

**Provenness Criteria/Qualification Requirement (SUB-QR) for Oxidation Blower****Project : NTPC BARH-I (3X660 MW)**

NTPC Clause No.

4.00.00 QUALIFYING REQUIREMENTS FOR Oxidation Blowers

4.01.00 Only Manufacturers of Oxidation Blowers can seek for qualification. In the event of Order, only Manufacturers will be considered for placement of order. The bidder is required to meet the provenness criteria and/or qualification requirement for Oxidation Blower as stipulated below:

4.01.01 Oxidation Blowers for the Wet Limestone based Flue Gas Desulphurisation (FGD) System offered shall be only from such manufacturer(s) who has previously designed (either by itself or under collaboration / licensing agreement), manufactured the respective equipment(s) of the type, application and minimum equipment rating as stipulated below such that the respective equipment(s) should have been in successful operation in at least one (1) plant for a period not less than one(1) year reckoned as on 21st March 2019

	Name of Equipment	Type of Equipment	Application	Equipment Rating
04.01.01(C)	Oxidation Blowers	Single stage integrally geared centrifugal blower	Wet Limestone based FGD application in Coal fired power plant or any other process application.	80% of the flow & 100% of the head of the offered Oxidation Blower

Bidder shall offer and supply only the type of the above equipment(s) for which he himself is qualified.

4.01.03 A JV / Subsidiary Company formed for manufacturing and supply of equipment(s) as listed at clause no. 4.01.01 above in India, can also manufacture such equipment(s), provided that it has a valid collaboration or licensing agreement for design, engineering, manufacturing of such equipment(s) in India with a qualified equipment manufacturer who meets the requirements stipulated at clause 4.01.01 above (or the technology provider of the qualified equipment manufacturer) for the respective equipment(s). Before taking up the manufacturing of such equipment(s), the bidder must create /have created manufacturing facilities at his works as per collaborator's/licenser's design, manufacturing and quality control system for such equipment(s).

Further, in such a case, such qualified equipment manufacturers should have, directly or indirectly through its holding company/ subsidiary company, at least 26% equity participation in the Indian Joint Venture Company/ Subsidiary Company, which shall be maintained for a lock-in period of seven (7) years from the date of incorporation of such Joint Venture/ Subsidiary or upto the end of defect liability period of the contract, whichever is later.



4.01.04 In case the Bidder is not manufacturer of proven Oxidation Blowers as per clause 4.01.01 (c) above but is a manufacturer of Blowers/compressors for minimum 50 NM³/min capacity, the Bidder can also manufacture Oxidation Blowers, provided it has collaboration or valid licensing agreement for design, engineering, manufacturing, supply of such Oxidation Blowers in India with such manufacturer who meet the requirements stipulated at clause 4.01.01 (c) above for the Oxidation Blowers. Before taking up the manufacturing of such equipment, the bidder must create /have created manufacturing facilities at his works as per collaborator's /licenser's design, manufacturing and quality control system for such equipments.

4.01.08 Before taking up the manufacturing of such equipment(s) as per clause 4.01.03, 4.01.04, above, the Bidder must create (or should have created) manufacturing and testing facilities at its works as per Collaborator / licensor's design, manufacturing and quality control system for such equipments duly certified by the Collaborator / licensor. Further, the Collaborator / Licensor shall provide (or should have provided) all design, design calculation, manufacturing drawings and must provide (or should have provided) technical and quality surveillance assistance and supervision during manufacturing, erection, testing, commissioning of equipments.

04.01.09 Bidder shall offer and supply only the type of the above equipment(s) for which it itself / Collaborator(s) / Licensor(s) proposed by the Bidder for the above equipment(s) is qualified.

The Employer (NTPC) reserves the right to fully satisfy himself regarding capability and capacity of the bidder and the proposed arrangement and may prescribe additional requirement before allowing manufacture of the equipment listed above for this contract

Note to clause 4.01.02

- (1) Whenever the term 'coal fired' is appearing above, "Coal" shall be deemed to also include bituminous coal/brown coal/lignite.

Bidder shall submit the Attachment 3K enclosed along with Supporting Documents. Also, Bidder has to submit Reference list of Plants where Oxidation Blowers have been supplied.

The following terminology shall be followed for attachment 3k:
Bidder means BHEL
Bidder's Sub vendor means Oxidation Blower Manufacturer
Employer/Owner means NTPC

**FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE
FOR
LOT-1A PROJECTS
BIDDING DOCUMENT NO. CS-0011-109(1A)-2**

Bidder's Name and Address:

To
Contract Services-II
NTPC Limited
Noida-201301

Summary of Critical Equipment indicated under clause 4.01.00, sub-section-I, Part-A of Section-VI.

Equipment Name	Sub-Vendor Name	Collaborator's Name, if applicable	Seeking Qualification as per clause..... Sub-Section-I, Part-A of Section-VI
Booster Fans			*4.01.01 /*4.01.02 /*4.01.03
*Slurry Recirculation Pumps			*4.01.01 /*4.01.03 /*4.01.07
Oxidation Blowers			*4.01.01 /*4.01.03 /*4.01.04
Wet limestone Grinding mills			*4.01.01 /*4.01.03 /*4.01.05 (i)/ 4.01.05 (ii)
Slurry Pumps			*4.01.01/*4.01.03
Agitators			*4.01.01 /*4.01.03 /*4.01.06
Vacuum Belt filters			*4.01.01 /*4.01.03

Note : *Strike-off whichever is not applicable.

1. If qualification sought as per clause 4.01.01, sub-section-I-A, Part-A of Section-VI then the details of the sub vendor (manufacturer) shall be filled by the bidder in the format A to G.

2. If the qualification sought as per the clause 4.01.02, sub-section-I-A, Part-A of Section-VI, then the details of proposed sub vendor (i.e manufacturer of such equipments for at least 500 MW unit rating) shall be filled individually by the bidder in the format A and the details of collaborator who meets the requirement stipulated at 4.01.01, sub-section-I-A, Part-A of Section-VI shall also be filled by the bidder in the format A separately. Further, in case of qualification vide clause 4.01.02, sub-section-I-A, Part-A of Section-VI a copy of valid ongoing collaboration and technology transfer agreement for design, engineering, manufacturing, supply of such equipment in India with the collaborator who meets the requirement stipulated at 4.01.01, sub-section-I-A, Part-A of Section-VI shall also be furnished.
3. If the qualification sought as per the clause 4.01.03, sub-section-I-A, Part-A of Section-VI then the details of JV/Subsidiary Company formed for manufacturing of such equipments in India shall be furnished individually for each equipment by the bidder such as,
 - i) Copy of document of incorporation of JV/Subsidiary company in India
 - ii) Copy of valid ongoing collaboration and technology transfer agreement for design, engineering, manufacturing, supply of such equipment in India with the collaborator who meets the requirement stipulated at 4.01.01, sub-section-I-A, Part-A of Section-VI.
 - iii) Copy of document of at least 26% equity participation of qualified equipment manufacturer in the Indian JV company/subsidiary company directly or indirectly through its holding company /Subsidiary company, which shall be maintained for a lock -in period of seven (7) years from the date of incorporation of such JV/subsidiary or up to the end of defect liability period of the contract which ever is later.

Further, the details of collaborator or technology provider of the qualified equipment manufacturer who meets the requirement stipulated at 4.01.01, sub-section-I-A, Part-A of Section-VI shall be filled by the Bidder in the format A to G (format given at 1.00.00). In addition to that, the sub vendor along with the Indian JV company/subsidiary company, qualified equipment manufacturer and its holding company/subsidiary company as applicable shall furnish the DJU.

*** strike out whichever is not applicable.**

- 1.00.00 (Applicable for Bidder/his sub vendors seeking qualification as per clause no. 4.01.01, Sub section-I, Part-A of Section-VI. Bidder shall furnish the required data only for those equipments / auxiliaries which are proposed to be sourced under this route.)

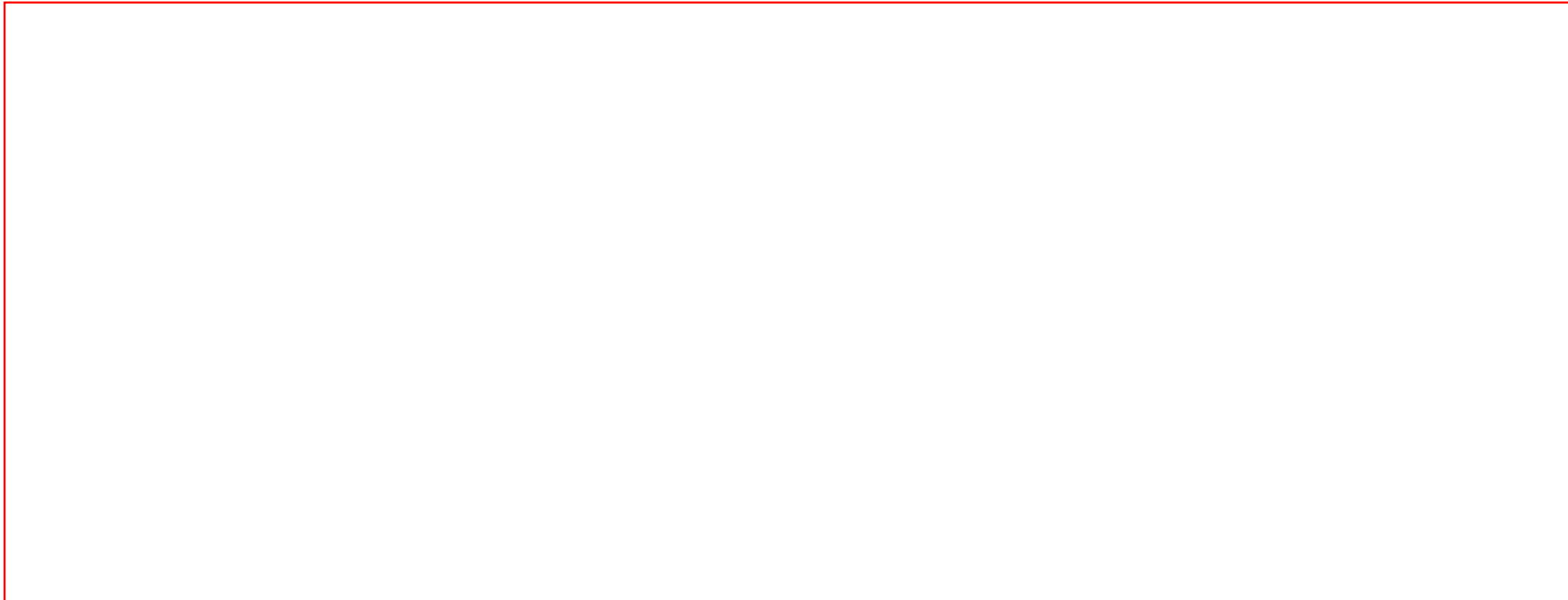
We, hereby furnish the data on proveness criteria for critical equipment, auxiliaries, systems and Bought Out Items such as Booster Fans, *Slurry Recirculation Pumps, Oxidation Blowers, Wet Limestone Grinding Mills, Slurry Pumps, & Agitators which have been designed (either by self manufacturer or under valid ongoing collaboration and technology transfer agreement), *manufactured/ *got manufactured and supplied by us /Manufacturer (or manufactured/ got manufactured & supplied by our proposed sub-vendors) and these are in successful operation in at least one (1) plant for a period not less than one year reckoned as on the date

- C. Oxidation Blowers:** We declare that, we/our Sub-Vendor, have designed (either by itself or under collaboration / licensing agreement), *manufactured/ *got manufactured and supplied at least one (1) number of Oxidation Blower of minimum 80% of the flow & 100% of the head of the offered Blower, Centrifugal/positive displacement type working in FGD application in Coal fired power plant and which has been in successful operation for minimum one (1) year reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder, as per the details furnished below:

Sl. No.	Description	Reference Work
1.	Name of the reference plant & location:	
2.	Client name and his address: Oxidation	
3.	No. of units and capacity in MW of unit:	
4.	Whether power plant is coal fired	-*Yes/*No
5.	Whether operating in a Wet Limestone based FGD application in Coal fired power plant	-*Yes/*No
6.	Name of equipment manufacturer & address:	
7.	Date of commission of the equipments:	
8.	Model no. of the equipment:	
9.	Brief Technical particulars of the equipments:	
10.	Flow-	Nm ³ /h

Sl. No.	Description	Reference Work
11.	Head-	 mmWC
12.	Whether the equipment(s) are in successful operation in atleast one (01) plant for a period not less than one (01) year reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder	-*Yes/*No
13.	Flue gas Desulphurization system details:	*Technical extract/ *paper letter/ *email/ *Drawing from user or *contract document or *scheme or *any document in public domain enclosed at annexure....to Attachment-3K
14.	Scope of Work:	*Letter of Award or *Contract or *P.O. enclosed at Annexure.....to Attachment-3K
15.	Performance details:	*Certificate/*Letter/*E-mail from End user enclosed at Annexure.....to Attachment-3K

*** Strike off whichever is not applicable.**



* Strike off whichever is not applicable.

