive	Multiplicity	85 dB (A)
Critical equipment	Extreme	Ambient Temp. plus 3	—	None	15 or as per heat load whichever is higher	Depending upon internal equipment	None	2 x 100%	85 dB (A)
Diesel generator area	Extreme	Ambient Temp. plus 3	—	None	8 or as per heat load whichever is higher	None	None	None	Background
Water treatment plant	Normal	Ambient Temp. plus 3	—	None	30	None	Negative	Multiplicity	85 dB (A)
Ozonisation room	Normal	Ambient Temp. plus 3	—	None	30	None	Negative	Multiplicity	85 dB (A)
battery room	Extreme	Ambient Temp. plus 3	—	None	30 or as Required for hydrogen dilution	None	Negative	2 x 100%	85 dB (A)
Switchgear room	Extreme	Ambient Temp. plus 3	—	None	20	90%	Pressurised	2 x 50%	_DO_
Non AC area of FGD control room	Extreme	Ambient Temp. plus 3	—	none	20 or as per heat load whichever is higher	90% down to 10 microns	Positive	Multiplicity	85 dB (A)
Battery room of FGD control room	Extreme	Ambient Temp. plus 3	—	None	30 or as Required for hydrogen dilution	None	Negative	2 x 100%	85 dB (A)
Closed area of Ball mill building	Extreme	Ambient Temp. plus 3	—	None	20	None	Negative	None	85 dB (A)
Closed area of Gypsum dewatering building	Extreme	Ambient Temp. plus 3	—	None	20	None	Negative	None	85 dB (A)

	1x660MW BHUSAWAL TPS VENTILATION SYSTEM SPECIFIC TECHNICAL REQUIREMENT					SPECIFICATION No: PE-TS-415-554-A001			
						SECTION : I			
						SUB-SECTION : C 1			
						REV. 00			

Closed area of RC pump and oxidation blower room	Extreme	Ambient Temp. plus 3	–	None	20	None	positive	None	85 dB (A)
DMCW pump house (if applicable)	Extreme	Ambient Temp. plus 3	–	None	20	None	positive	None	85 dB (A)

5. CONTROL PHILOSOPHY

- 5.1.1 Ventilation system control shall be done with DCS.
- 5.1.2 The fire damper shall close the air flow inside the duct on receiving fire alarm signal from FPS. Also respective fan shall trip once the fire damper is closed.
- 5.1.3 Provision of alarm (audio-visual) for Trip of any motor
- 5.1.4 Provision for interlocking of AWU/UAF fan motors with the motorized fire dampers.
- 5.1.5 Provision of alarm (audio-visual) for low water level in the sump

6. PAINTING SCHEDULE

- 6.1.1.1. As per MAHAGENCO Specification, clause number 6.3.6.3, 6.4.8, 6.5.9, 6.6.4, Volume III-G, bid specification number DG/BSL U-6/2011/T-1.

	1x660MW BHUSAWAL TPS VENTILATION SYSTEM SPECIFIC TECHNICAL REQUIREMENT	SPECIFICATION No: PE-TS-415-554-A001	
		SECTION : I	
		SUB-SECTION : C 1	
		REV. 00	

7. SPECIFIC REQUIREMENTS: -

- The system shall be designed to maintain specified inside design conditions during peak summer under design outdoor condition.
- All ventilation system shall operate on 100% fresh air.
- The air washer shall have minimum 90% saturation efficiency and UAF shall have minimum 70% saturation efficiency.
- The fire damper shall close the air flow inside the duct on receiving fire alarm signal from FPS. Also respective fan shall trip once the fire damper is closed.
- Velocity of air in duct shall not exceed 12 m/sec.
- RE / wall mounted fans/ wall mounted louver/ wall mounted damper shall be selected so as to have motor rating (for fans) and wall / slab opening as under. Feeder suitable for following ratings only shall be provided by BHEL.

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
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

	1x660MW BHUSAWAL TPS VENTILATION SYSTEM			SPECIFICATION No: PE-TS-415-554-A001	
				SECTION : I	
				SUB-SECTION : C 1	
				REV. 00	
	SPECIFIC TECHNICAL REQUIREMENT				

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.		
	Capacity	Motor rating	Wall opening
a.	1200 CMH	100 W	380 mm circular
7.	Louver	NA	900 mm x 1300 mm (h)
8.	Damper	NA	700 mm x 550 mm (h)

	1x660MW BHUSAWAL TPS VENTILATION SYSTEM SPECIFIC TECHNICAL REQUIREMENT	SPECIFICATION No: PE-TS-415-554-A001	
		SECTION : I	
		SUB-SECTION : C 1	
		REV. 00	

8

GENERAL

a.

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.

b.

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

c.

Vendor to include the Back wash arrangement of pot strainer as per P&ID

d.

Vendor to include instrument as per P&ID.

e.

All drawings and documents shall be computer based.

f.

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

g.

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

h.

Indicative list of makes is enclosed as per Annexure-I however this equipment's / items shall be subject to Customer & BHEL approval during detail engineering Stage.

i.

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

j.

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

k.

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

l.

Necessary beam from main column in TG building along row, shall be provided by BHEL. Vendor shall take secondary support (in form of angle/channel/beam/bracket etc.) from main column/beam provided by BHEL as required for supporting the duct / piping / equipment's. Supporting structure shall be in vendor scope on lump sum basis and no unit rate shall be applicable.

m.

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

n.

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

	1x660MW BHUSAWAL TPS VENTILATION SYSTEM SPECIFIC TECHNICAL REQUIREMENT	SPECIFICATION No: PE-TS-415-554-A001	
		SECTION : I	
		SUB-SECTION : C 1	
		REV. 00	

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

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

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

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

s. Temperature transmitter/switch shall be provided with thermo-well and fixing arrangement.

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

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

v. 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%.

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

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

y. 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.

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

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

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

	1x660MW BHUSAWAL TPS VENTILATION SYSTEM SPECIFIC TECHNICAL REQUIREMENT	SPECIFICATION No: PE-TS-415-554-A001	
		SECTION : I	
		SUB-SECTION : C 1	
		REV. 00	

cc. 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/DCS / 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.

dd. 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.

ee. 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.

ff. 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.

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

hh. 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 BHEL as per opening sizes indicated under clause number 7. Any opening requirement on account of change in size of equipment over and above the opening size indicated under clause number 7, same shall be done by vendor along with finishing of opening and painting as per finished wall. Grouting of fans along with anchor fasteners shall 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.

ii. 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.

	1x660MW BHUSAWAL TPS VENTILATION SYSTEM SPECIFIC TECHNICAL REQUIREMENT	SPECIFICATION No: PE-TS-415-554-A001	
		SECTION : I	
		SUB-SECTION : C 1	
		REV. 00	
jj. All codes and standards shall be as per contract specifications kk. Development of storage facility shall be in scope of vendor 9 EXCLUSIONS Items of works listed below are excluded from scope of the Ventilation plant supplier. i. Construction of Air washer/UAF plant room, foundations for Ventilation equipment's (air washer, centrifugal fan, RE Unit only). ii. Slab cut out for running ducts, pipes, cables, grilles/dampers. Underground masonry trenches and masonry risers. iii. Provision of drain points, iv. For Electrical scope, refer Electrical scope matrix sheet. v. Lighting of Air washer plant rooms /areas			



**TECHNICAL SPECIFICATION
CHAIN PULLEY BLOCKS
1X660 MW BHUSAWAL TPS UNIT-6**

Material Handling Equipments



**TECHNICAL SPECIFICATION
CHAIN PULLEY BLOCKS
1X660 MW BHUSAWAL TPS UNIT-6**

1.0 ELECTRIC HOIST AND MANUAL HOIST (CHAIN PULLEY BLOCK)

Required number of electric hoist / manual hoist of adequate capacity, to meet the erection and maintenance requirements are to be provided for the various areas.

Manual hoists (hand operated) shall be designed to duty class 2 as per IS 3832 and electric wire rope hoist shall be designed as per IS: 3938 (latest).

The stipulations of all statutory codes like Indian Electricity Act, Indian Electricity Rules, Factory Acts, Local Municipality act etc. shall however prevail over the specification requirements, in case any conflict arises between this specification and the statutory codes.

Maintenance tools and tackles shall be as per data sheet attached.