***2.00.00** **Applicable for Bidder/his sub vendors seeking provenness criteria as per clause no. 4.01.02, Sub section-I, Part-A of Section-VI.**

2.01.00 We, hereby confirm that we/our sub-vendors are a regular manufacturer of Booster Fan for units of atleast 500MW rating and the details in this regard on provenness criteria as per clause **4.01.01**, sub-section-I, Part-A, Section-VI are hereby furnished below:

***Bidder to strike off whichever is not applicable.**

(Data to be furnished in line with format given at 1.00.00 of this Attachment)

2.02.00 We further confirm that details in respect of collaboration / valid licencing agreement for the aforesaid equipment as per 2.01.00 above who meets the requirement stipulated at clause **4.01.01**, sub-section-I, Part-A, Section-VI are enclosed at **Annexure-.....** to this Attachment. The data in respect of proveneness criteria for these equipment which are in successful operation in at least one (1) plant for a period not less than one reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder are furnished below. We further confirm that we/ our sub vendor(s) have created manufacturing and testing facilities at our/ their works as per collaborator's/ Licensor's design, manufacturing & quality control system for these equipment(s)/ Auxiliary(ies).

(Data to be furnished in line with format given at 1.00.00 of this Attachment)

***3.00.00 Applicable for JV Company/Subsidiary Company meeting provenness criteria as per clause no. 4.01.01, Sub section-IA, Part-A of Section-VI.**

3.01.00 We, hereby confirm that JV company/ Subsidiary company (Strike off whichever is not applicable) formed for manufacturing and supply of equipment(s) (*Booster Fans, *Slurry Recirculation Pumps, *Oxidation Blowers, *Wet Limestone Grinding Mills, *Slurry Pumps, *Agitators) has a valid ongoing collaboration and technology transfer agreement for design, engineering, manufacturing of such equipment(s) in India with a qualified equipment manufacturer who meets the requirements stipulated at clause 4.01.01 of sub-section-I, Part-A, Section VI of bidding documents (or the technology provider of the qualified equipment manufacturer). Further, in such a case, such qualified equipment manufacturers is having, directly or indirectly through its holding company/subsidiary company, at least 26% equity participation in the Indian Joint Venture Company/subsidiary company, which shall be maintained for a lock-in period of seven (7) years from the date of incorporation of such Joint Venture / Subsidiary or up to the end of defect liability period of the contract, whichever is later. Before taking up the manufacturing of such equipment(s) (*Booster Fans, *Slurry Recirculation Pumps, *Oxidation Blowers, *Wet Limestone Grinding Mills, *Slurry Pumps,*Agitators), we/ our sub vendor(s) *will create /*have created manufacturing facilities at his works as per collaborator's/licenser's design, manufacturing and quality control system.

We further confirm that details in respect of collaboration / valid licencing agreement for the aforesaid equipment(s) (*Booster Fans, *Slurry Recirculation Pumps, *Oxidation Blowers, *Wet Limestone Grinding Mills, *Slurry Pumps, *Agitators) who meets the requirement stipulated at clause **4.01.01**, sub-section-I, Part-A, Section-VI for are enclosed at **Annexure-.....** to this Attachment.

***4.00.00** **Applicable for Bidder/his sub vendors seeking provenness criteria as per clause no. 4.01.04, Sub section-I, Part-A of Section-VI.**

4.01.00 We, hereby confirm that *we/*our sub-vendors is a manufacturer of Blowers/compressors for minimum 50 NM³/min capacity. (Details of references enclosed at Annexure)

(Data to be furnished in line with format given at 1.00.00 of this Attachment))

4.02.00 We further confirm that details in respect of collaboration / valid licencing agreement for the Oxidation Blower between *us/*our sub-vendors, as per 4.01.00 above, and with qualified Oxidation Blower manufacturer, who meets the requirement stipulated at clause **4.01.01**, sub-section-I, Part-A, Section-VI are enclosed as per **Annexure-I** to this Attachment. The data in respect of provenness criteria for the qualified Oxidation Blower manufacturer, which are in successful operation in at least one (1) plant for a period not less than one reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder are furnished below. We further confirm that we/ our sub vendor(s) have created manufacturing and testing facilities at our/ their works as per collaborator's/ Licensor's design, manufacturing & quality control system for the Oxidation Blowers.

We further confirm that before taking up the manufacturing of such Oxidation Blower *we/ *our sub vendor(s) *will create /*have created manufacturing facilities at his works as per collaborator's/licenser's design, manufacturing and quality control system.

We further confirm that details in respect of collaboration / valid licencing agreement for the Oxidation Blowers who meets the requirement stipulated at clause **4.01.01**, sub-section-I, Part-A, Section-VI for are enclosed at **Annexure-.....** to this Attachment.

(Data to be furnished in line with format given at 1.00.00 of this Attachment)

***5.00.00** **Applicable for Bidder/his sub vendors seeking provenness criteria as per clause no. 4.01.05 (i), Sub section-I, Part-A of Section-VI.**

5.01.00 We, hereby confirm that *we/*our sub-vendors is a manufacturer of Dry Grinding Mills for minimum 20 T/h capacity. (Details of references enclosed at Annexure)

(Data to be furnished in line with format given at 1.00.00 of this Attachment))

5.02.00 We further confirm that details in respect of collaboration / valid licencing agreement for the Wet Grinding Mills between *us/*our sub-vendors, as per 5.01.00 above, and with qualified Wet Grinding Mill manufacturer, who meets the requirement stipulated at clause **4.01.01**, sub-section-I, Part-A, Section-VI are enclosed at **Annexure-.....** to this Attachment. The data in respect of proveneness criteria for the qualified Wet Grinding Mill manufacturer, which is in successful operation in at least one (1) plant for a period not less than one reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder are furnished below.

(Data to be furnished in line with format given at 1.00.00 of this Attachment)

We further confirm that before taking up the manufacturing of such Wet Grinding Mill *we/ *our sub vendor(s) *will create /*have created manufacturing facilities at his works as per collaborator's/licenser's design, manufacturing and quality control system.

In addition, the Bidder along with our sub-vendors, as per 5.01.00 above (if applicable) and the qualified Wet Grinding Mill manufacturer and its holding/ subsidiary Company, as applicable, shall furnish DJU in which executant of the DJU shall be jointly and severally liable for the successful performance of the equipment as per the format enclosed at **Annexure-III of Attachment-3K**.

(Data to be furnished in line with format given at 1.00.00 of this Attachment)

***6.00.00 Applicable for Bidder/his sub vendors seeking provenness criteria as per clause no. 4.01.05 (ii), Sub section-I, Part-A of Section-VI.**

6.01.00 We, hereby confirm that *we/*our sub-vendors have designed, manufactured & supplied dry Grinding Ball Tube mills for at least 500 MW pulverized coal fired power plant. (Details of references enclosed at Annexure)

(Data to be furnished in line with format given at 1.00.00 of this Attachment))

6.02.00 We further confirm that details in respect of valid licencing agreement for the Wet Grinding Mills between *us/*our sub-vendors, as per 6.01.00 above, and with qualified Wet Grinding Mill manufacturer, who meets the requirement stipulated at clause **4.01.01**, sub-section-I, Part-A, Section-VI are enclosed at **Annexure-.....** to this Attachment. The data in respect of proveneness criteria

for the qualified Wet Grinding Mill manufacturer, which is in successful operation in at least one (1) plant for a period not less than one reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder are furnished below.

(Data to be furnished in line with format given at 1.00.00 of this Attachment)

We further confirm that *we/*our sub-vendors shall provide an extended warranty of three (3) years for the Wet Limestone Grinding Mills provide an additional on demand bank guarantee for INR 10 Million (Indian Rupees Ten Million only) for each project.

(Data to be furnished in line with format given at 1.00.00 of this Attachment)

***7.00.00 Applicable for Bidder/his sub vendors seeking provenness criteria as per clause no. 4.01.06, Sub section-I, Part-A of Section-VI.**

7.01.00 We, hereby confirm that *we/*our sub-vendors is a manufacturer of a manufacturer of Agitators for similar process/duty application in petrochemical or metals and mining industry. (Details of references enclosed at Annexure)

(Data to be furnished in line with format given at 1.00.00 of this Attachment))

7.02.00 We further confirm that details in respect of collaboration / valid licencing agreement for the Agitator between *us/*our sub-vendors, as per 6.01.00 above, and with qualified Agitator manufacturer, who meets the requirement stipulated at clause **4.01.01**, sub-section-I, Part-A, Section-VI are enclosed at **Annexure-.....** to this Attachment. The data in respect of proveneness criteria for the qualified Agitator manufacturer, which is in successful operation in at least one (1) plant for a period not less than one reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder are furnished below.

We further confirm that before taking up the manufacturing of such Agitator, *we/ *our sub vendor(s) *will create /*have created manufacturing facilities at his works as per collaborator's/licenser's design, manufacturing and quality control system.

(Data to be furnished in line with format given at 1.00.00 of this Attachment)

***8.00.00** **Applicable for Bidder/his sub vendors seeking provenness criteria as per clause no. 4.01.07, Sub section-I, Part-A of Section-VI.**

8.01.00 We, hereby confirm that *we/*our sub-vendors is a manufacturer of a manufacturer of Slurry Pumps who meets the requirements stipulated at clause 4.01.01 (e), sub-section-I, Part-A, Section-VI.
(Details of references enclosed at Annexure)

(Data to be furnished in line with format given at 1.00.00 of this Attachment)

8.02.00 We further confirm that details in respect of collaboration / valid licencing agreement for the Slurry Recirculation Pumps, between *us/*our sub-vendors, as per 7.01.00 above, and with qualified Slurry Recirculation Pump manufacturer, who meets the requirement stipulated at clause **4.01.01**, sub-section-I, Part-A, Section-VI are enclosed at **Annexure-.....** to this Attachment. The data in respect of proveneness criteria for the qualified Slurry Recirculation Pump manufacturer, which is in successful operation in at least one (1) plant for a period not less than one reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder are furnished below.

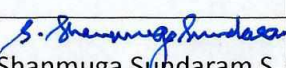
We further confirm that before taking up the manufacturing of such Slurry Recirculation Pumps, *we/ *our sub vendor(s) *will create /*have created manufacturing facilities at his works as per collaborator's/licenser's design, manufacturing and quality control system.

(Data to be furnished in line with format given at 1.00.00 of this Attachment)

	BHARAT HEAVY ELECTRICALS LIMITED (A GOVT OF INDIA UNDERTAKING)	Flue Gas Desulphurization Group-FGD, Boiler Auxiliary Plant (BAP), Ranipet
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TECHNICAL SPECIFICATION OF SINGLE STAGE CENTRIFUGAL OXIDATION AIR BLOWERS

SPECIFICATION NO : **NTPC:FGD:OAB**
PROJECT OWNER : **NTPC Limited, India**
BUYER (EPC) : **BHEL, BAP Ranipet**
APPLICATION : **WET LIMESTONE FGD**

					
01	18-11-2019	Generally Revised	Arun Kumar	 Shanmuga Sundaram S	 V. Kesavan
00	21-10-2019	Fresh Release	Shanmuga Sundaram S	P.Naveen Reddy	V. Kesavan
REV	Date	Description	Prepared	Checked	Approved

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TECHNICAL SPECIFICATION OF SINGLE STAGE CENTRIFUGAL BLOWERS

NTPC:FGD:OAB:R01

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TECHNICAL SPECIFICATION OF SINGLE STAGE CENTRIFUGAL BLOWERS

NTPC:FGD:OAB:R01

A) DOCUMENTS TO BE SUBMITTED ALONG WITH THE OFFER:

Sl. No.	Description	Purpose
1.	Annexure to qualification requirements : Attachment - 3K	Qualification Requirement (QR)
2.	Reference plant details of similar or higher capacity oxidation blower supplied as per Annexure-II	Qualification Requirement (QR)
3.	Proforma Invoice of Supply	Consideration of Bid
4.	Proforma Invoice of Mandatory Spares	Consideration of Bid
5.	Proforma Invoice for Supervision of Erection & Commissioning	Consideration of Bid
6.	Seal & Sign of bidder on all pages of specification	Technical Evaluation of Bid (TEB)
7.	Filled Data Sheets of & All accessories as per Annexure-I	TEB
8.	Deviation List (if any) as per Annexure-III	TEB
9.	Schedule of Guarantee as per Annexure-IV	TEB
10.	Blower & Motor Sizing Calculation	TEB
11.	GA drawing including cross sectional view & BOM of Oxidation Blower	TEB
12.	P & ID diagram of oxidation blower & Lube oil system	TEB
13.	Performance curves i. Flow v/s Total Pressure ii. Flow v/s Efficiency iii. Flow v/s Power consumption iv. Torque v/s Speed curve for motor selection	TEB
14.	Required Electric power & other Utility List	TEB
15.	Schedule of Guarantee (Annexure)	TEB
16.	Make of all bought out items & sub vendor list	TEB
17.	Quality Plan	TEB
18.	List of Start-up & Commissioning Spares	TEB
19.	List of Special Tools	TEB
20.	Delivery Schedule	TEB
21.	Catalogue	TEB
22.	Price bid	Price Bid



TECHNICAL SPECIFICATION OF SINGLE STAGE CENTRIFUGAL BLOWERS

NTPC:FGD:OAB:R01

B) DOCUMENTS TO BE SUBMITTED AFTER CONTRACT:

Sl. No.	Description	Handing over of Documents after Contract (in weeks)	Purpose
1.	Utility Consumption & Lubricating Oil List	2	Customer Approval
2.	Foundation Drawing, Anchor Bolts, static & dynamic details	2	Customer Approval
3.	GA drawing including cross sectional view of Oxidation Blower & Accessories with bill of material (in PDF & Autocad format)	2	Customer Approval
4.	P&ID drawing of Oxidation Blower & Lube Oil System in PDF & AUTOCAD format	3	Customer Approval
5.	Filled Data Sheets of Oxidation Blower & All accessories	3	Customer Approval
6.	Quality Plan with Inspection & Performance Test Procedure at site	3	Customer Approval
7.	Blower & HT Motor Sizing Calculation	4	Customer Approval
8.	Performance curves i. Flow v/s Total Pressure ii. Flow v/s Efficiency iii. Flow v/s Power consumption iv. Torque v/s Speed curve for motor selection	4	Customer Approval
9.	Motor Rating in Kw	4	Customer Approval
10.	Sub vendors List	4	Customer Approval
11.	Manufacturing Schedule	4	Customer Approval
12.	List of Special Tools	8	E&C
13.	List of Start-up & Commissioning Spares	9	E&C
14.	Required Electric power	10	E&C
15.	Pre- Commissioning Check List	10	E&C
16.	Installation & assembly procedure	10	E&C
17.	Erection & Commissioning Shedule	10	E&C
18.	Recommended Repair Procedure	10	E&C
19.	Operation and Maintenance Manual (10 hardcopies and 5 electronic copies in English)	10	E&C
20.	Electrical Load List with Single Line Diagram	10	BHEL Review
21.	Control Logic of Oxidation Blower	10	BHEL Review
22.	Catalogue	10	BHEL Review
23.	Proforma Packing List	12	Dispatch



TECHNICAL SPECIFICATION OF SINGLE STAGE CENTRIFUGAL BLOWERS

NTPC:FGD:OAB:R01

1.0 APPLICABLE CODES & REGULATIONS

The design and materials shall conform to the requirements of applicable codes and regulations of the latest edition. The design, manufacture, installation and testing of the Oxidation blower shall follow the latest applicable Indian/International (AISI / ASME/EN) Standards.

2.0 INTENT OF SPECIFICATION

This specification covers the minimum requirements for the complete design, material, manufacturing, shop inspection, testing at the manufacturer's works, supervision of erection & commissioning and performance testing of Single Stage Centrifugal Integrally Geared Oxidation blower along with accessories which is to be furnished in the Flue Gas Desulphurization plant of NTPC projects. The following points may be noted.

- a. Bidder shall assume full unit responsibility for the entire equipment assembly and make all possible efforts to comply strictly with the requirements of this specification and other specifications/attachments to inquiry/order.
- b. The Bidder shall offer only proven design which meets the Provenness criteria indicated in **Annexure for Qualification Requirement**. Necessary document evidences as per **Attachment-3K** for qualification shall be submitted along with the bid. If the Bidder doesn't meet the specified proven ness criteria, then the Bidder will not be allowed to participate in the Tender.
- c. In case, deviations are considered essential by the Bidder (after exhausting all possible efforts), the same shall be separately listed in the Bidder's proposal under separate section, titled as "List of Deviations/Exceptions to the Enquiry Document (**Annexure-III**)".
- d. Any deviation, not listed under the above section, even if reflected in any other portion of the proposal, shall not be considered applicable.
- e. No deviation or exception shall be permitted without the written approval of the purchaser.
- f. Compliance to this specification shall not relieve the Bidder of the responsibility of furnishing equipment and accessories/auxiliaries of proper design, materials and workmanship to meet the specified start up and operating conditions.
- g. In case, the Bidder considers requirement of additional instrumentation, controls, safety devices and any other accessories/auxiliaries essential for safe and satisfactory operation of the equipment, the same shall be recommended along with reasons in a separate section and include the same in scope of supply.
- h. All accessories, items of work, though not indicated but required to make the system complete for its safe, efficient, reliable and trouble free operation and maintenance shall also be in supplier's scope unless specifically excluded.

3.0 PROVENNESS CRITERIA/Pre-QUALIFICATION REQUIREMENT/SUB-QR:

The Bidders are required to meet the Qualification Requirement (QR) for Oxidation Blower as per **Annexure for Qualification Requirement and necessary documentary evidence requirement as per Attachment 3K**.



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4.0 SCOPE OF SUPPLY

Scope for the bidders shall include Design, Supply, and Supervision of Erection & Commissioning

Design: Includes basic engineering, detail engineering, preparation and submission of engineering drawings/calculations/datasheets/quality assurance documents/field quality plans, storage instructions commissioning procedures, operation & maintenance manuals, performance guarantee test procedures and assisting BHEL in obtaining time bound approval from NTPC.

Supply: Includes manufacturing/fabrication, shop floor testing, stage inspections, final inspections, painting & packing

Supervision of Erection & commissioning: Includes supervision of erection & commissioning, supervision of trial operation, training of customer's O&M Personnel.

Supplier's scope shall cover complete air blower unit including sub-systems, start-up spares and special tools (typically) as given below. The scope of supply for air blower shall include but not limited to the following:

Sl. No	Scope
1.	Blower complete with
	i. Casing
	ii. Rotor and Shaft assembly
	iii. Common base frame and shock absorber
	iv. Suction filter
	v. Suction & Discharge silencers
	vi. Lubrication system complete with all instruments
	vii. Accessory piping within the skid as per P&ID
	viii. Safety Valves & Check valves and other valves as per P&ID and as per specification.
	ix. Acoustic Enclosure to meet specified Noise Level
	x. Coupling with guards
	xi. Expansion joints at inlet and Discharge
	xii. Companion flanges with gaskets and fasteners
	xiii. Bearing cooling completed with all instruments
	xiv. Cooling arrangement to reduce the discharge air temperature to <70 deg C 
	xv. Foundation bolts for supplied items
	xvi. Instruments : Differential pressure indicator in the suction filter, 6 Nos RTD for each blower(3 no's at each Drive end and Non-Drive End), Pressure Indicator at discharge as per P&ID. Any other instruments, not indicated in the P&ID, but required as per blower manufacturer's standard practice or required for the completeness of the system shall also be provided. 
	xvii. Mechanical Running and Performance test at shop
	xviii. Painting and Rust Prevention during shipment and construction
	xix. Supervision of Erection & commissioning at site
	xx. Proper Packing
	xxi. Special tools & tackles as applicable
	xxii. Mandatory spares
	xxiii. Erection and start-up spares as applicable
	xxiv. Installation, operation and maintenance manuals



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Sl. No	Scope
xxv.	Any other items required for completeness of the equipment except the items covered in the exclusions.
	Bidder shall refer to the P&ID enclosed in Annexure –V for detailed clarity on the scope.

4.1	CONSTRUCTION FEATURES
a.	Each blower shall be a complete unit with casing, rotor, shaft and drive unit etc.
b.	The Blowers shall be preferably Centrifugal type. It shall be compact and simple in design requiring minimum number of spares.
c.	The oxidation blowers should be complete with drive arrangement consisting of coupling, coupling guard, base frame shock absorbers, mounting bolts, air filter, Acoustic enclosures, silencers, safety valves and check valves etc.
d.	The Oxidation Blowers shall be designed for continuous operation along with suitable cooling arrangement to meet the exit temperature < 70 deg C. The Bidder shall specify the cooling water requirement for reducing the temperature of discharge air. 
e.	The rotor shall be ground all over and accurately machined. The Rotor along with other rotating parts shall be statically balanced and then dynamically balanced as per ISO 1940 to ensure efficiency, vibration, performance and long bearing life.
f.	The air intake filter cum silencer, preferably dry type, to prevent dust and other atmospheric impurities from entering the blower shall be provided for each blower. Air filter shall have better filtering efficiency.
4.2	COOLING ARRANGEMENT
a.	The discharge air temperature <70 Deg C shall be obtained by Quenching arrangement with water injection at the common discharge. 
b.	In case of Casing cooling, the vendor shall consider the water quality available and accordingly select the casing material to withstand the corrosion, if any. The inside of the casing also to be coated with corrosion resistant materials of adequate thickness to enhance corrosion resistance of the Blower.
c.	The vendor to provide the following accessories along with cooling arrangement(with auto drain) - Required pipe fittings within the scope of terminal points - Required number of spray nozzles - Water quantity required - Required flow control devices like valves, pressure gauges and other instruments.



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	▪ Scheme & arrangement drawing shall be mentioned in offer.
4.3	CASING
a.	Casing shall be of robust construction. It shall be made from Casting or fabricated from heavy gauges steel sheets or plates or bidder's proven design standard meeting the provenness criteria as stipulated in Clause 3.0.
b.	In case of castings, the casing will be of Gray Cast Iron confirming to IS: 210 grade 25 or equivalent, designed for the duty conditions or proven design standard meeting the provenness criteria as stipulated in Clause 3.0. Castings shall be free from all defects and blowholes and shall be machined to close tolerance. In case of fabricated casings, it shall be rigidly reinforced and supported by structural members. Weld seams shall be continuous to have air-tight enclosure.
c.	Casings shall also have smooth interior to avoid accumulation of dense particles. Inlet shall be spun to have a smooth contour.
d.	If necessary, provision for ready access to the interiors of casings and other possible trouble points shall be made by means of readily removable, bolted on plates or by hinged and latched doors.
e.	Any connections shall be flanged. Flange diameter and drilling shall conform to ANSI B16.5 Class 150
B)	ROTORS & Impellers
a.	The rotor shall be made of Cast iron or forged steel or proven design standard meeting the provenness criteria as stipulated in Clause 3.0.
b.	Rotor assemblies shall be statically balanced and then dynamically balanced as per ISO 1940.
c.	In case of centrifugal blowers the Impellers shall be made of high strength aluminum alloy impellers or bidder's proven design standard meeting the provenness criteria as stipulated in Clause 3.0.
C)	SHAFT, SHAFT SEALS AND BEARINGS:
a.	The shaft shall be made of alloy steel or bidder's proven design standard meeting the provenness criteria as stipulated in Clause 3.0.
b.	Shafts shall be conservatively designed to transmit maximum power required and to assure rigidity. Shafts shall be machined and ground to close tolerances and shall be tapered to permit easy removal of the seals and bearings.
c.	Shaft shall run in high precision heavy duty bearings. Lubrication system provided shall be such that visual checking of lubricant level is possible
d.	The shaft shall be finished to close tolerance at the rotor, coupling, pulley and bearing



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	diameters. The size of shaft shall be calculated on the basis of maximum combined shear stress. This shear stress shall not exceed 30 percent of the elastic limit in tension or 18 percent of ultimate tensile strength.
e.	The design of shaft shall also take into consideration the critical speed of the shaft, which shall be at least 20% above the operating speed or 60 to 75% of the operating speed to minimize vibrations. Shafts shall be tapered to permit easy removal of the seals and bearings
f.	Shaft seals shall be provided to seal rotating shafts. Shaft seals shall be of the labyrinth type, of non-sparking material and shall be horizontally split to facilitate maintenance. The housing shall be of cast iron or fabricated steel construction and shall be horizontally split to provide access to all bearings and shafts.
g.	The bearings may be ball, roller or sleeve bearing. If sleeve bearings are used these shall be machined for close running fit. The bearings shall be designed to take the necessary radial load as well as the net axial thrust. Bearings shall be lubricated properly and sized for an operating life of 50,000 hours on the basis of maximum load.
h.	Blower induced vibration due to flow pulsations shall be avoided through suitable design.
i.	Bearing temperature sensor shall be provided for local monitoring of the bearing metal temperature of blowers. 3 Nos of RTD shall be provided to measure bearing temperature at each DE and NDE ends.
D)	COUPLING
a.	The HT drive motor is excluded from the scope of supply. However, the bidder shall supply coupling for secondary transmission.
b.	Coupling shall be of flexible type. The Bidder shall furnish both halves of the coupling. Both the Coupling halves shall be bored and keyed to fit shafts of the blower and the motor by bidder.
c.	All rotating parts such as coupling shall be covered with suitable protective guards. Guards shall be easily removable type.
E)	BASE PLATE
a.	A common base plate shall be provided for Blower assembly & Motor and the same shall be rigidly constructed, adequately braced and provided with finish pads for mounting blower.
b.	Suitable holes shall be provided for grouting and these shall be so located that the base plate can be grouted in place without disturbing the blower and motor.
c.	Common base plate for Blower and Motor shall be in the scope of the bidder and the details of the Motor will be furnished to the bidder to provide Motor mounting bolts.
F)	MOTORS
	• Above 0.2 kW and upto 200 kW: 3 phase 415 V AC-VENDOR SCOPE • Above 200 kW and upto 1500 kW: 3.3 KV- BHEL SCOPE • Above 1500 kW: 11 KW-BHEL SCOPE