DESIGN CRITERIA

- 1.0.0** Hoists shall be provided in all areas where any equipment/ component weighing above half ton is installed and needs to be handled for maintenance purposes. Number of monorail beams shall be such that the centre line of the hoist and the centre line of equipment to be handled shall be not more than half meter. The location and number of hoists is to be finalized during detailed engineering. Final arrangement is subject to approval of Customer. The hoist capacity shall be selected considering 25% margin over the weight of heaviest component /equipment to be handled. The hoist parameters (i.e. lift & travel) are subject to change/s, to suit the final layout of the area in which it is intended to be installed.

Electric hoist shall be provided for capacity >1T.

Chain pulley block (Manual hoist) - 500kg to ≤1T, wherever feasible, considering layout constraints.

For hand operated hoists, the hoists shall be suitable for operation from floor level. Hand chain shall be provided for long travel of trolley and the Hoisting mechanism. The operator shall be able to control the movement of the electrical/ manual hoist with the help of floor operated pendant

Note:

1. Area, type, capacity mentioned are minimum requirement and shall be finalised during detail engineering without any commercial implication
2. Travel and Lift are layout dependent and shall be finalised during detail engineering without any commercial implication
3. Additional electric/manual hoist required during detail engineering shall be provided as per design criteria given above without any commercial implication.

2.0 SCOPE OF SUPPLIES

Equipment and services to be furnished by the bidder for the ELECTRIC HOIST/ MANUAL HOIST with accessories as per the details given in the technical specification and data sheet. Any equipment / accessories not specified in the specification but required to make the ELECTRIC HOIST/ MANUAL HOIST complete and efficient operation shall also be under the bidder's scope of work.

Compliance with this specification shall not relieve the bidder of the responsibility of furnishing material and workmanship to meet the specified working/duty conditions.

A) MANUAL HOIST (CHAIN PULLEY BLOCK):

DATA SHEET-A



TECHNICAL SPECIFICATION
CHAIN PULLEY BLOCKS
1X660 MW BHUSAWAL TPS UNIT-6

Sr. No.	DESCRIPTION	TECHNICAL PARTICULARS
1	Type	Hand operated chain pulley blocks. Chain pulley blocks shall be with or without the travelling trolley depending upon the layout requirement and intended use.
2	Area of installation	As per Annexure A
3	Design	IS: 3832
4	Duty Class as per IS:3832	Class -II
5	Hoisting Mechanism	Through endless chains
5.1	Type	Hand operated gear transmission
5.2	Type of gear	Spur
5.3	Load Chain	
5.3.1	Type	Link type
5.3.2	Material	Alloy steel (grade 40) as per IS 3109 (part-II)
5.4	Hand Chain	
5.4.1	Type	Link type
5.4.2	Material	Mild steel (grade 30) as per IS 2429 (Part I)
5.5	Load Hook & Hook Block	
5.5.1	Type of load hook	Plain shank- Trapezoidal section
5.5.2	Load hooks conforms to (Std./Code)/ Material	IS: 15560/ Forged steel
5.5.3	Type of hook suspension	Swivelling type fitted with a locking device.
5.5.4	Type of make of bearing of hook suspension	Thrust ball bearing
5.6	Gears	
5.6.1	Type	Spur
5.6.2	Material	Alloy steel / carbon steel
5.6.3	Type of bearing used	Antifriction ball bearing / Roller
5.7	Pinions	
5.7.1	Type of bearing used	Antifriction ball bearing / Roller
5.8	Sprockets	
5.8.1	Type of bearings used	Antifriction ball bearing / Roller
5.8.2	Method of lubrications Used	
5.8.2.1	Bearings	Grease
5.8.2.2	Gearing & Pinions	Grease
5.8.2.3	Sprockets	Grease
5.8.3	Brakes	
5.8.3.1	Type	Screw and friction disc type
5.8.3.2		Chain pulley block shall be fitted with an automatic mechanical ratchet and pawl arrangement to prevent self- lowering of load.
6	Trolley & Bridge Drive	Through endless chains
6.1	Trolley	
6.1.1	Type	Geared (Manually operated)
6.1.2	Material of frame	Rolled structural steel (IS:2062 Grade A or B)
6.2	Drive Chain	
6.2.1	Type	Link type
6.2.2	Material	Steel Gr.30
6.2.3	Wheel	
6.2.3.1	Number of pairs of wheel in each trolley/bridge	Two/four
6.2.3.2	Flange	Wheels in trolley unit travel shall be single flanged with straight / taper/ barrel shaped tread to suit the monorail.
6.2.3.3	Wheel material	Wheels should be preferably of forged steel construction
6.2.3.4	Type of bearings need	Antifriction



**TECHNICAL SPECIFICATION
CHAIN PULLEY BLOCKS
1X660 MW BHUSAWAL TPS UNIT-6**

6.3	Gears	
6.3.1	Type	Spur / helical
6.3.2	Material	Alloy/ Carbon steel
6.3.3	Type of bearings used	Antifriction
6.4	Method of lubrication for	
6.4.1	Bearings	Grease
6.4.2	Sprockets	Grease
6.5	Load chain wheel	
6.5.1	Material	SG iron / Steel casting / Pressed sheet steel.
6.6	Hand chain wheel	
6.6.1	Material	SG iron / Steel casting / Pressed sheet steel / Gray iron casting
7	Hoisting and trolley travel effort	As per IS 3832

11.0 Maintenance Tools and Tackles

One (1) complete unused new set of special purpose tools, tackles and accessories along with detailed instructions and maintenance manual shall be supplied. Tools shall be of suitable sizes for maintenance of electric hoist of each type and capacity. Each tool and wrench shall be stamped so as to be identified easy for its use. The tools shall be supplied in steel toolbox and with a copy of instruction manual. The items supplied shall be of the best quality, specially protected against rusting. The following shall be provided as minimum requirement:

S. No.	Description	Qty.
1	Complete set of ring spanners	1 Set
2	Complete set of screwdrivers (Min. 6 nos of suitable sizes)	1 Set
3	Adjustable Spanner	1 No.
4	Insulated pliers	1 No.
5	Wrench spanner	1 No.
6	Grease Gun	1 No.
7	Oil Gun	1 No.
8	Hand Lamp	1 No.
9	Line tester	1 No.

Note: -The tools shall be supplied in one tool box. Bidder shall ensure that the tools & tackles mentioned in above list are sufficient to handle all sizes/capacities of hoists & in case any other /additional tool is required for handling/maintenance any size/capacity of hoist the same shall be included in this list.

12.0 DRAWING/DOCUMENT SUBMISSION

The successful bidder shall submit the following drawings / documents during detail engineering for customer's approval /information:

MANUAL HOIST (CHAIN PULLEY BLOCK):

SI. No.	BHEL DRG.NO	DRAWING TITLE
1	PE-V0-415-553-A200	Manufacturing Quality Plan

	TECHNICAL SPECIFICATION CHAIN PULLEY BLOCKS 1X660 MW BHUSAWAL TPS UNIT-6	
---	---	--

2	PE-V0-415-553-A201	GA Drawing for Chain Pulley Block with detail BOM with painting details
---	--------------------	---

Notes:

1. The above drawing list is tentative and shall be finalized with the successful bidder after placement of order.
2. Drawings shall be prepared in Auto-Cad latest edition. Required no. of hard and soft copies (editable) of the drawings shall be furnished as per requirement specified elsewhere in the specification.
3. All the drawings and documents including general arrangement drawing, data sheet, calculation etc. to be furnished to the customer during detailed engineering stage shall include / indicate the following details for clarity w.r.t. Inspection, construction, erection and maintenance etc.:
 - a) All drawings and documents shall indicate the list of all reference drawings including general arrangement.
 - b) All drawings shall include / show plan, elevation, side view, cross - section, skin section, blow - up view; all major self-manufactured and bought out items shall be labeled and included in BOQ / BOM in tabular form.
 - c) Painting schedule shall also be made as a part of general arrangement drawing of each equipment / items indicating at least 3 trade names.
 - d) All the drawings required to be furnished to customer during detailed engineering stage shall include technical parameters, details of paints and lubrication, hardness and BOQ / BOM in tabular form indicating all major components including bought out items and their quantity, material of construction indicating its applicable code / standard, weight, make etc.
 - e) Drawings/ documents to be submitted for purchasers review/ approval shall be under Revision A, B, C... etc. while drawings /documents to be submitted thereafter for customer's approval after purchaser's approval shall be under R-0, 1, 2, 3etc.