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F)	ACCESSORIES:
1.	Lube Oil Unit : (If applicable)
i.	Each blower shall be furnished with an integral lubricating oil package. Each package shall be complete with single water to oil heat exchanger, full flow oil filter and oil pump. The oil pump shall be direct driven from the blower shaft. The complete package shall be factory wired, assembled and mounted on the base plate. Air cooled LO System shall be applied. If cooling water is required, bidder shall provide the supply requirements(flow, pressure) and the return conditions(temperature, pressure drop)
ii.	Emergency power supply is not available. The Lubricating oil system shall be designed that will satisfy the required lubrication for bearing at the time of electric power failure also.
iii.	Oil Bath System for Lubrication shall also be provided instead of Lube oil system.
2.	Coupling Guards- All rotating parts outside casing such shall be covered by the guard.
3.	Timing Gears
i.	Timing gears shall be of the wide faced spur or helical type, hardened & ground to DIN Class V or better accuracy.
ii.	Bearings shall be of anti-friction type only. The bidder shall provide the countermeasure for the fretting corrosion on the fitting surface of the thrust disc and separated outer race of anti-friction bearings.
iii.	Lubrication is required for Timing gear pair and bearings.
4.	Intake Air Filter Silencers:
i.	Each blower shall be provided with an inlet filter silencer of dry type and a conical shaped screen ahead of the filter. Filters shall be capable of removing minimum 82 Percent of all particles 10 microns and larger. Suitable filter area shall be provided for air suction. The suction area shall be minimum of twice the inlet pipe area. Differential pressure gauges shall be provided in filters to monitor any clogging in filters. Silencers shall be provided in discharge also.
5.	Expansion Joints:
i.	Expansion Joints shall be provided at the inlet and discharge of each blower
6.	Safety Valves:
i.	Each blower shall be provided with a safety relief valve on its discharge.
ii.	The valve, valve operator and controller shall be remotely mounted to prevent vibration damage. The valve shall be mounted in an easily accessible location to allow for maintenance and testing
iii.	The safety valve discharge piping shall be routed to a location such that personal exposure to



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	the discharge is prevented.
7. Piping and Valves:	
i.	All interconnecting piping whichever is necessary for operation of each unit shall be provided complete with shut off valves, check valves, strainers and fittings. Details of Oxidation blower piping : Material: A53-B, Thickness: Sch -20
ii.	Details of valves are given below: i) MOTORISED GATE VALVE Rating: CL 150, Body: A105, Trim:13CR, Lining: Seat STL, Connection: RF, Operation: Electrically operated with hand wheel integral starter type. SIL 2, Non intrusive type. ii) CHECK VALVE: Rating: CL 150, Body: A395, Trim: 13CR, connection: RF , Type: BC,SWING. iii) GATE VALVE: Rating: CL 150, Body: A105, Trim:13CR, Lining: Seat STL, Connection: SW, Operation: Hand wheel, Bonnet: BB,OS&Y
8. Blower control:	
i.	Each blower shall be furnished with required instrumentation and electrical accessory devices mounted and connected in a control cabinet.
ii.	Provisions shall be made for the interface between the local cabinet and the DCS such that the operation of the forced oxidation system can be controlled from the control console in the FGD Control room
9. Blower Shut Down:	
i.	Following is a typical list of abnormal conditions which might require blower shut down/Alarm. The contractor shall propose the exact conditions which require shutdown/alarm Blower shutdown signals: a) Discharge air temperature high b) Discharge pressure low or high. Temperature transmitter for initiating Shutdown of blower during when "Discharge air temperature high" shall be supplied by BHEL. Pressure Switch for initiating Shutdown of blower during when "Discharge pressure low or high" shall be supplied by Bidder.
ii.	In addition to the Instrumentation & Control devices sensing conditions which require shut down an emergency stop push button shall be provided. The push button shall be wired to the terminal blocks in the control cabinet for external connection to the blower controller.



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iii.	Provision shall be made to shut off the blower automatically should the level of lubricating oil falls below the design value. Suitable provision shall be made to take the signal to PLC / DCS system. In case of water cooling, the blower shall be shut off automatically whenever the pressure of the cooling water supply line falls below preset value.
10.	PROVISION FOR VIBRATION MONITORING:
	Provision for vibration sensor, key phase sensor shall be provided. There shall be provided for X axis & Y axis vibration measurement in bearing housing. Provision shall be in line AP1670, 15 editions, provision shall be covered suitably.
11.	INSTRUMENTS AND ACTUATORS:
	All instruments & actuators shall be connected to DDCMIS through fieldbus i.e. PROFIBUS PA protocol complying to IEC 61158. All electrical actuators shall be with integral starters (non-intrusive with SIL2 certification). Bidder shall refer to Annexure for specification of Instruments.

5.0	GENERAL REQUIREMENTS
S.No	Description
1.	Metric unit shall be used in the drawings and in the any displays on the equipments. Special attention should be taken that the unit of pressure shall be in dual scales of kPa and kg/cm ² G. For instance the pressure gauges should have dual units indication.
2.	Descriptions in the drawings, in the documents, and in the displays shall be in English
3.	All rotating parts such as coupling, shall be covered with suitable protective guards. Guards shall be easily removable type.
4.	The equipment shall be designed to withstand the corrosive and moist environment in which these are proposed to operate.
5.	Noise level produced shall not exceed 85 dB measured at a distance of 1.0 meters from the source in any direction and 1.5m above operating floor. Predicted sound pressure levels for the blower drive assemblies shall be submitted as part of the proposal data. The Acoustic enclose should be suitably designed to meet the required Noise Level.
6.	The overall vibration level shall be as per ISO 10816.
7.	Suitable drain connections shall be provided.
8.	The equipment shall be suitable for stable operation continuously.
9.	Limit of connection: The buyer (BHEL) has an intention to minimize interface for utilities as much as possible. The bidder shall consider this requirement in the planning stage of layout for the equipment. The bidder shall provide the header piping for utilities and branch piping to each nozzle. Terminal points for all utilities shall be located at skid edge. The bidder shall specify all terminal points with tie-in number in the P&ID and submit it in the proposal to confirm the scope of supply.



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10.	Service life: Entire equipment except wearing parts shall be designed and fabricated for a minimum service life of 30 years of operation or 200,000 full load operating hours whichever is longer.
11.	Corrosion allowance: Corrosion allowance for entire equipment shall be in accordance with latest applicable international standard.
12.	Unless otherwise specified , flanges shall be in accordance with ANSI B16.5 Class 150
13.	Name plate: All equipment shall be provided with nameplates indicating the item number and service name. Name plates shall be of 304 Stainless steel plate and placed at a readily visible location. Nameplate of main equipment shall have enough information, which will be confirmed during engineering phase. Stainless steel nameplates for all instruments and valves shall be provided.
14.	Rotation arrows shall be cast in or attached with stainless steel plate on each item of rotation equipment at a readily visible location.
15.	Unless otherwise specified, all equipment items where the weight exceeds 15 kg shall be provided with suitable lifting lugs, ears or ring bolts or tapped holes for lifting rings. Minimum shock factor for lifting lugs shall be minimum 2.0. The position of lifting lugs and reference dimension shall be shown on GA and/or outline drawings. NDT shall be conducted for lifting lugs. When any spreader bars are required for lifting and laydown, the bidder shall provide spreader bar with equipment.
16.	Skid Mount/Transportation: Equipment shall be fabricated as skid mount design as much as practical to minimize erection at the site.
17.	Two pieces of stainless steel earth lugs shall be provided with equipment diagonally. The position of earth lugs shall be shown on each GA and/or outline drawing.
18.	Provide double nuts for anchor bolts
19.	Bidder shall provide allowable vibration level on foundation in foundation drawings and/or general arrangement drawings.
20.	If the driver/driven equipment train is in the resonance condition or any vibration problems occur, the bidder shall solve the problems in a timely manner.
21.	The bidder shall have full responsibility for vibration control of the equipment train at the site and the unit's satisfactory performance, even if the foundation and drivers are provided by the BHEL.
22.	Bidder shall provide the mating flanges with the necessary gaskets.
23.	All the surfaces of the carbon steel should be rust prevented before shipment for the period of at least 12 months for storage and construction.
24.	Bidder to provide capacity of crane or hoist required for material handling and the details of heaviest component to be handled.
25.	The list of all Bought out items with makes and country of origin to be mentioned along with offer to be submitted.
26.	Quality Plan to be submitted along with the offer.



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27.	During entire period of the equipment / project erection, commissioning & operation, the bidders shall strictly follow and adhere to the guidelines for effective Health & Safety Management. Supply of safety gears/PPE for bidder's/bidder's sub vendor personnel deputed at site for Supervision of E&C, PG tests etc. shall be in bidder's scope.
28.	Cost towards the participation in discussions/meetings, providing technical assistance during technical discussions/meetings with customer for approval of drawing/documents etc. TA/DA, boarding and lodging to attend these meetings shall be borne by the bidder and shall be inclusive in supply portion.
29.	Material of construction for all equipment/components shall be subject to BHEL/NTPC approval during detail engineering. Accordingly bidder shall consider MOC for all equipment/component as per best engineering practice, global standard and global references.
30.	Bidder to provide sub vendor list and Bidder shall strictly adhere to BHEL/NTPC approved vendor list.
31.	It shall be the complete responsibility of the successful bidders to obtain "Sub Vendor Approval" from NTPC for all equipments & components. Any delay in sub vendor's approval should not affect the project schedule. If any of the sub vendors does not have the approval of NTPC, the same may be replaced with another NTPC approved sub-vendor only, without any price implications to BHEL.
32.	The modalities of inspection (Stage, Final, In-process) shall be finalized during detail engineering after submission of quality assurance plan (QAP). It shall be reviewed by the NTPC and BHEL. Bidder shall follow the procedures of inspection as per the approved QAP. Bidder has to submit the following documents along with inspection call and if any other documents required as per approved QAP. - Raw material inspection certificate - Internal test reports - Statutory certificates as required. - All inspection & testing shall be carried out based on the following documents: a. Relevant Standards b. Specifications c. Approved drawings d. Data Sheets e. Calibration certificate for all the measuring instruments f. Bidder should also coordinate in getting the MDCC's (Material Dispatch clearance certificate) and all types of IC's (Inspection Certificates) from the customer/customer's consultant along with BHEL.
33.	Minor Chipping i.e. up to 50 mm thk, micro leveling and providing shim plates for erection of equipment / item at site shall be in the scope of bidder.
34.	During detail engineering, bidder to strictly adhere to BHEL/ NTPC drawing formats, document numbering, quality plan & FQP formats.
35.	The identification and numbering of equipment, systems, items, etc. of supply, as well as of all documents and drawings shall be in accordance with the VGB guideline RDS-PP (Reference



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	Designation System for Power Plants - KKS system).
36.	Complete detail engineering drawings, calculations, selection of components etc. shall be reviewed & subject to approval of BHEL/NTPC during detail engineering
37.	Bidder shall furnish necessary inputs & drawings of all equipment in editable Auto CAD/ MS-Word /Excel format.
38.	During detail engineering, successful bidder shall ensure flow of drawings/documents as per schedule. Any comments from BHEL/NTPC should be addressed timely by the bidder.
39.	Bidder to note that list above is not exhaustive and any work /items required for completing the smooth operation and ensuring satisfactory running of the machines till final hand over to the end user shall also be in the scope of the bidder.
40.	Bidder shall submit the signed and stamped copy of all the pages which constitutes this technical enquiry specification signed by authorized signatory and clearly mentioning each clause under following two categories to avoid any ambiguity in scope understanding & the scope division along with technical offer. a. "Accepted without deviation and considered in scope of work" b. "Not considered in scope of work"
6.0	PACKING INSTRUCTIONS
1.	Proper packing to be ensured. Indigenous Supply: Pump & sub system assembly shall be wrapped in polythene bags & packed in a strong rigid wooden crate. Rain water should not enter into the item internals during storage in the outer yard of power plant. Imported Supply: All imported supply(supplies from outside India) should be packed as per Sea worthy packing specification no. PE-TS-888-100-A001. All imported items should have Sea worthy packing. Liberal packing materials and struts shall be provided to arrest rolling and to protect from transit damages.
2.	Equipment and process materials shall be packed and semi-knocked down, to the extent possible, to facilitate handling and storage and to protect bearings and other machine surfaces from oxidation. Each container, box, crate or bundle shall be reinforced with steel strapping in such a manner that breaking of one strap will not cause complete failure of packaging. The packing shall be of best standard to withstand rough handling and to provide suitable protection from tropical weather while in transit and while awaiting erection at the site.
3.	Equipment and materials in wooden cases or crates shall be properly cushioned to withstand the abuse of handling, transportation and storage. Packing shall include preservatives suitable to tropical conditions. All machine surfaces and bearings shall be coated with oxidation preventive compounds. All parts subject to damage when in contact with water shall be coated with suitable grease and wrapped in heavy asphalt or tar impregnated paper.
4.	Crates and packing material used for shipping will become the property of owner.(NTPC)
5.	Packaging or shipping units shall be designed within the limitations of the unloading facilities of the receiving ports and the ship will be used. It shall be the bidder's responsibility to investigate these limitations and to provide suitable packaging and shipping to permit transportation to site.