13.0 **MANDATORY SPARES:**

MANDATORY SPARES FOR MANUAL HOIST (AS APPLICABLE)

A. Mechanical spares for Manual hoist

	Mandatory Spares for Chain Pulley Blocks (for each type and rating)	
1	Load chain wheel	One (1)
2	Load chain stripping fork	Five (5)
3	Hand chain wheel	Two (2)
4	Ratchet pawl	One (1)
5	Locking ratchet wheel	Two (2)
6	Guide roller	Two (2)
7	Brake disc	Two (2)

	TECHNICAL SPECIFICATION CHAIN PULLEY BLOCKS 1X660 MW BHUSAWAL TPS UNIT-6	
---	---	--

Note:-

1. "One (1) Set" is defined as 100% requirement for one hoist for the entire hoists of similar size & capacity.

	TECHNICAL SPECIFICATION CHAIN PULLEY BLOCKS 1X660 MW BHUSAWAL TPS UNIT-6	
---	---	--

ANNEXURE I: MAKES AND SUB VENDOR LIST

Package Name	Vendor Name
CHAIN PULLEY BLOCK	UNIVERSAL HOIST-O-FABRIK
	CENTURY CRANE ENGINEERS PVT. LTD.
	BAKELITE ELECTRICAL MFG. CO. PVT. LTD.
	TRACTEL TIRFOR INDIA PVT. LTD.
	BRADY & MORRIS ENGINEERING CO. LTD.
	TUOBRO FURGUSON (INDIA) PVT LTD
	TECHNO INDUSTRIES

Note: No other make will be acceptable, until and unless specifically got approved by BHEL/Customer / Customer's consultant during detail engineering only. Acceptance/non acceptance of same shall not have any impact on manufacturing, delivery schedule and on cost of the Electric hoists/CPB.

MAKES OF SUB VENDORS ITEMS AS APPLICABLE TO MANUAL HOIST:

Sl no.	ITEM	MAKES
1.0	STEEL	SAIL/IISCO/TATA STEEL / JINDAL
2.0	HOOKS	STEEL FORGINGS/ KARACHIWALA/SMRITI/NASIK FORGE.
3.0	STEEL FORGINGS	CHOWDHARY/WESTERN INDIA FORGINGS/ HINDUSTAN STEEL FORGINGS/ RUBY FORGINGS OR AS APPROVED BY BHEL.
4.0	BRAKES	OEM

NOTE:

1. THE SUB VENDOR LIST ABOVE IS INDICATIVE ONLY AND IS SUBJECT TO BHEL AND CUSTOMER APPROVAL DURING DETAILED ENGINEERING STAGE WITHOUT ANY COMMERCIAL & DELIVERY IMPLICATION TO BHEL.