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6.	Packing (tare) shall be part of the equipment cost and shall not be subject to return. The packing should ensure integrity and cohesiveness of each delivery batch of equipment during transportation. In case of equipment assemblies and unit's delivery in the packing of glass, plastics or paper the specification of packing with the material and weight characteristics are to be indicated.
7.	Each package should have the following inscriptions and signs stenciled with an indelible ink legibly and clearly: a. Destination b. Package Number c. Gross and Net Weight d. Dimensions e. Lifting places f. Handling marks and the following delivery marking
8.	Separate packing has to be done for each unit. Each package or shipping units shall be clearly marked or stenciled on at least two sides as per the Dispatch Address given in the indent/enquiry. In addition, each package or shipping unit shall have the symbol painted in red on at least two sides of the package, covering one fourth of the area of the side.
9.	Each part of the equipment which is to be shipped as a separate piece or smaller parts packed within the same case shall be legibly marked to show the unit of which it is part, and match marked to show its relative position in the unit, to facilitate assembly in the field. Unit marks and match marks shall be made with steel stamps and with paint.
10.	Each case shall contain a packing list showing the detailed contents of the package. When any technical documents are supplied together with the shipment of materials no single package shall contain more than one set of such documents. Shipping papers shall clearly indicate in which packages the technical documents are contained.
11.	The case number shall be written in the form of a fraction, the numerator of which is the serial number of the case and the denominator the total number of case in which a complete unit of equipment is packed.
12.	Wherever necessary besides usual inscriptions the cases shall bear special indication such as "Top", "Do not turn over", "Care", "Keep Dry" etc. as well as indication of the center of gravity (with red vertical lines) and places for attaching slings (with chain marks)
13.	Marking for Safe handling: To ensure safe handling, packing case shall be marked to show the following: a. Upright position b. Sling position and center of Gravity position c. Storage category d. Fragile components (to be marked properly with a clear warning for safe handling)
14.	Each crate or package is to contain a packing list in a waterproof envelope. All items are to be clearly marked for easy identification against the packing List. All cases, packages etc. are to be clearly marked on the outside to indicate the total weight where the weight is bearing and the correct position of the slings are to bear an identification mark relating them to the appropriate shipping documents. All stencil marks on the outside of



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	cases are either to be made in waterproof material or protected by shellac or varnish to prevent obliteration in transit.
15.	The packing slip shall contain the following information: - Customer name, Name of the equipment, Purchase Order number with Date, Address of the delivery site, Name and Address of the Sender, Serial Number of Blower & accessories, BHEL item Code, Gross Weight and Net weight of Supplied items.
16.	Prior to transport from manufacturer's work to destination, components of the unit shall be completely cleaned to remove any foreign particles. Flange faces and other machined surfaces shall be protected by an easily removable rust preventive coating followed by suitable wrapping.
17.	All necessary painting, corrosion protection & preservation measures shall be taken as specified in painting schedule. Supplier shall consider the coastal environment zone which is defined as "very severe" during final finishing/shipping.
18.	Successful bidder shall furnish the detail packing /shipment box details with information like packing box size, type of packing, weight of each consignment, sequence no. of dispatch, no. of consignment for each deliverable item against each billing break up units/ billable blocks. Without these details the BBU shall not be approved during detail engineering. Also, complete billing break-up with above mentioned details shall be submitted within 10days of LOI.
19.	All items/equipment shall be dispatched in properly packed condition (i.e. no item shall be dispatched in loose condition such that it becomes difficult to store/identify its location at site at a later stage).
20.	Cases which cannot be marked as above shall have metal tags with the necessary markings on them. The metal tags shall be securely attached to the packages with strong steel binding wire. Each piece, Skid, Case or package shipped separately shall be labelled or tagged properly.
7.0	SUPERVISION OF ERECTION, TESTING AND COMMISSIONING
1.	The erection of Oxidation Blower will be done by owner as per Erection Manual and check List. However, the bidder shall make one visit per boiler for the supervision of erection, pre-commissioning & post- commissioning check-up, start-up, testing and trial runs of all the items covered under the scope of supply.
2.	There will be one visit per unit and total visit will depend on the total no. of Units. The bidder will be informed well in advance for the visit. Bidder shall include minimum 15 working days per visit in the offer and no. of visits shall be as per enquiry/Purchase Order.
3.	TA/DA, travel charges, boarding and lodging shall be borne by the bidder and shall be inclusive in supply portion.
4.	Price comparison for evaluating the lowest bid will be considered all main supply, supervision of E&C charges and mandatory spares price all together.



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8.0	EXCLUSION
	The following work associated with the air blower will be by others: - Supply of main drive HT motor - Civil foundations - Walkways, platforms and ladders - Element handling hoists
9.0	INSPECTION AND TESTING
	The General inspection requirements to be considered are as below:
1.	Bidder shall furnish written copies of shop production, fabrication and quality test procedures and drawings to be used on the Blowers for review by BHEL/NTPC prior to manufacture.
2.	The Bidder shall furnish performance test procedure along with standard. The test procedure will be reviewed and approved by the BHEL/NTPC.
3.	All Oxidation blowers will be inspected at the Bidder's works before dispatch or where the test facilities are available. However, the quantum of check may vary as per the approved quality plan.
4.	The Bidder shall conduct performance test for the remaining blowers and submit the reports.
5.	Final inspection and release by BHEL / NTPC is a mandatory requirement unless specially waived.
6.	A dynamic balancing certificate stating that the rotating assembly has been balanced dynamically shall be sent to BHEL/NTPC within one (1) week of the successful completion of balancing.
7.	Acceptance tolerance of actual versus guaranteed performance for capacity, Static head, efficiency and power absorbed shall be as per applicable standard.
8.	Vibration levels shall be measured during shop running/performance tests.
9.	Contract shaft seals shall be used during shop tests, unless the seal design is unsuitable for the shop-test condition.
10.	Blower shall not be released for shipment, until shop tests data and performance tests curves have been approved by Owner.
11.	Bidder should furnish performance guarantee as per applicable standard guarantee for the design, manufacture, material and safe operation of the equipments.
12.	BHEL/NTPC shall witness the test at Bidder's works and a notice of minimum three (3) weeks shall be given for attending the inspection.
13.	Bidder shall arrange all calibrated gauges, Instruments during inspection.
14.	Mechanical running and the performance test shall be carried out. Bidder shall arrange Motor with same/higher rating for the shop test and inspection.



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15.	The performance test may be carried out using air at shop and shall be converted to the design condition.
16.	Inspection and testing will be done as per NTPC approved Quality Plan. In case of order placed on foreign Vendor, Vendor shall engage and appoint at their cost of any reputed Third Party Inspection Agencies having international presence for carrying out inspection of equipment's and material at vendor's & sub vendors works. Sample QP (indicative) is attached herewith for reference, however any change during final approval will be acceptable to vendor.
10.0	PAINTING
1.	Surface Preparation : Power Tool Cleaning to St3(SSPC-SP3)
2.	Primer Coat : Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats) – 60 $\mu\text{m min}$
3.	Finish Coat : Synthetic Enamel to IS 2932 ;Shade: Grey white RAL 9002 (Two coats) – 60 $\mu\text{m min}$
4.	Rust preventive paint after inspection at shop floor before dispatch shall be in bidder's scope
5.	Corrosion protection, coating and galvanizing, painting shall be taken care by the bidder. The above painting schedule is tentative. Bidder shall submit the painting scheme during detail Engg in line with the specification and shall be subject to approval of BHEL / NTPC.
11	SPARES,TOOLS & TACKLES
11.1	START UP & COMMISSIONING SPARES
	Start-up & Commissioning Spares shall be part of the main supply of Oxidation blowers. Start-up & commissioning spares are those spares which may be required during the start- up and commissioning of the equipment/system. All spares required for successful operation till commissioning of Oxidation blowers shall come under this category. Bidder shall provide an adequate stock of such start up and commissioning spares to be brought by him to the site for the equipment erection and commissioning. The spares must be available at site before the equipments are energized. These start-up & commissioning spare part list shall not be included in "Mandatory spares".
11.2	Mandatory Spares
	Bidder shall quote for the "mandatory spares" as per the enquiry, and it will be considered for L1 evaluation. Initial spare parts items shall be handed over separately and shall not be mixed with the supply of the main equipment parts. Spares shall be sent in pre-decided lots in containers/secure boxes. All boxes/containers are to be distinctly marked in red color with boldly written "S" mark on each face of the containers. Spares shall not be dispatched before dispatch of corresponding main equipment's. Each item shall be labelled in English and be packed against damage and sealed to prevent deterioration from corrosion. The protection shall be sufficient for a minimum of 10 years' storage in a dry weatherproof building. All spares supplied under this contract shall be strictly inter-changeable with the parts for which they are intended for replacements. All the mandatory spares shall be manufactured along with the main equipment components as a continuous operation as per same specification and quality plan. All spares to be used during this contract shall be strictly inter-changeable with the parts for



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	which they are intended for replacements.
11.3	Recommended Spares
	In addition to the spare parts mentioned above, the bidder shall also provide a list of recommended spares for 3 years of normal operation of the plant and should be independent of the list of the mandatory spares. Prices of recommended spares will not be used for evaluation of the bids. The price of these spares shall remain valid up to 6 months after placement of Notification of Award for the main equipment.
11.4	SPECIAL TOOLS & TACKLES:
	Any special tools & tackles required for the entire equipment to disassemble, assemble or maintain the units, they shall be included in the quotation and furnished as part of the initial supply of the machine. List of special tools & tackles shall be decided by bidder as per his proven practice. When special tools are provided, they shall be packaged in separate, boxes with lugs and marked as "Special Tools for (tag / item number)." Each tool shall be stamped or tagged to indicate its intended usage. Levers and eye bolts for the removal of parts to be serviced shall be submitted with special tools.
12.0	PERFORMANCE GUARANTEE
	All performance tests for blowers shall be carried out in accordance with any latest international codes/standards. 1) Bidder shall furnish Performance guarantee for the design, manufacture, material, safe and trouble-free operation of the Oxidation Blower and its accessories 2) Capacity and pressure/head of the blower has to be guaranteed. 3) The bidder shall guarantee 98% availability of equipment for a continues period of 120 days 4) Noise level-≤ 85 dB (A) at 1m horizontal distance from equipment/enclosures and 1.5m above operating floor is to be guaranteed. 5) Vibration levels measured on the non-rotating parts shall not exceed the zone limit "B" as defined in ISO 10816 at steady conditions and shall not exceed the zone limit "C" as defined in ISO 10816 at transient conditions. 6) Acceptance tests to be carried out as per the procedure defined by the bidder which shall be submitted for NTPC's approval. 7) In the event that the performance test is unsuccessful in meeting performance guarantees, bidder shall take necessary remedial action at his cost and the performance test shall be repeated.
13.0	BID EVALUATION CRITERIA FOR POWER CONSUMPTION:
	POWER GUARANTEE Bidder to specify the guaranteed Shaft power per blower operating at the duty point in their offer. Bidder has to meet the minimum efficiency as stipulated in the specification.
1.	BID EVALUATION CRITERIA FOR POWER CONSUMPTION: Power consumption quoted by bidder shall be limited to the ceiling value specified below.



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	The Lowest of the power consumption quoted by any qualified bidder shall be taken as the base or ceiling value. Bid prices of other bidders will be loaded for every KW excess over the ceiling value as per the formula given below. In case, Guaranteed Shaft power offered by the bidder exceeds the ceiling value specified above, his bid price will be loaded for excess power consumption as per the formula given below. Adjustment factor for excess power consumption = $(GPC-BV) \times PL \times \text{No of Working Blowers}$ GPC- Guaranteed Power Consumption quoted by bidder in KW BV- base Value i.e. lowest quoted power consumption in KW PL- Power Loading per KW Exchange rate as applicable on bid opening date will be considered.
14.0	LIQUIDATED DAMAGES FOR POWER CONSUMPTION
1.	If actual Power Consumption during prove out (or) PG Test measured at motor input terminals operating at the duty point exceeds the value guaranteed by the bidder., liquidated damages for shortfall in performance shall be deducted from contract price as per the formula given below Liquidated damage deductible in USD = $(GPC-APC) \times P \times \text{No's of Working Blowers}$ - GPC- Guaranteed Power Consumption quoted by bidder in KW/ blower. - APC- Actual Power Consumption in KW/blower. - P- Penalty per KW Note : 1. LD will be levied after conducting performance test as above subjected to the maximum 10% of the main equipment value. LD will be adjusted from the pending bills payable to the bidder. 2. For conducting PG test at project site for demonstrating the guaranteed parameters of blower, vendor has to make own arrangement for TA/DA and hotel charges, which is to be considered while submitting the offer.
15.0	WARRANTY
1.	The Bidder shall warrant that the equipments/items shall be free from defects in the design, engineering, materials and workmanship of the Plant and Equipment supplied and of the work executed. The Warranty period shall be 24 months from the date of supply or 18 months from the date of commissioning , whichever first occurs. If during the Defect Liability Period any defect should be found in the design, engineering, materials and workmanship of the Plant and Equipment supplied or of the work executed by the Bidder, the Bidder shall promptly, in consultation and agreement with BHEL regarding appropriate remedying of the defects, and at its cost, repair, replace or otherwise make good (as the Bidder shall, at its discretion, determine) such defect as well as any damage to the Facilities caused by such defect..
2.	In case of failure of the equipment to meet the guarantee, NTPC/BHEL reserves the right to reject the equipment. However, NTPC/BHEL reserves the right to use the equipment until new equipment supplied by bidder meets the guaranteed requirement .



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16.0	FIRST FILL OF CONSUMABLES:
1.	Bidder's scope shall also include supply and filling of all chemicals, reagents, resins, lubricants, grease, filters and consumable items for operation up to COD including top up requirements at the time of issuance of PAC/declaration of COD. All lubricants proposed for the plant operation shall be suitable for all operating and environmental conditions that will be met on site consistent with good maintenance procedures as instructed in the maintenance manuals.
2.	Detailed specifications for the lubricating oil, grease, gases, servo fluids, control fluids, chemicals including items qualities and quantities required per month of the plant operation for the NTPC/BHEL's approval herein shall be furnished eighteen (18) months prior scheduled COD of the 1 st unit. On completion of erection complete list of bearings/equipment giving their location and identification marks shall be furnished to NTPC along with lubrication requirements. All types of chemicals, consumables, lubricants and grease shall be readily obtainable locally and the number of different types shall be kept to a minimum. For each type and grade of lubricant recommended, bidder shall list at least three equivalent lubricants manufactured by alternative companies.
17.0	TRAINING
	Successful bidder shall provide comprehensive training for NTPC Engineering, O&M, Erection & Commissioning staffs at site covering all aspects of the Oxidation blower- Operation & Maintenance, Troubleshooting etc.
18.0	CONFLICT
	Bidder's equipment shall be designed for and shall meet the service, performance and minimum level of quality requirements specified. Bidder shall be solely responsible for advising BHEL in writing of any conflicts between the specifications and Bidder's design, including performance and levels of quality. Bidder agrees that its obligations, liabilities and warranties shall not be diminished or extinguished due to its meeting the requirements of the Specification.
19.0	DOCUMENTATION
	The Successful bidder shall submit necessary data, documents and drawings for review, approval with requirements as specified in this specification. Drawings that are reviewed by the NTPC/BHEL will be returned to bidder with a transmittal letter with any comments and / or questions marked on the drawings or noted in the letter. All comments and questions must be resolved before resubmission of drawings / documents. If the design has not developed enough to resolve some of the comments or questions, bidder shall place a "hold" on those items or areas of design. NTPC / BHEL reserves the right to return drawings unprocessed to bidder if there exists any evidence that bidder has not acknowledged all comments and questions. All necessary GA drawings, sections, sub-assembly drawings, specifications of main and sub components and necessary set of operation & maintenance manual as asked by NTPC must be furnished by bidder in soft and hard copy forms. For all documents softcopy format shall be searchable pdf, however in addition all drawings, diagrams like P&IDS shall be supplied in ACAD or other editable format and all lists in Excel format. Further break up of technical documents



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will be discussed during finalization of the purchase contract.

Unless agreed otherwise, ten (10) hard copies and five (05) sets of electronic copies of all documents are to be submitted in the English language. Electronic Copies shall be submitted in primary original data format (e.g. DOC, XLS, DWG) as well as in a printable non-proprietary document format (e.g. PDF). Especially P&IDs shall be submitted as DWG files and PDF files. Bidder to ensure submission of hard copies as per NTPC's requirement for all engineering drg/doc and for all subsequent revisions along with a soft copy through email to concerned project team. However all the engineering related information shall be furnished in soft form to BHEL.



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Annexure-I: TECHNICAL DATASHEET

Enquiry No : _____; Project : _____

1.0	GENERAL	
a	Client	BHEL Ranipet
b	Project	
c	End Customer	NTPC
d	Service	Continuous
e	Installation	In-door
f.	Total number of Blowers	
2.0	MANUFACTURER'S DETAILS	
a	Manufacturer's Name	
b	Type	Centrifugal
c	Type of Driver	Motor (BHEL scope)
d	Area classification	Safe
e	No of Stage	Single stage, integrally geared
3.0	OPERATING CONDITION	
a	Gas composition % by weight / Mole percent %	Atmospheric air
b	Solids at suction g/m3	As per ambient condition
c	Relative humidity at suction %	As per ambient condition
d	Molecular weight	As per ambient condition
f.	Specific weight at suction Kg/m3	As per ambient condition
g.	Capacity at suction Nm3/ Hr-wet	
h	Suction pressure KPa	
i	Discharge pressure mmWc	
j	Differential Pressure	Bidder to confirm
k	Suction temperature Deg C	Ambient
l	Discharge temperature Deg C (after Quenching)	<70
4.0	PERFORMANCE DATA	
a	Capacity Nm3/Hr	
b	Static efficiency %	
c	BKW Normal / Maximum KW	
d	BKW at minimum suction temperature KW	
f.	Motor rating KW	
g.	Motor Speed rpm	
h	Discharge pressure static (inclusive of losses) mmWc	
i	Differential pressure (inclusive of losses) mmWc	
j	Speed Maximum/ Normal/Minimum	
k	Noise level	
l	Filtering Efficiency	



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m	Performance curve	
5.0	CONSTRUCTION DATA	
a	Model No.	
b	Suction (Single)	
c	Suction Rating / Size	
d	Discharge Rating / Size	
f	Type of rotor	
g	Size of rotor Dia mm	
h	Journal bearing: Type / Size:	
i	Thrust bearing: Type / Size:	
j	Bearing cooling required(Yes / No)	
k	Cooling water required(m ³ /hr)	
l	Type of drive	
m	Shaft seal (Packing / Rubber seal)	
n	Size / Code	
o	Type of coupling	
p	Service factor	
q	GD2 at drive shaft end	
r	Rotation viewed from coupling end(Clock wise / Counter clock wise)	
s	Fluid Coupling(Yes / No)	
t	Fluid Coupling make	
u	Fluid Coupling control	
v	Suction filter(Required)	
w	Degree of filtration	
x	Base plate common to Blower. Inboard bearing housing and fluid coupling & Motor (Yes / No)	
y	Total weight kg	
z	Maximum Erection weight kg	
6.0	MATERIALS	
a	Casing	
b	Rotor	
c	Shaft	
d	Packing Seal	
e	Suction filter elements/ housing	
f.	Base frame	

Bidder shall submit completely filled datasheet.

SIGNATURE OF BIDDER

NAME

DESIGNATION



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ANNEXURE – II

a) REFERENCE LIST FOR OXIDATION BLOWERS

Sl.No	Project Name , Customer & Plant capacity	Coal fired Yes/No	Wet Limestone Based FGD Yes/No	Type of blower	Mode I	Capacity	Head	Speed	Year of Com mg	Qty
						Nm ³ /hr.	mmWc	rpm		

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----



TECHNICAL SPECIFICATION OF SINGLE STAGE CENTRIFUGAL BLOWERS

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ANNEXURE – III- LIST OF DEVIATIONS/EXCEPTIONS TO THE ENQUIRY DOCUMENT

Enquiry No : _____; Project : _____

*We hereby fully accept to the technical Specification as per the subject enquiry

Or

*The following are the deviation to the enquiry document

SI No	Clause No	Page No	Description of Deviation

SIGNATURE OF BIDDER _____

NAME _____

DESIGNATION _____

*Strike out whichever is not applicable



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ANNEXURE IV- SCHEDULE OF GUARANTEES

Enquiry No : _____; Project : _____

Sl. No	Description	Data
1.	Rated capacity of Blower Nm ³ /hr	:
2.	Discharge head at rated capacity mmWc	:
3.	Guaranteed power consumption at guarantee point conditions cl. No.5 sl. No.(3) kW	:
4.	Noise level at a distance of 1.0 meter from the equipment at site and 1.5 m above operating floor dB(A)	:
5.	Maximum vibration (peak to peak amplitude at site) microns	:
6.	Equipment Availability (%) for 120 days	:

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----

Annexure V- P&ID of oxidation Blower

SYMBOLS FOR PIPING PARTS
& INSTRUMENT PARTS

SYMBOLS	NAME
	SUCTION FILTER
	SILENCER
	EXPANSION JOINT
	SIGHT GLASS
	REDUCER
	FLEXIBLE HOSE
	BLIND FLANGE
DPI	DIFFERENTIAL PRESSURE INDICATOR (MECHANICAL)
PG	PRESSURE GAUGE
FT	FLOW TRANSMITTER
PT	PRESSURE TRANSMITTER
TG	TEMPERATURE GAUGE
TT	TEMPERATURE TRANSMITTER

MACHINERY SYMBOLS

SYMBOLS	NAME
	FAN / BLOWER

INSTRUMENT SYMBOLS

SYMBOLS	NAME
	FOR DCS

INSTRUMENT VALVE SYMBOLS

SYMBOLS	NAME
	ACTUATED BY MOTOR
	ACTUATED BY PNEUMATIC (REGULATING)

REMARKS

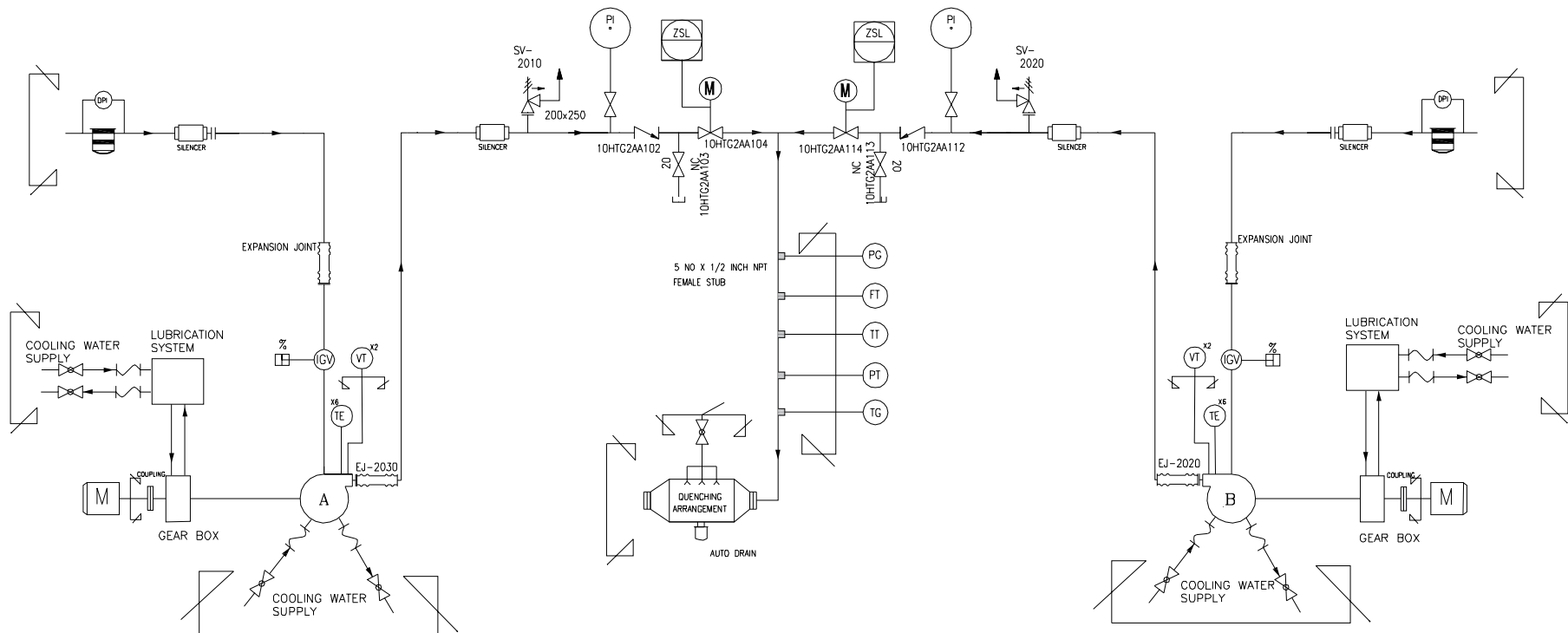
- 1) IN CASE THAT OXIDATION AIR TEMPERATURE IS MORE THAN 120 DEGREE CELCIUS, HEAT-RESISTANT GASKET (WITH EXFOLIATED GRAPHITE OR TEFLON) IS REQUIRED.
- 2) QUENCHING ARRANGEMENT TO BE PROVIDED IF DISCHARGE TEMP>70 C
- 3) THIS P & ID IS TYPICAL FOR UNIT-1 THE SAME IS APPLICABLE FOR UNIT-2/UNIT-3 (AS APPLICABLE)
- 4) PIPE SIZING AND ALL INTER CONNECTING PIPES FROM SUCTION FILTER TO QUENCHING CHAMBER OUTLET FLANGE IN VENDOR SCOPE. TO BE INDICATED BY VENDOR DURING OFFER
- 5) COOLING WATER INLET & OUTLET TERMINATION WITH FLEXIBLE HOSE & BALL VALVE IN VENDOR SCOPE
- 6) PROVISION FOR VIBRATION TRANSMITTER MOUNTING ARRANGEMENT TO BE PROVIDED AT BASE FRAME BY VENDOR.
- 7) ANY INSTRUMENT SUPPLIED TO BE PROFIBUS COMPATIBLE.