**1x660MW BHUSAWAL TPS
VENTILATION SYSTEM**

CUSTOMER SPECIFICATIONS

SPECIFICATION No: PE-TS-415-554-A001

SECTION : I

SUB-SECTION : C 2

REV. 00

SECTION: I

SUB-SECTION: C 2

CUSTOMER SPECIFICATIONS



**1x660MW BHUSAWAL TPS
VENTILATION SYSTEM
CUSTOMER SPECIFICATIONS
TECHNICAL REQUIREMENT**

SPECIFICATION No: PE-TS-415-554-A001

SECTION : I

SUB-SECTION : C 2A

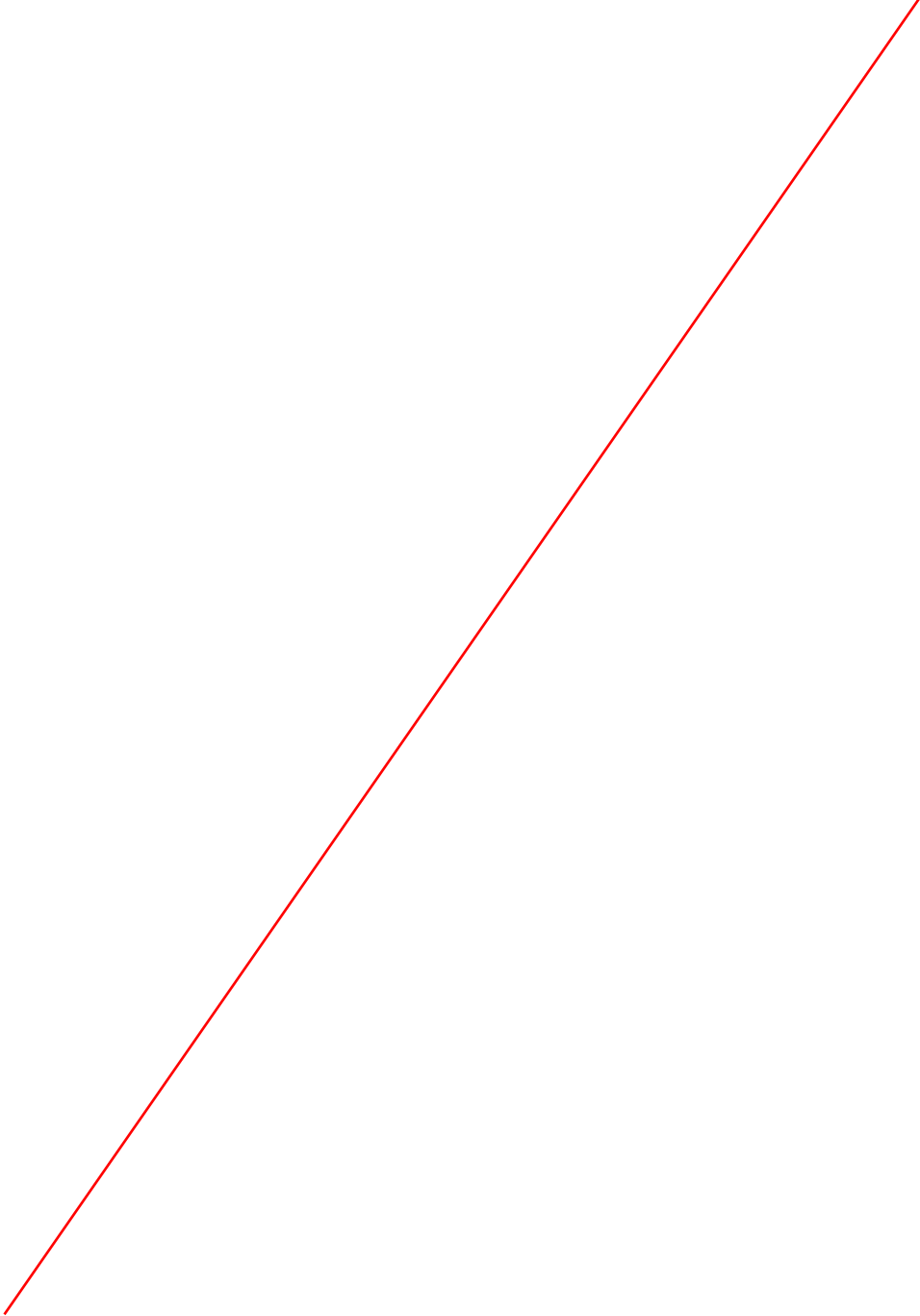
REV. 00

SECTION: I

SUB-SECTION: C 2A

**CUSTOMER SPECIFICATIONS
TECHNICAL REQUIREMENT**

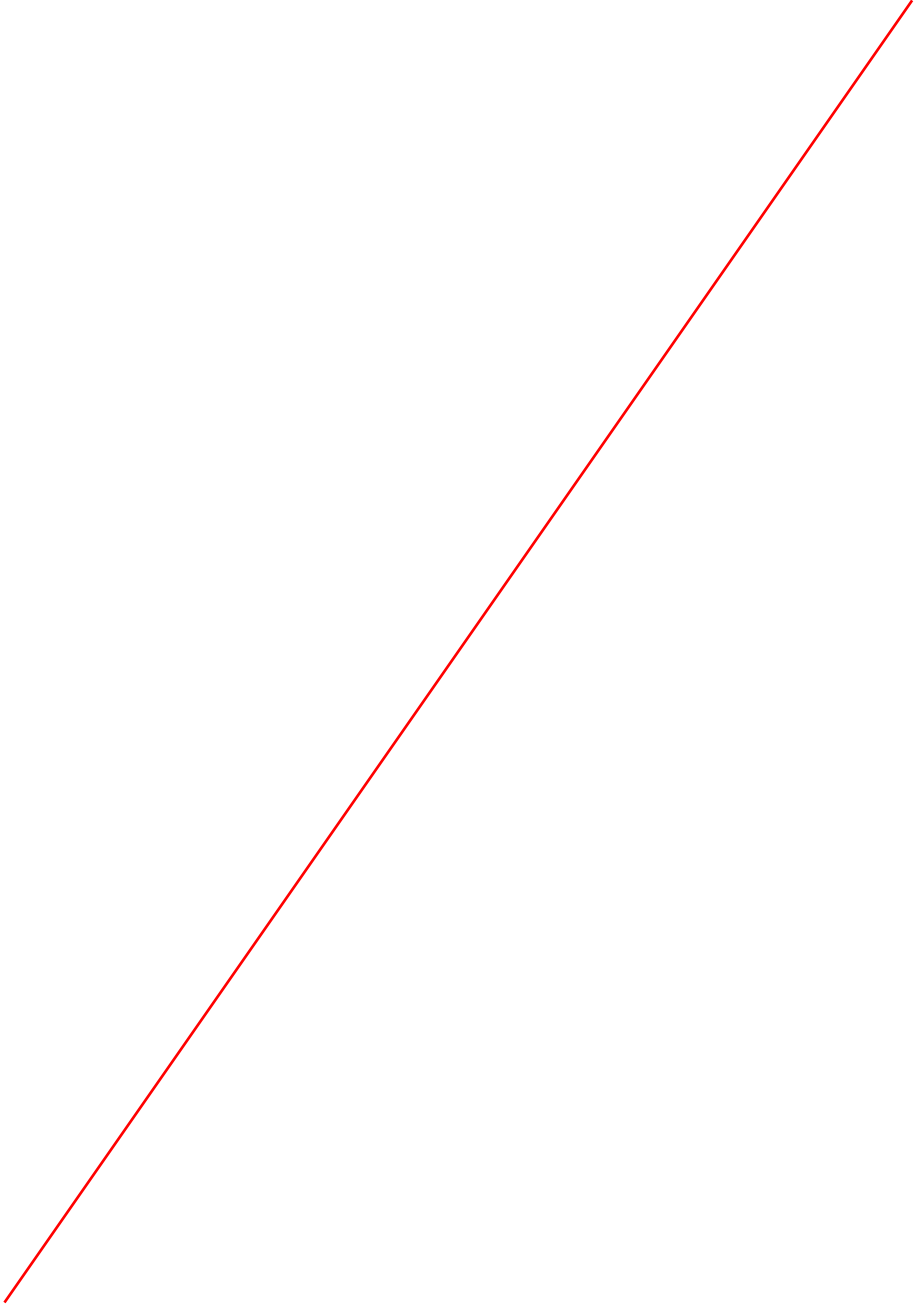
 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	: VENTILATION SYSTEMS	Page 113 of 171
VOLUME III-G SECTION-3 TECHNICAL SPECIFICATION FOR VENTILATION SYSTEM		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	VENTILATION SYSTEMS	Page 114 of 171
		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	COMPRESSED AIR, AIR-CONDITIONING & VENTILATION SYSTEMS	Page 115 of 171

CONTENTS

<u>CLAUSE NO.</u>	<u>DESCRIPTION</u>
1.0	INTRODUCTION
2.0	CODES & STANDARDS
3.0	EXTENT OF PACKAGE
4.0	BIDDER'S RESPONSIBILITIES
5.0	TECHNICAL REQUIREMENTS
6.0	TECHNICAL SPECIFICATION FOR VENTILATION SYSTEM
7.0	GUARANTEED PERFORMANCE TESTING
8.0	SPECIAL CLEANING, PROTECTION AND PAINTING
9.0	DRAWING, DATA AND INFORMATION REQUIRED
ANNEXURE - A	MINIMUM TESTING AND INSPECTION REQUIREMENTS
DATASHEET – A	DESIGN CRITERIA FOR VENTILATION SYSTEM

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	VENTILATION SYSTEMS	Page 116 of 171
		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	VENTILATION SYSTEMS	Page 117 of 171
1.0 <u>INTRODUCTION</u> 1.1 This specification is intended to cover the Design, Engineering, Manufacture, Fabrication, Assembly, Inspection, Testing at Manufacture's works, Packing, Transportation, Delivery, Receipt, Unloading, Storage and handling at site, supervision of Erection, Testing, Commissioning and Field Acceptance/Performance Guarantee test of Ventilation System for Bhusawal TPS Unit-6: 1 X 660 MW Project at Bhusawal, Maharashtra. 2.0 <u>CODES & STANDARDS</u> The design, manufacture, fabrication, installation and testing of equipment covered by this specification shall comply with latest edition of the appropriate equivalent international standards, all currently applicable statutes, regulations and safety codes in the locality where the equipment shall be installed. Minimum following standards or equivalent Indian/ International standard shall be followed: 2.1 IS-655 : Specification for Metal Air Duct 2.2 IS-277 : Galvanized steel sheets - Specification 2.3 IS-737 : Wrought aluminium and aluminium for sheet and strip for general engineering purposes. 2.4 BS-848 : Methods of performance test for fans 2.5 ACM-210 : Test code for air moving devices 2.6 BS-2831 : Methods of test for air filters used in general ventilation. 2.7 IS-3963 : Roof extractor units 2.8 IS-3069 : Glossary of terms, symbols and units relating to thermal insulation materials 2.9 IS-4671 : Expanded polystyrene for thermal insulation purposes 2.10 IS-8183 : Bonded mineral wool		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section – 3
REV: R0	VENTILATION SYSTEMS		Page 118 of 171
2.11	IS-702	:	Specification for Industrial bitumen
2.12	IS-4894	:	Centrifugal fans
2.13	ACMA	:	Standard 210 test code for air moving devices
2.14	IS-1239	:	Steel tubes, tubular and other wrought steel fittings
2.15	IS-3588	:	Specification for electrical axial flow fans
2.16	IS-210	:	Grey iron casting - Specification
2.17	IS-2062	:	Specification for general structural purposes
2.18	IS-2676	:	Dimensions for wrought aluminium and aluminium alloy sheets and strips
3.0	<u>EXTENT OF PACKAGE</u>		
3.1	The Ventilation System shall be provided in the following locations within the Power House by air washers. Coursing of air in desired direction/areas shall be done using roof extractors and wall mounted supply/exhaust fans.		
3.2	Complete TG building i.e TG bay (Ground, Mezzanine and Operating floor), HP/LP heater area, condenser area, boiler feed pump area, oil cooler area and all other areas in the TG Building.		
3.3	Service Building		
3.4	Mill Bay		
3.5	Deaerator Floor		
3.6	Oil Rooms		
3.7	Battery Rooms		
3.8	Battery Charger Rooms		
3.9	MCC Rooms		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	VENTILATION SYSTEMS	Page 119 of 171
3.10 3.11 3.12 3.13 3.14 3.15	Cable Spreader Rooms Switchgear Rooms Elevator M/C Rooms Cable Vault Toilet Areas Air conditioning System Plant Rooms. Coal Conveyor Tripper Floor of Coal Mill bay shall be ventilated by exhausting air by roof exhausters. The mill bay located in Power House ground floor shall have one side completely open for natural ventilation. But the backside of the mill will become hot to some extent due to the presence of stagnant air between the mill and the long continuous wall behind it. In order to avoid this, blast of fresh air from Air Washer Unit should be provided from the roof, near the wall behind the mill area. This will, in effect, considerably reduce the temperature in the back of mill area. Ventilation provision for Auxiliary Buildings in various locations shall be done as follows: 3.16.1 Non-AC areas of ESP : Washed and filtered air supply from Building Unitary Air Filtration Unit (UAF) and exhausting it by back Draft Damper 3.16.2 Non-AC areas of Fly Ash : Washed and filtered air supply from Conveying Compressor Building Unitary Air Filtration Unit (UAF) 3.16.3 Compressor/DG House : Filtered Air supply by means of wall mounted fans and dry panel HDPE filter 3.16.4 CW Pump House : Supply air by wall mounted fans	

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section – 3
REV: R0	VENTILATION SYSTEMS		Page 120 of 171
3.16.5	CW Ozonisation Building	: Wall mounted exhaust fans	
3.16.6	Fuel Oil Transfer Pump House	: Wall mounted axial flow exhaust fans with fire damper	
3.16.7	Fuel Oil pressuring Pump House	: Wall mounted axial flow exhaust fans with fire damper	
3.16.8	Ash Water/Ash Slurry Pump House	: Wall mounted supply fan	
3.16.9	Blower Room near FA Silos	: Wall mounted supply fan	
3.16.10	Raw Water/Fire Water Pump House	: Wall mounted supply fan	
3.16.11	Store	: Wall mounted exhaust fans with fire dampers	
3.16.12	Toilets in all Buildings	: Wall mounted exhaust fans	
3.16.13	All electrical rooms associated with the pump houses	: Pressurised ventilation with wall mounted fan filter units and air exhaust through back draft dampers.	
3.16.14	Toilet area of Service Building (non AC area)	: Wall mounted exhaust fans	
3.16.15	Permanent store, Inflammable store	: Wall mounted exhaust fans with fire dampers. Fans shall be of spark proof construction & with flameproof motor.	
3.16.16	Toilet area of Fire Station Building	: Wall mounted exhaust fans	
3.16.17	Fly Ash Handling Buildings	: Wall mounted Exhaust Fans or roof extractors units.	