PIPING VALVE SYMBOLS

SYMBOLS	NAME
	GATE VALVE (NOR.CLOSED)
	GLOBE VALVE (NOR.CLOSED)
	BUTTERFLY VALVE (NOR.CLOSED)
	CHECK VALVE
	PRESSURE RELIEF VALVE
	BALL VALVE

NOTE:

- 1 HT motor is in BHEL scope. Bidder shall supply coupling for secondary transmission.
- 2 Each blower shall be complete with following items (vendor scope)
 - I. Casing
 - II. Rotor and Shaft assembly
 - III. Common base frame for the blower including motor and shock absorber
 - IV. Suction filter
 - V. Suction & Discharge silencers
 - VI. Lubrication system
 - VII. Accessory piping within the skid as per P&ID
 - VIII. Safety Valves, Check valves, Motorised Gate valve, isolation valves and other valves as per P&ID and specification.
 - X. Acoustic Enclosure to meet specified Noise Level 85 dBA
 - XI. Coupling with guards
 - XII. Expansion joints at inlet and Discharge of blower
 - XIII. Companion flanges with gaskets and fasteners
 - XIV. Bearing cooling
 - XV. Foundation bolts for supplied items
 - XVI. Instruments : Differential pressure indicator in the suction filter, 6 Nos RTD for each blower(3 no's at each Drive end and Non-Drive End), Pressure Indicator at discharge as per P&ID. Any other instruments, not indicated in the P&ID, but required as per blower manufacturer's standard practice or required for the completeness of the system shall also be provided
 - XVII. All the instruments have to be connected to JB's.
 - XVIII. All the instruments have to be provided with isolation valves
 - XIX. Supporting structure required for the silencer shall be provided with mounting fasteners including anchoring bolt.
 - XX. All valves shall be provided with counter flanges
 - XXI. Flexible hose with ball valve at inlet & outlet of all cooling water line.
- Water Quenching arrangement shall be provided at the common discharge of the blowers. Quenching arrangement shall be complete with enclosure, pipes, nozzles, flange connection for water, Floor mounting arrangement.
- 3
- 4 For complete scope Bidder shall refer P&ID & Specification.



10 HTG 00 AN 001
OXIDATION AIR BLOWER A

10 HTG 00 AN 002
OXIDATION AIR BLOWER B

BHEL SCOPE

VENDOR SCOPE

BHEL SCOPE

CUSTOMER: NTPC LIMITED. FGD SYSTEM PACKAGE			
	DEPT CODE	NAME (BHEL)	DATE
	DRN	E. LOGESH	19.11.19
	CHD	R.YUVARAJ	19.11.19
	APPD	P.NAVEEN	19.11.19
MITSUBISHI HITACHI POWER SYSTEMS, LTD. AIR QUALITY CONTROL SYSTEMS TECHNOLOGY DIVISION			
TITLE: P & ID - OXIDATION AIR BLOWER SYSTEM ALONGWITH WRITEUP- UNIT1			SCALE : NTS
NTPC DRG NO:			
BHEL DRG NO	FILE NO	REV NO	
		00	

CLAUSE NO.	TECHNICAL REQUIREMENTS		
2.00.00	SPECIFICATION FOR ELECTRONIC TRANSMITTERS		
2.01.00	SPECIFICATION FOR ELECTRONIC TRANSMITTER FOR PRESSURE, DIFF PRESS AND DP BASED FLOW / LEVEL MEASUREMENTS		
	SI.No.	Features	Essential/Minimum Requirements
	1.	Type of Transmitter	Microprocessor based 2 wire type (loop powered), Hart protocol compatible.
	2.	Accuracy	± 0.1% of calibrated span (minimum)
	3.	Output signal range	4-20 mA DC (Analog) along with superimposed digital signal (based on HART protocol)
	4.	Turn down ratio (minimum)	10:1 for vacuum/very low pressure applications (i.e. pressure <= 200 mmWC) 5:1 for very high pressure application (i.e. pressure >= 200 Kg/cm2) 30:1 for other applications
	5.	Stability	± 0.1% of calibrated span for six months for Ranges up to and including70 Kg/cm² ± 0.25% of calibrated span for six months for Ranges more than 70 Kg/cm²
	6.	Zero and span drift	+/- 0.015% per deg.C at max span +/-0.11% per deg.C at min. Span
	7.	Load impedance	500 ohm (minimum)
	8.	Housing	Weather proof as per IP-65, metallic housing with durable corrosion resistant coating
	9.	Over Pressure	150% of max. Operating pressure
	10.	Connection (Electrical)	Plug and socket type
	11.	Process connection	1/2 inch NPT (F)
	12.	Span and Zero	Continuous, tamper proof, Remote as well as manual adjustability from instrument with zero suppression and elevation facility.
	13.	Accessories	-Diaphragm seal, pulsation dampeners, syphon etc. as required by service and operating condition. -2 valve manifold for absolute & Gauge pressure transmitters, 3-valve and 5 valve manifold for DP/Level/Flow applications. The valve manifold shall be non integral type (except Fuel Oil area).
LOT-IB PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOCUMENT NO.: CS-0011-109(1B)-9	SUB-SECTION-III-C2 MEASURING INSTRUMENTS PAGE 2 OF 34

CLAUSE NO.	TECHNICAL REQUIREMENTS																
2.02.00		-For hazardous area, explosions proof enclosure as described in NEC article 500															
		Mounting: 2 inch pipe mounting.															
	14.	Diagnostics & display	Self-Indicating feature and digital display on transmitter														
	15.	Power supply	24V DC ± 10%.														
	16.	Adjustment/calibration/maintenance	From hand held HART calibrator/ centralized PC based system (as applicable).														
	Notes																
	- For primary air/ secondary air/flue gas applications, DP type transmitters shall be provided for pressure measurement. - LVDT type is not acceptable. - Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application.																
	GUIDED WAVE RADAR TYPE LEVEL TRANSMITTER																
	<table><tr><td>Type</td><td>Microprocessor based 2 wire type (loop powered), HART protocol compatible Guided wave radar transmitter.</td></tr><tr><td>Principle</td><td>TDR (Time domain reflectometry)</td></tr><tr><td>Probe Type & Material</td><td>(i) Coaxial probe of SS316/316L. If required, probe shall be suitable for overfill prevention. (ii) Rod probe, cable probe of SS316/SS316L can be used for applications wherever coaxial probe is not suitable.</td></tr><tr><td>Output signal</td><td>4-20 mA DC along with superimposed digital signal (based on HART protocol), suitable for over fill prevention.</td></tr><tr><td>Accuracy</td><td>+/- 0.5% of calibrated span or minimum 5mm.</td></tr><tr><td>Power supply</td><td>24 VDC +/- 10%.</td></tr><tr><td>Housing</td><td>Weather proof as per IP-65, metallic housing with durable corrosion resistance coating.</td></tr></table>			Type	Microprocessor based 2 wire type (loop powered), HART protocol compatible Guided wave radar transmitter.	Principle	TDR (Time domain reflectometry)	Probe Type & Material	(i) Coaxial probe of SS316/316L. If required, probe shall be suitable for overfill prevention. (ii) Rod probe, cable probe of SS316/SS316L can be used for applications wherever coaxial probe is not suitable.	Output signal	4-20 mA DC along with superimposed digital signal (based on HART protocol), suitable for over fill prevention.	Accuracy	+/- 0.5% of calibrated span or minimum 5mm.	Power supply	24 VDC +/- 10%.	Housing	Weather proof as per IP-65, metallic housing with durable corrosion resistance coating.
	Type	Microprocessor based 2 wire type (loop powered), HART protocol compatible Guided wave radar transmitter.															
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Output signal	4-20 mA DC along with superimposed digital signal (based on HART protocol), suitable for over fill prevention.																
Accuracy	+/- 0.5% of calibrated span or minimum 5mm.																
Power supply	24 VDC +/- 10%.																
Housing	Weather proof as per IP-65, metallic housing with durable corrosion resistance coating.																
LOT-IB PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOCUMENT NO.: CS-0011-109(1B)-9	SUB-SECTION-III-C2 MEASURING INSTRUMENTS														
PAGE 3 OF 34																	

CLAUSE NO.	TECHNICAL REQUIREMENTS		
2.03.00	Adjustment/ calibration	Using hand held HART calibrator/ centralized PC based system (as applicable).	
	Zero & span adjustment	Continuous, temper proof, remote as well as manual adjustability from instrument. It should be possible to calibrate the instrument without any level in the tank/sump etc.	
	Display	Integral digital display.	
	Load Impedance	500 ohms (minimum).	
	Electromagnetic compatibility	Shall meet EN 61326-1 (1997) and AmdtA1, class A equipment/EN 50081-2 & EN 5008 1-2 & EN 50082-2	
	Mounting	(i) External cage shall be provided where ever side mounting is required. External cage and other mounting accessories to be provided by the contractor. (ii) Where ever top mounting is required, all mounting accessories, stilling well (as required) etc., shall be provided by the contractor. (iii) All weather canopy shall be provided for protection from direct sunlight and direct rain for open locations.	
	Note: Four wire type transmitters can also be provided for applications where 2- wire transmitter has some technical limitations, subject to employer's approval during detailed engineering stage. However, in such cases isolated 4-20 mA DC (analog) output shall be provided. Power supply required for such transmitters shall be 240V AC / 24V DC.		
	Ultrasonic Type level Transmitter		
	S.No.	Features	Essential/Minimum requirement
	1.	Type of Transmitter	Non-contact Microprocessor based 2 wire type (loop powered), HART protocol compatible Ultrasonic transmitter.
2.	Output signal	4-20 mA DC (Analog) along with superimposed digital signal (based on HART protocol).	
LOT-IB PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOCUMENT NO.: CS-0011-109(1B)-9	SUB-SECTION-III-C2 MEASURING INSTRUMENTS PAGE 4 OF 34

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	3.	Accuracy	+/- 0.5% of calibrated span or minimum 5mm.	
	4.	Power supply	24 V DC +/- 10%.	
	5.	Temperature compensation	To be provided within transducer.	
	6.	Housing	Weather proof as per IP-65, metallic housing with durable corrosion resistance coating.	
	7.	Adjustment/calibration/ maintenance	Using hand held HART calibrator/ centralized PC based system (as applicable).	
	8.	Zero and Span adjustment	Continuous, tamper proof, remote as well as manual adjustability from instrument. It should be possible to calibrate the instrument without any level in the tank/sump etc.	
	9.	Sensor Material	Corrosion resistant material to suit individual application requirement.	
	10.	False signal tolerance	Transmitter shall be capable of ignoring false echoes from internal tank/sumps obstructions such as pipes, heating coils or agitator blades. Also transmitter shall have adjustable damping circuitry.	
	11.	Range	Range of transmitter shall be capable of covering the complete level span of tank taking care of blocking distance, frequency attenuation due to surface, obstructions, vapors etc.	
	12.	Display	Integral digital display	
	13.	Diagnostics	Loss of echo alarm etc.	
	14.	Load Impedance	500 ohms (minimum).	
	15.	Electrical Connection	Plug and socket	
LOT-IB PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOCUMENT NO.: CS-0011-109(1B)-9	SUB-SECTION-III-C2 MEASURING INSTRUMENTS	PAGE 5 OF 34

CLAUSE NO.	TECHNICAL REQUIREMENTS		एनडीपीसी NTPC												
2.04.00	16.	Accessories	- All weather canopy shall be provided for protection from direct sunlight and direct rain for open locations. - All mounting accessories required for erection and commissioning shall be provided. - For hazardous area, explosion proof enclosure as described in NEC article 500												
	Note:														
	1) Contractor can also provide Radar type transmitter as per above specification in place of ultrasonic transmitter subject to approval by Employer during detailed Engineering. Sonic frequency based transmitters can also be provided under “ultrasonic transmitters” category for fly ash silo level.														
	2) Four wire type transmitters can also be provided for applications where 2- wire transmitter has some technical limitations, subject to employer’s approval during detailed engineering stage. However, in such cases isolated 4-20 mA DC (analog) output shall be provided. Power supply required for such transmitters shall be 240V AC / 24V DC.														
	3) For applications where transmitter location is not accessible, the transmitter shall have separate sensor unit and electronic unit for such applications. It shall be possible to mount the electronic unit at accessible location.														
Specification for ULTRASONIC TYPE FLOW TRANSMITTER															
<table><tr><th>S.No</th><th>Features</th><th>Essential/Minimum requirement</th></tr><tr><td>1.</td><td>Type of Transmitter</td><td>Non contact Microprocessor based 2 wire type, HART protocol compatible Ultrasonic transmitter. Insertion type.</td></tr><tr><td>2.</td><td>Output signal</td><td>4-20 mA DC (Analog) along with superimposed digital signal (based on HART protocol).</td></tr><tr><td>3.</td><td>Sensor Accuracy</td><td>+/- 2% of calibrated span.</td></tr></table>				S.No	Features	Essential/Minimum requirement	1.	Type of Transmitter	Non contact Microprocessor based 2 wire type, HART protocol compatible Ultrasonic transmitter. Insertion type.	2.	Output signal	4-20 mA DC (Analog) along with superimposed digital signal (based on HART protocol).	3.	Sensor Accuracy	+/- 2% of calibrated span.
S.No	Features	Essential/Minimum requirement													
1.	Type of Transmitter	Non contact Microprocessor based 2 wire type, HART protocol compatible Ultrasonic transmitter. Insertion type.													
2.	Output signal	4-20 mA DC (Analog) along with superimposed digital signal (based on HART protocol).													
3.	Sensor Accuracy	+/- 2% of calibrated span.													
LOT-IB PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOCUMENT NO.: CS-0011-109(1B)-9	SUB-SECTION-III-C2 MEASURING INSTRUMENTS PAGE 6 OF 34												