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	VENTILATION SYSTEMS	Page 121 of 171
3.16.18 Toilet area of Canteen : Wall mounted exhaust fans. □ Building Kitchen and Dining Hall 3.16.19 Toilet area of Time and : Wall mounted exhaust fans. Security Office 3.17 Suitable Ventilation provision for Auxiliary Buildings at following locations shall be done : 3.18 HCSD Pump & AR Tank Area 3.19 MCC cum Control Room of HCSD System 3.20 Silo Utility Room 3.21 Work Shop Building 3.22 Chemical Dozing Pump House 3.23 DM Plant Building 3.24 Pre-treatment and Filtration Plant 3.25 Filtered water Pump House 3.26 Raw Water /Fire Water Pump House 3.27 ETP building 3.28 Crusher House 3.29 CHP maintenance & loco shed building and associated pump houses 3.30 Fire Station Building 3.31 Time office & security building		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	VENTILATION SYSTEMS	Page 122 of 171
3.32 Elevator Machine Rooms & bunker floor 3.33 Boiler Bunker Building 3.34 Coal handling and Ash handling building Any other area within Package where ventilation is required but not covered above shall also have to be provided. 4.0 <u>BIDDER'S RESPONSIBILITIES</u> Equipment, material and services to be furnished shall include, but not limited to the following 4.1 Ventilation system consisting of evaporative cooling system/Dry type mechanical ventilation system with all associated accessories and auxiliaries for Electrical MCC/Switchgear area, Pump Houses, Toilets, Pantries etc as specified. 4.2 All field instruments and interconnecting cables between field sensors and local JB/control panels. Interface provision for remote monitoring with plant DCS. 4.3 Anchor bolts with nuts, sleeves, washers, shims, packers, sole plates, sub sole plates for the plant and equipment. 4.4 Equipment earthing at two points up to plant earthing grid. 4.5 Coupling and coupling guard with fasteners. 4.6 Painting as per specification. 4.7 Charge of lubricants and consumables till handing over. 4.8 Tools and tackles required for the plant erection and future maintenance. 4.9 Start-up and commissioning spares. 4.10 Mandatory Spares		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	VENTILATION SYSTEMS	Page 123 of 171
4.11	Erection, testing, commissioning and handing over.	
5.0	<u>TECHNICAL REQUIREMENTS</u>	
5.1	<u>AREAS TO BE COVERED UNDER VENTILATION SYSTEM:</u>	
5.1.1	Areas to be ventilated by evaporative cooling process are as follows :	
	(a) All floors of Steam Turbine Generator Building other than the areas, which are air-conditioned (By Air Washer Units). (b) Switch gear/MCC rooms and cable gallery areas of Steam Turbine Generator Building (By Air Washer Units) (c) ESP/VFD Building non-air conditioned areas (By UAF Units) (d) Battery rooms in TG building	
5.1.2	Areas to be ventilated by mechanical ventilation process shall be, but not limited to, the following	
	(a) CW-ACW Pump House, Fuel Oil heating & Pressurizing Pump House and their associated MCC/Switchgear rooms. (b) Non-AC areas of Service Building including Toilets, Pantries and Electrical rooms (c) Toilets and Elevator Machine rooms of STG Building. (d) Coal Conveyor Tripper floor of Mill Bay. (e) Air Conditioning Plant Equipment areas. (f) All the pump Houses, (g) Ash Handling Plant Buildings (h) All other MCC/Switchgear rooms and Control rooms, which are not Air-conditioned.	

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	VENTILATION SYSTEMS	Page 124 of 171

(i) DG & Air Compressor house

(j) Ozonisation area

(k) Complete Water treatment Plant building facilities such as PT, DM, CW Treatment plant etc

(l) All Toilets & Pantries (to be provided with exhaust fans)

(m) Battery rooms located in any auxiliary building, if at all.

(n) Other areas such as, Fire station, Workshop, Store etc, which are not covered by Air-Conditioning system.

5.2 DESIGN PHILOSOPHY FOR VENTILATION SYSTEM

5.2.1 Design ambient conditions for all Ventilation system shall be as follows:

	Design Temperature	Summer	Monsoon	Winter
(a)	DBT (°C)	48 50	29.4	15.6
(b)	WBT (°C)	24.7 27	27.2	11.1

5.2.2 The number of air changes per hour in mechanically ventilated areas shall be as follows:

(a) For all evaporative cooled areas : 8

(b) General areas (including Pump Houses) : 20

(c) Battery rooms, ozonisation, storage area & other areas where gaseous fumes/vapours are generated : 30

(d) Electrical Rooms : 15

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	VENTILATION SYSTEMS	Page 125 of 171
5.2.3 However, in areas/facilities/buildings where substantial quantities of heat is generated, the temperature should be the criteria, which is as follows: (a) Inside temperature shall be maximum 3°C above the design ambient temperature during summer for mechanically ventilated areas. (b) Inside temperature shall be minimum 3°C below the design ambient temperature during summer for evaporative cooled areas. Selection of ventilation air quantity will be higher value calculated based on Air change rate or Heat load. 5.2.4 All ventilation system shall operate on 100% fresh air. All mechanically ventilated areas shall be positively ventilated except battery room by means of supply air fans fitted with filters and/or gravity operated back draft dampers and exhaust fans. MCC, control rooms shall necessarily be pressurized condition. Supply air fan serving electrical areas shall be provided with both pre filter and fine filters and for other areas, supply air fans shall be provided with pre-filter only. Battery room shall be kept under negative pressure by exhaust ventilation system so as to prevent escaping of fumes outside. Exhaust Ventilation system shall be provided for ozonisation area, Water treatment Plant, DM plant, Pantries, toilets etc. 5.2.5 All the equipment of Ventilation system shall be designed for continuous duty and shall be located indoor/outdoor. 5.2.6 Motorized Fire dampers shall be provided with each supply duct branch (from Evaporative Cooling Units) entering the Electrical premises like switchgear room, cable galleries etc. The operation of these Motorized dampers shall be interlocked with the fire alarm system and shall also be operated from the remote control panel manually. 5.2.7 For maintenance of Air washer units, chain pulley block of suitable capacity shall be provided in each Air Washer room. 5.2.8 Circulating water Capacity for Air washer units shall be minimum 1 m³/hr per 1000 m³/hr of airflow. Velocity through piping shall be limited to 2.5 m/sec and for gravity flow the same shall be limited to 1.5 m/sec. The air		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	: VENTILATION SYSTEMS	Page 126 of 171
	distribution system shall be sized to have a constant frictional drop along its length and air velocity through ducts shall not exceed 12 m/sec. 5.2.9 The air washer unit shall be designed for a maximum velocity of 2.5 m/sec and at least 90% saturation efficiency. 5.2.10 For pumps, continuous motor rating (at 50°C ambient) shall be at least ten percent (10%) above the maximum load demand of the pump in the entire operating range. For fans and blowers continuous motor rating (at 50°C ambient) shall be at least ten percent (10%) above the maximum load demand of the fan and blower at the design duty point. There shall be minimum of two belts per drive. 5.2.11 Supply air fans and/or exhaust air fans provided for ventilation of each area shall be associated with local starter panels. Local starter panel in BHEL scope 5.2.12 All dry type transformers shall be provided with independent exhaust fans ^{Natural air circulation}. 5.2.13 For the exhaust ventilation system, wall mounted air intake louvers shall be provided for fresh air entry. 5.2.14 For DG area dry ventilation system with intake louvers, filter fans, duct work shall be provided. 3x 50% fans shall be considered for this system. 5.2.15 All Air Washer Units/Unitary air system shall be sheet metal fabricated. 5.3 <u>REDUNDANCY OF EQUIPMENTS</u> 5.3.1 Redundancy of various Ventilation system equipment shall be follows: (a) There shall be at least Three ⁴ (3) Air Washer for STG building to make the duct layout simpler and shorter and to reduce the size of ducts. (b) Supply Fans of Evaporative type Ventilation System shall be 2 x 50% Capacity for each Air washer unit/ each Unitary Air Filtration system while Water Circulating Pumps shall be 2 x 100 % for each Air washer unit/ each Unitary Air Filtration system. (c) For mechanical exhaust ventilation system, standby is not required.	

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	: VENTILATION SYSTEMS	Page 127 of 171
(d) 100% redundancy shall be provided for ventilating fans of battery room. MS ducting shall be provided for ventilation system of battery room. (e) 3 x 50% fans shall be provided for dry ventilation system for DG area.		
6.0	<u>TECHNICAL SPECIFICATION FOR VENTILATION SYSTEM</u>	
6.1	<u>FANS</u>	
6.1.1	General	
This specification is intended to cover the design, manufacture, assembly, testing, delivery at site properly packed, erection, commissioning and guarantee of all centrifugal fans, axial flow fans and roof exhausters with all auxiliaries and accessories as specified hereinafter.		
6.1.2	The scope of supply shall include the following:	
6.1.2.1	The Centrifugal Fans, complete with all accessories	
(a) Electrical drive motor, fan wheel, housing (b) Drive pulley, V-belts, belt guard etc. (c) Vibration isolators. (d) Volume control damper at outlet of fan (e) Flexible canvas connections with matching flanges, etc.		
6.1.2.2	Axial flow wall mounted exhaust fans, Tube axial type supply fans (mounted on duct/roof) and Bifurcator exhauster, complete with all accessories.	
(a) Fan wheel, housing. (b) Electrical drive motor with coupling		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	VENTILATION SYSTEMS	Page 128 of 171
(c) Mounting brackets. (d) Gravity operated backdraft damper, wherever specified. (e) Coned inlet. (f) Grouting frame etc. 6.1.2.3 Roof Exhausters, complete with all accessories as mentioned. (a) Fan wheel, housing (b) Electrical drive motor with coupling (c) Mounting brackets. (d) Gravity operated backdraft damper (e) Short duct mounting (f) Grouting frame. (g) Disconnections switch, etc. (h) Hoods shall be provided to protect from rain & other contingencies Anchor bolts, nuts, bolts and loose fittings as necessary for all items above. Any other equipments and/or material necessary to ensure safe and satisfactory operation of each unit. 6.1.3 Standards and Codes Unless otherwise specified, it is intended that bidders shall offer standard equipment for this specification. Materials of construction, construction of components, performance testing of equipment, erection and commissioning etc. shall be in accordance with the latest edition of the appropriate standards as mentioned elsewhere in this specification.		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	: VENTILATION SYSTEMS	Page 129 of 171
6.1.4 Operating Conditions and Performance Required All the equipment shall be installed inside the various buildings as mentioned else where in this specification. The roof exhausters shall be mounted on the building roof and therefore shall be designed for outdoor installation. 6.1.4.1 Performance Required The supplier shall offer fans by optimising such that the type of fans shall be minimum. If the equipment is designed for voltage other than that specified, necessary equipment for rectification of the same shall also be included in the scope of supply 6.1.5 General design requirement The equipment supplied shall be suitably constructed for safe and proper operation under all conditions described or implied in this specification without undue strain, vibrations, corrosion or other operating difficulties. All parts subjected to substantial temperature changes shall be designed and supported so as to permit free expansion or contraction without resulting in leakage, distortion and excessive strains in the equipment. Parts subjected to wear corrosion or other deterioration or requiring adjustment, inspection or repairs shall be accessible and have reasonable convenience for removal, replacement and repair. All such parts shall be of suitable material or suitably lined for keeping maintenance to a minimum. All close fitting parts that are interchangeable shall be machined to gauge. (a) Centrifugal and axial flow fans All the centrifugal fans shall be of DIDW or SISW as required. The fan shall have end suction and discharge in the direction as required. All centrifugal fans shall be coupled to the drive motors with V-belts. All roof exhausters and wall mounted supply fans shall be of direct driven axial flow type. Roof exhausters shall have multi-bladed		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	VENTILATION SYSTEMS	Page 130 of 171
impeller with a short duct casing while wall exhausters shall have coned inlet suitable for free discharge of air into atmosphere. Necessary mesh shall be provided at inlet of fan to arrest any material falling down. It is desirable that all centrifugal fans shall be designed to operate within 9% and 25% of system throttling line. The axial flow fan impeller shall be cast in one piece finished all over and carefully balanced both statically and dynamically. Finally the assembled impeller along with shaft shall be dynamically balanced. All axial flow fan impeller shall consist of high efficiency aerofoil section blades. The centrifugal fan impellers shall be formed backwardly with non-overloading characteristics and welded to the back plate and shroud, if any. The fan wheel shall be statically and dynamically balanced. Centrifugal fan housing shall be of welded construction and provided with flanges at outlet for duct connection. The large size fans shall be split casing type. A common base frame shall be provided for fan and driving motor and whole assembly shall be mounted on vibration isolators. Casing for roof exhausters and their components shall be suitable for outdoor installation. The fan housing shall be constructed of heavy gauge galvanized MS sheets. The base shall be suitable for mounting on the roof opening. The base shall be designed to prevent ingress of water into the building and shall ensure that the assembly is totally weather proof. The hood shall be hinged type and arranged such that the fan and driving motor shall be readily accessible for maintenance and inspection. An enclosed type disconnecting (lock-out) switch shall be provided under the hood so that power supply to the fan motor is disconnected upon opening the hood. Suitable motor brackets as per manufacturer's standard for both roof and wall mounted axial flow fans shall be provided. The brackets shall be designed to provide rigid mounting for motors. A suitable access door shall be provided in casing for motor. Wherever required for, the fans shall be provided with a damper at		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	VENTILATION SYSTEMS	Page 131 of 171

outlet. Dampers at the outlet of centrifugal fan shall be of approved multi-bladed type with neoprene edging on blades for tight shut off. Each blade shall be provided with bronze/gun metal bearing at each end of spindle. Operating lever along with the necessary linkages shall be provided at an accessible position for operating the dampers.

Suitable fixing device for locking the damper at desired position and an indicator to show the percentage of opening of damper shall also be provided.

All roof exhausters shall be provided with gravity operated type back draft damper. For wall mounted axial flow fans, gravity operated back draft dampers shall be provided. The back draft damper shall be such that it shall not allow infiltration of air from outside while forced infiltration by fan shall be achieved through the above damper. The blades of the damper shall be freely mounted to allow the damper to open with the pressure developed by the fan. The damper shall be provided with suitable flanges.

Centrifugal fans shall be provided with adjustable V-belts and sheaves. All belts shall be sized for 250% rated horsepower. All V-belts drives shall be equipped with removable guards that do not impede the air flow to the fan inlet and belt tensioning device. There should be minimum two belts per drive. Belts shall be designed for following performance.

(i)	Service Factor:	:	2.5
(ii)	<u>BHP</u>		<u>Minimum no of belts</u>
	Less than 5	:	Two
	5 - 10	:	Three
	Greater than 10	:	Four

Small Centrifugal fans of Fan-filter unit of BHP rating less than 1 HP may be of directly driven type.

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	VENTILATION SYSTEMS	Page 132 of 171

All axial flow fans shall be directly mounted on the extended motor shaft.

First critical speed of the rotating assembly shall be at least 25% above the operating speed.

Centrifugal fan shall be mounted on self-aligning heavy-duty ball bearing or roller bearing of adequate capacity and life. Bearing shall be grease/oil lubricated and is provided with fittings for lubrication from outside. The bearings shall be located in an easily accessible location to facilitate maintenance. The minimum adjusted rating life for Bearings at operating conditions shall be 40,000 hrs and the same shall be as per IS-3824.

Inlet screen shall be provided at centrifugal fan suction made out of 14 SWG galvanized wire knitted in 25 mm square mesh. Suitable flanges to protect the edges of the screen shall be provided.

Double deflection rubber in shear or rubber in compression type vibration isolator shall be provided for each fan. Rubber bushes, washers, wherever needed for the vibration isolators shall be included in the supply. Sufficient number of such isolators shall be provided to ensure isolation of foundation from vibration of the equipment.

6.1.6 Materials of construction

6.1.6.1 The following materials shall be used for the construction of various parts of centrifugal and axial flow fans and its auxiliaries:

(a)	Centrifugal fan impeller	:	M.S Sheet min. 16 SWG thick
(b)	Axial flow fan impeller	:	Cast Aluminium Alloy
(c)	Fan Shaft	:	EN-8
(d)	Fan Scrawl	:	Heavy gauge M.S. min14 SWG thick

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	: VENTILATION SYSTEMS	Page 133 of 171
(e) Supported frame and structure : M.S. of adequate thickness (min. 14 g thick) (f) Cone inlet for wall exhauster : M.S (14 SWG thick). (g) Gravity loaded back-draft damper (i) Blades : Aluminium of min. 26 SWG thick (ii) Casing / frame : Galvanized iron. (h) Flexible connection of fan outlet for duct connection : Plastic impregnated canvas with M.S. flanges and cleats (i) 'V' pulleys : C.I. Multigrooved (j) 'V' Belt : Reinforced rubber of appropriate section. (k) Slide rails : Structural Steel. (l) Bolts and nuts : M.S. (IS: 1367 unless otherwise specified) (m) Connection pieces : Galvanized iron according to supplier's design (Minimum 18 g thick) (n) Rain protection cowl, hoods, and casing for Axial flow fans : M.S. to be hot dipped galvanized after fabrication. (o) Vibration isolating pad, washers, and bushes, if any : Hard synthetic rubber of hardness 40 deg shore. 6.1.6.2 Fans for special application: (a) Axial flow exhaust fans for Battery Room shall be of spark proof construction & bifurcated type or indirectly driven. All the parts coming in contact with acid fumes shall have epoxy coating.		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	VENTILATION SYSTEMS	Page 134 of 171
(b) The fans for oil equipment rooms shall be of spark proof construction with flame proof motor. 6.1.6.3 Drive Motors The drive motors for the equipments covered under this specification shall confirm to the specification enclosed elsewhere. Small motors (less than 0.5 kW) used for fans in washrooms, toilets etc shall be single-phase induction motors. 6.1.7 Spare Parts The supplier shall furnish and quote for following spare parts for the equipment covered under this specification. Centrifugal and axial flow fans (a) One set of bearing for each of the fans and motor. (b) Two sets of V-belts for each drive set. (c) One set of vibration isolators. Any other spares recommended by manufacturer for 3 years operation of the plant 6.2 <u>AIR FILTERS</u> This part of the specification is intended to cover design, manufacture, assembly, testing, erection & commissioning of Air Filters along with filter mounting frame for package. 6.2.1 The scope of supply shall include the following: (a) Type-A Filters: Dry panel type H.D.P.E Filters having filtration efficiency not less than 90% down to particle size of 10 microns. Total number of filter modules shall be decided based on approved filter schedule.		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	: VENTILATION SYSTEMS	Page 135 of 171
(b) Type-B Filters: Dry panel type filters having filtration efficiency not less than 99% down to particle size of 5 microns. Total number of filter modules shall be decided based on approved filter schedule. Nuts, Bolts, rubber bushes, loose fittings, spring as necessary for mounting the filter modules in ladder type frames. One (1) complete set of special maintenance tools. Cleaning, protection, painting as specified. Any other equipment and/or material necessary to ensure safe and satisfactory operation. General arrangement and fabrication drawings for mounting frames of filters, drawings/data as required for filters. 6.2.2 Standard and Codes Unless otherwise specified, it is intended that tenders shall offer standard equipment for this specification. Materials of construction, construction of components, performance testing of equipments etc shall generally conform to the standards and codes as mentioned elsewhere in this specification. 6.2.3 General Description Type of air filters specified herein is required to filter the outside air for ventilated spaces, housing the sophisticated equipment. The maintenance of clean environment is utmost important for proper functioning of all these equipment and the whole power station. As such air filters shall be made of best quality material and shall be of high reliability proven design. 6.2.4 Performance Required (a) Type-A Filters: These filters shall be capable of filtering out the air borne particles		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	VENTILATION SYSTEMS	Page 136 of 171
with a filtration efficiency of 90% down to particle size of 10 microns. Air quantity to be filtered is indicated in schedule. The pressure drop across the filter should be limited to 6 mm WC when clean and 12 mm WC when dirty. The face velocity shall not exceed 2.5 m/sec. The filter media shall be suitable for service at 100% relative humidity. (b) Type-B Filters: These filters shall be capable of filtering out the air borne particles with a filtration efficiency of 99% down to particle size of 5 microns. Air quantity to be filtered is indicated in schedule. The pressure drop across the filter should be limited to 6 mm WC when clean and 12 mm WC when dirty. The face velocity shall not exceed 1.5 m/sec. Filter media shall be suitable for service at 100% R.H. 6.2.5 General Design Requirements Panel type dry air filters (Type-A): All filters shall be designed for horizontal air flow and vertical mounting. The filter shall be H.D.P. dry panel type. The filter media shall be designed to hold dust, sand, lint etc. and prevent it from being dislodged by vibration or other cause and passing through filter. The filter media shall be non-flammable type and shall be suitable for operation under extreme conditions of humidity upto and including 100% RH. The filter media shall have resistance to corrosion and contaminant producing action and perform through out its life without the possibility of deterioration. The filter shall be of washable type and the filter media shall be constructed from several layers of H.D.P. Wire mesh shall be stitched together with G.I. on both side for support and crimped to form deep folds for maximum filtration area, low differential pressure, high dust retention capacity and high flow rate. The filter folds shall be separated by aluminium spacers to ensure uniform distribution of air flow through the filter media. Proper sealing between filter and filter casing shall be done to obviate the possibility of air leakage.		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	VENTILATION SYSTEMS	Page 137 of 171

Each filter panel shall consist of an aluminium frame.

Face velocity shall not exceed 2.5 m/sec. and pressure drop shall be limited to 6 mm W.C. and 12 mm W.C. in clean and dirty conditions respectively.

The filtration efficiency of dry filters shall be not less than 90% down to particle size of 10 microns.

The filters shall be in panels of size about 600 mm X 600 mm unless otherwise indicated specifically.

The filter-mounting frame shall be made of M.S. rolled section and hot dip galvanized to withstand corrosion. Necessary fabrication and G.A. drawings for mounting frame shall be furnished by Vendor. The mounting frame shall be designed strong enough to take the load of double the pressure drop in dirty condition of the filters.

Panel type dry filters (Type-B):

The filter media shall be preferably of H.D.P. and shall be washable type.

The filtration efficiency of dry filters shall be not less than 99% down to particle size of 5 microns.

The face velocity through filter shall not exceed 1.5 m/sec. The pressure drop shall be limited to 6 mm W.G. in clean and 12mm W.G. in dirty condition.

For further details, refer the relevant points of this specification.

(a) Material of Construction

The following materials shall be used for the construction of various parts of filters.

- | | | | |
|------|--------------|---|---------------------------------|
| (i) | Filter media | : | As given in general description |
| (ii) | Filter frame | : | Aluminium |

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	: VENTILATION SYSTEMS	Page 138 of 171
(iii) Nut – Bolts : Galvanized (iv) Gasket : Neoprene (v) Bush, Springs : Galvanized (vi) Filter mounting : M. S. Rolled section hot galvanized. frame 6.2.6 Erection And Maintenance Tools The supplier shall furnish a complete unused set of all tools; wrenches etc. with necessary toolboxes as required for erection, maintenance, overhaul and complete replacement of any equipment being supplied under this specification. 6.3 <u>AIR WASHER PLANT</u> 6.3.1 The scope of supply shall include the following: (a) For TG building (covering HT/LT switchgear rooms and cable galleries), Minimum Four (4) air washer units shall be provided. Each Air Washer unit shall consist of: (i) Air Intake Louver with bird screen (ii) Double bank water spray system with nozzle and header. (iii) Water repellent filters with mounting frame. (iv) Water eliminator screen. (v) Water circulating pumps sets. (vi) Two (2) Air Pressure Breaker Valves. (vii) Float valve for make-up water line, galvanized water suction screen.		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	VENTILATION SYSTEMS	Page 139 of 171
(viii) Control panel for control of water circulating pumps and operation of Air Washing Plant. (ix) Pressure gauges on water recirculating pumps and any other instrument for trouble-free operation of the air washing plant. (b) Two (2) unitary air filtration (washer) units (one working and one standby) shall be provided for ESP building. Each Unitary Air Filtration unit shall consist of: (i) Air Intake Louver with bird screen (ii) Single bank water spray system with nozzle and header. (iii) Water repellent filters with mounting frame. (iv) Water eliminator screen. (v) Water circulating pumps sets. (vi) Two (2) Air Pressure Breaker Valves. (vii) Float valve for make-up water line, galvanized water suction screen. (viii) Control panel for control of water circulating pumps and operation of Air Washing Plant. (ix) Pressure gauges on water recirculating pumps and any other instrument for trouble-free operation of the air washing plant. (c) Anchor bolts, nuts, bolts, loose fittings as necessary for all items above. (d) One (1) set of spares. (e) Cleaning, protection, painting as specified.		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	: VENTILATION SYSTEMS	Page 140 of 171
(f) Any other equipment and/or material necessary to ensure safe and satisfactory operation of each unit. 6.3.2 Standards and Codes Unless otherwise specified, it is intended that standard equipments shall be offered for this specification. Materials of construction, construction of components, performance testing of equipments, erection, commissioning etc shall be in accordance with the latest edition of the appropriate standards as mentioned in this specification. 6.3.3 General Description Equipment required for the ventilation system of the following buildings shall be covered under this specification. Steam Turbine Building and ESP Control Building As the reliability is of utmost importance for the proper functioning of the whole power station, all equipment shall be made of best quality material, high reliability and proven design. 6.3.4 Performance Required Number of air washer plants required for providing evaporating cooling of supply air during hot season shall be worked out by bidder based on the space availability and rating. However, at least Four (4) Air Washer Units shall be provided for TG Building and Two (2) UAF units shall be provided for ESP Building. Air washer plants capacity shall be decided by the Bidder based on the design requirements for the Building as well as to suit them in the available space. Due consideration shall be given to minimise the supply ductwork. The friction drop on air side shall not exceed 20 mm W.G. The saturation efficiency of air washer plant shall not be less than 90%. The plant shall also act as an air filter to remove air borne particles down to 10 micron with an efficiency of 90%		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	VENTILATION SYSTEMS	Page 141 of 171

6.3.5 General Design Requirement

The requirements supplied shall be suitably constructed for safe and proper operation under all conditions described or implied in this specification without undue strain, vibrations, corrosion or other operating difficulties.

All parts subjected to substantial temperature changes shall be designed and supported so as to permit free expansion or contraction without resulting in leakage, distortion and excessive strains in the equipment. Parts subjected to wear, corrosion or other deterioration or requiring adjustment, inspection or repairs shall be accessible and have reasonable convenience for removal, replacement and repair. All such parts shall be of suitable material or suitably lined for keeping maintenance to a minimum. All close fitting parts that are changeable shall be maintained to gauge.

6.3.6 Air Washer Plant

The air washer plant shall be of draw through design. The louver shall generally suit the space available.

The spray system shall consist of M.S. galvanized pipes as per IS: 1239 Heavy class. Adequate number of spray nozzles shall be provided so as to have good water distribution over the water repellent polypropylene filter. Nozzles shall be made of brass.

Two pumps of 100% capacity each and adequate head shall be provided for recirculating the water for each of the air washer plants. The pumps shall be horizontal split casing centrifugal type directly coupled to drive motor through a flexible coupling. The pumps shall have continuously rising head characteristics from the design point to shut-off. The pumps shall be non-overloading type. A common base plate shall be provided for mounting pump and drive motor. The base frame shall be strong enough to provide rigidity and stability and capable of supporting the weight and reaction of pump, motor drive and piping.

Each pump set shall be complete with accessories such as pressure gauge, coupling guard, anchor bolts, necessary drain and vents for the casing and counter flanges at pump suction and discharge.

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	VENTILATION SYSTEMS	Page 142 of 171

The following material shall be used for the pump:

- (a) Pump Casing : CI as per IS-210 Gr. FG-260
- (b) Impeller & Wear ring : Bronze conforming to IS-318 Grade LTB-1
- (c) Shaft : EN-8 Carbon steel BS-970 or equal.
- (d) Shaft sleeve : Bronze conforming to IS-318 Grade LTB-1

The Bidder shall indicate with relevant calculations his proposal to meet the requirement of rated flow and head.

The filter shall be of water repellent polypropylene construction or equivalent. Standard size filter modules shall be provided. Each filter module shall consist of an aluminium frame packed with water repellent filter material. Galvanized wire mesh screens shall be employed on both faces of filter module to retain the filter material. A frame of galvanized steel section shall be designed and supplied by the supplier for mounting these filters. The pressure drop through dry and wet filter shall be limited to 6 mm and 12 mm W.G. respectively. Eliminators shall be provided on downstream side of the filter to remove entrained moisture from air stream. The eliminator shall be of similar construction as that of filter section.

All air washers and Unitary Air Filter Units internals coming in contact with moist air shall be provided with FRP lining. For fine finishing of FRP surface, two coats of epoxy paint shall be applied. All inside and outside parts of the fans and the connection piece between fan and AWU and UAF units shall also be provided with FRP lining along with two coats of epoxy painting for fine finishing of FRP lining except the fan shaft which shall be epoxy painted.

6.3.6.1 Drive Motors

The drive motors for the equipments covered under this specification shall conform to the specification mentioned elsewhere.

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	VENTILATION SYSTEMS	Page 143 of 171
6.3.6.2	Performance Guarantee If the stipulated requirements are not fulfilled, the contractor shall make good the deficiency in every case by altering and/or replacing the part or whole equipment free of charge to Owner immediately. All replaced parts/ equipment shall be removed from the site at the contractor's expenses. 6.3.6.3 Special Cleaning, Protection and Painting Internal surfaces of all parts shall be cleaned to remove loose scale and dirt. The external surface of the motor and cover shall be sand blasted to remove all rust, scale etc. All sharp edges shall also be removed. Weld rod stubs and other foreign objects shall be removed prior to final assembly. Excess oil and grease shall be removed by wiping. All parts shall be painted with two coats of red or zinc-chromate primer and one coat of aluminium paint before dispatch. 6.4 <u>LOUVERS</u> 6.4.1 General This specification is intended to cover the design, manufacture, assembly, testing and delivery at site, properly packed, erection of all louvers as specified hereinafter. The scope of supply shall include the following: All louvers consist of following: (a) 45° Bend louver blades. (b) All internal fittings, nuts and bolts, specialities and supports forming an integral part of it. (c) Fixing arrangement. (d) Special erection and maintenance tools.	

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	: VENTILATION SYSTEMS	Page 144 of 171
6.4.2 Standards and Codes Unless otherwise specified, it is intended that tenders shall offer standard equipment for this specification. Material of construction, construction of equipment, performance testing of equipment, etc. shall be in accordance with the latest edition of the appropriate standards. 6.4.3 General Description The louvers specified herein are required for the fresh air supply systems designed for the various building of this plant. These louvers shall be installed on the outer sidewall of the buildings so as to avoid ingress of rainwater inside the buildings. As these louvers shall be provided on the outer walls of the building, the louvers shall be made of best quality material for better architectural view. 6.4.4 Performance Required Over all size of the louvers shall be suitable for mounting the same in the openings provided in the wall. The louvers shall be designed such that face velocity of air shall not exceed 3 m/sec. 6.4.5 General Design Requirement The louver blades shall have bends at 45° to the direction of airflow. 5 Mesh M.S. galvanized wire netting shall be provided on front side of louvers. The louver blades shall be held rigidly in their position with the help of SS self tapping screws of 3 mm size with washer as shown in louver drawing, to maintain the proper gap between two blades and prevent them from fluttering due to external wind. The complete louver assembly shall be designed in such a way that it shall be easy for handling, erection and replacement, whenever necessary. The louver blades shall be made of minimum 14 G thick aluminium sheets.		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	: VENTILATION SYSTEMS	Page 145 of 171
The holding frame for the louvers shall be made out of aluminium boxes. The frame shall be supported at regular intervals with the help of ISMC 100 x 50 as required. 6.4.6 Erection and Maintenance Tools The supplier shall furnish a complete unused set of all tools, wrenches, etc. with necessary tool boxes as required for erection, maintenance, overhaul and complete replacement of any louver being supplied under this specification. 6.4.7 Performance Guarantee The supplier shall guarantee that upon completion of the satisfactory commissioning and acceptance of the plant by owner, all the portions thereof, shall be in accordance with requirement of the contract and shall be perfect as to design, materials, workmanship, etc. for minimum period of one year from date of the satisfactory commissioning and acceptance of the plant or 36 months from the date of receipt of complete supply to site, whichever is earlier. The supplier shall further guarantee that during the guarantee period he shall repair all defective equipments and replace all defective material furnished or installed under this contract free of cost to the Owner. If stipulated requirements are not fulfilled, the supplier shall make good the deficiency in every case by altering and/or replacing the part of whole equipment free of charge to Owner immediately. All replaced parts/ equipment shall be removed from the site at the supplier's expenses. 6.4.8 Special Cleaning, Protection and Painting The louvers shall be made of aluminium plates/sections. All the parts shall have smooth and even surface. Any damage to the galvanized coating, during transport or during welding shall be made good by zinc spraying.		