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	4.	Power supply	24 V DC +/-10%.
	5.	Temperature compensation	To be provided within transducer.
	6.	Housing	Weather proof as per IP-55 with durable corrosion resistance coating.
	7.	Adjustment/calibration/maintenance	From hand held calibrators/centralized PC based system (as applicable).
	8.	Zero and Span adjustment	Continuous, tamper proof, remote as well as manual to calibrate the instrument without any process flow.
	9.	Sensor Material	Corrosion resistant material to suit individual application requirement.
	10.	False signal tolerance	Transmitter shall be capable of ignoring false echoes from internal tank/sumps obstructions such as pipes, heating coils or agitator blades. Also transmitter shall have adjustable damping circuitry.
	11.	Range	Should be suitable for the required process range.
	12.	Display	LCD display with integral keypad to be provided.
	13.	Diagnostics	Loss of echo alarm etc.
	14.	Load Impedance	500 ohms minimum
	15.	Electrical Connection	Plug and socket
	16.	Accessories	• All weather canopy for protection from direct sunlight and direct rain. • All mounting hardware and accessories required for erection and commissioning mounting fittings materials shall be SS 316. • For hazardous area, explosion proof enclosure as described in NEC article 500

CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC																								
2.05.00	HART Hand Held calibrator Hand held calibrator shall be provided for adjustment/calibration/maintenance of the HART compatible transmitters. The hand held calibrator shall be suitable for all types of transmitters supplied in the package. If one type of hand held type calibrator is not suitable for communicating with all types of transmitters then separate hand held calibrator will be provided for that specific type of transmitter.																										
3.00.00	Temperature Elements and accessories																										
3.01.00	Thermocouple <table><tr><th>Sr. No.</th><th>Features</th><th>Essential/Minimum Requirements</th></tr><tr><td>1</td><td>Type of Thermocouple.</td><td>: 16 AWG wire of Chromel-Alumel (Type K) or 24 AWG wire Pt-Rhodium Pt (Type R) depending on operating temperature Range (ungrounded separate junction type).</td></tr><tr><td>2</td><td>No. of element</td><td>: Duplex</td></tr><tr><td>3</td><td>Housing/Head</td><td>: IP-65/Diecast Aluminium. Head of TE to be provided with sufficient space and arrangement to mount head mounted temperature transmitter (as applicable). Plug in connectors are to be provided for external signal cable connection. TE terminal head shall be spring loaded for positive contacts with the thermo well.</td></tr><tr><td>4</td><td>Insulation and Sheathing of Thermocouple</td><td>: Swaged type mineral (magnesium oxide) insulation and SS316 sheath.</td></tr><tr><td>5</td><td>Calibration and accuracy</td><td>: As per IEC-584/ ANSI-MC-96.1 (special limits of errors/ class1) for T/C.</td></tr><tr><td>6</td><td>Accessories</td><td>: Thermo well and associated fittings</td></tr><tr><td>7</td><td>Standard</td><td>: IEC-584/ ANSI MC 96.1 for Thermocouple and ASME PTC-19.3 for Thermo-well</td></tr></table>			Sr. No.	Features	Essential/Minimum Requirements	1	Type of Thermocouple.	: 16 AWG wire of Chromel-Alumel (Type K) or 24 AWG wire Pt-Rhodium Pt (Type R) depending on operating temperature Range (ungrounded separate junction type).	2	No. of element	: Duplex	3	Housing/Head	: IP-65/Diecast Aluminium. Head of TE to be provided with sufficient space and arrangement to mount head mounted temperature transmitter (as applicable). Plug in connectors are to be provided for external signal cable connection. TE terminal head shall be spring loaded for positive contacts with the thermo well.	4	Insulation and Sheathing of Thermocouple	: Swaged type mineral (magnesium oxide) insulation and SS316 sheath.	5	Calibration and accuracy	: As per IEC-584/ ANSI-MC-96.1 (special limits of errors/ class1) for T/C.	6	Accessories	: Thermo well and associated fittings	7	Standard	: IEC-584/ ANSI MC 96.1 for Thermocouple and ASME PTC-19.3 for Thermo-well
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LOT-IB PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOCUMENT NO.: CS-0011-109(1B)-9	SUB-SECTION-III-C2 MEASURING INSTRUMENTS PAGE 8 OF 34																								

CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC	
3.02.00	Resistance Temperature Detector (RTD)			
	Sr. No.	Features	Essential/Minimum Requirements	
	1	Type of RTD.	: Four wire, Pt-100 (100 Ohms resistance at zero degree Centigrade).	
	2	No. of element	: Duplex	
	3	Housing/Head	: IP-65/Diecast Aluminium. Head of TE to be provided with sufficient space and arrangement to mount head mounted temperature transmitter (as applicable). Plug in connectors are to be provided for external signal cable connection. TE terminal head shall be spring loaded for positive contacts with the thermo well	
	4	Insulation and sheathing of RTD	: Mineral (magnesium oxide) insulation and SS316 sheath,	
	5	Calibration and accuracy	: As per As per IEC-751/ DIN-43760 Class-A for RTD	
	6	Accessories	: Thermo well and associated fittings	
	7	Standard	: IEC-751/ DIN-43760 for RTD and ASME PTC-19.3 for Thermo-well.	
	NOTES :			
1)	The specifications for RTDs of winding/ bearings of motor/pump, can be as per their manufacturer standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice. However the type of RTD shall be Pt100.			
2)	The specifications of temp elements for air conditioning & ventilation system / process can be as per system manufacturer's standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice.			
3.03.00	Metal Temperature Thermocouples			
	Measuring Medium	Metal Temperature		
	Material of Thermocouple.	Chromel Alumel Type K		
	Type of Thermocouple	Duplex with ungrounded separate hot junctions		
	Insulation	Mineral Insulation (Magnesium Oxide).		
LOT-IB PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOCUMENT NO.: CS-0011-109(1B)-9	SUB-SECTION-III-C2 MEASURING INSTRUMENTS	PAGE 9 OF 34

CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC	
	Thermocouple wire gauge16 AWG Protective sheathSS 321 Protective sheath dia8 mm OD Calibration & accuracyAs per IEC-584/ ANSI-MC-96.1 (special limits of error) for T/C Mounting accessories1/2" BSP SS sliding end connector, weld pad, clamps of heat resistant steel SS310. Adjustable gland fitting for connection at the junction box end as per manufacturer's standard. Cold end sealingSS pot seal with colour coded PTFE Insulated flexible tails. Sealing compound- Epoxy resin. Length of PTFE insulated flying leads shall be minimum 750 mm. Minimum bending radius30 mm Length of T/COn as required basis considering location of measurement point and the JB/TTJB location. Notes : 1) The specification for thermocouples of bearings metal temp measurements can be as per their manufacturer standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice. However type of thermocouples shall be K-type.			
3.04.00	Thermo well (for all process temp. elements) (a) Shall be one piece solid bored type of 316 SS of step-less tapered design. (As per ASME PTC 19.3, 1974) (b) For Mill classifier outlet long life solid sintered tungsten carbide material of high abrasion resistance shall be provided. (c) For Air & Flue gas 316 SS protecting tube with welded cap. (However contractor shall provide better material for Flue gas service if required based on the specified boiler design parameters). (d) For furnace zone, impervious ceramic protecting tube of suitable material along with Incoloy supporting tubes and adjustable flanges.			
3.05.00	TEMPERATURE TRANSMITTER (TT) Following types of 2-wire (loop powered) temperature transmitter (directly powered from 4-20mA input cards of DDCMIS/PLC) shall be provided. The temperature transmitter shall be fully compatible with thermocouples and RTDs being provided by the contractor. Temperature compensation of the thermocouples shall be performed in the temperature transmitter itself.			
LOT-IB PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOCUMENT NO.: CS-0011-109(1B)-9	SUB-SECTION-III-C2 MEASURING INSTRUMENTS	PAGE 10 OF 34

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	a. Single Input Head mounted Temperature Transmitter These shall be suitable for mounting in the head of temperature element itself. Temperature transmitter and associated temperature element shall be factory fitted. b. Single Input DIN-rail mounted Temperature Transmitter These shall be suitable for mounting on DIN-rails in JBs. The specifications of the JBs shall be same as indicated in Subsection INST CABLE with additional DIN-rails and IP 65 Protection class. This temperature transmitter shall be the ones which are especially designed for DIN-rail mounting with IP 20 protection class. These shall have terminals for input/output provided on front side when mounted on DIN-rail. Head mounted temperature transmitter with clamps to make it suitable for DIN-rail mounting shall not be acceptable under this category. c. Dual-input Temperature Transmitter With integral Indicator: These shall be suitable for mounting on pipes/ support. Both elements of the duplex thermocouple/ RTD shall be wired to a single transmitter. Integral indicator shall be provided with these transmitters. These transmitters shall have bump less change over facility to second sensor in case first sensor fails .This change-over is to be alarmed. Protection class shall be IP65 minimum. d. Common requirements for each of the above type of temperature transmitters. Output : 2-wire (power supply from input card of Control System) with 4-20mA output with superimposed HART protocol signal. Input : Same transmitter shall be capable to handle Pt-100 RTD, Thermocouples –K & R types (input type to be selectable at site through HART terminal). Isolation : Min. 500 V AC. EMC compatibility : As per EN 61326. Operating ambient temperature : 0 to 85 deg C (without indicator). 0 to 70 deg C (with indicator). Power supply 24V DC +/- 10%. Accessories Mounting arrangements including clamps etc. Composite Accuracy (i) For head mounted and DIN-rail mounted types: (Refer note 2) RTD =<0.4% of 0-250 deg C span T/C-K type =<0.4% of 0-600 deg C span T/C-R type =<0.4% of 0-1000 deg C span CJC accuracy (for thermocouples) shall be =< 1 deg C (ii) For dual-input type: RTD =<0.25% of 0-250 deg C span T/C-K type =<0.2% of 0-600 deg C span CJC accuracy (for thermocouples) shall be =< 1 deg C			
LOT-IB PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOCUMENT NO.: CS-0011-109(1B)-9	SUB-SECTION-III-C2 MEASURING INSTRUMENTS	PAGE 11 OF 34

CLAUSE NO.	TECHNICAL REQUIREMENTS			
4.00.00	Notes (Common for a) to d) above):- - In case of failure (open or burn-out) of RTD/thermocouple, temp. Transmitter shall provide low temperature output. - Composite Accuracy is to be calculated as summation of all applicable accuracies of temp transmitter, for converting sensor input to output in 4-20 mA (e.g., basic accuracy, digital accuracy, D/A accuracy, etc.) and temperature effect on these accuracies at ambient temperature of 50 deg C, based on the figure/ formula given in the standard product catalogue for span as specified above for various types of Temperature Elements specified. All such accuracy/ temp effect figures in catalogue shall be first converted to deg C, and then percentage of this converted accuracy in specified span shall be calculated to compare with the specified composite accuracy figures. All temperature transmitters are to be interchangeable (i.e. can be used for either RTD or thermocouple) and composite accuracy shall be met for each type of input specified in (i) & (ii). SPECIFICATIONS FOR PR. GAUGE, D.P. GAUGE, TEMP. GAUGE AND LEVEL GAUGE.			
	SI. No	FEATURES	ESSENTIAL/MINIMUM REQUIREMENTS	
			Pr. Gauge/ DP Gauge/ Draught gauges	Temperature Gauge Level Gauge
	1	Sensing Element	Bourdon for high pressure, Diaphragm/ Bellow for low pr.	Inert gas actuated/ Liquid filled other than mercury Tempered * toughened Borosilicate gauge glass steel armoured reflex or transparent type.
	2	Material of sensing element	SS 316	SS 316
	3	Material of movement	SS 304	SS 304
	4	Body material	Die-cast aluminium	Die-cast aluminium Forged carbon steel/304 SS
	5	Dial size	150mm	150 mm Tubular covering entire range
	6	End connection	1/2 inch NPT (M)	1/2 inch or 3/4 inch NPT (M). Process connection as per ASME PTC and drain/vent 15 NB
LOT-IB PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOCUMENT NO.: CS-0011-109(1B)-9		SUB-SECTION-III-C2 MEASURING INSTRUMENTS PAGE 12 OF 34

CLAUSE NO.	TECHNICAL REQUIREMENTS					
	7	Accuracy	±1% of span	± 1% of span	± 2%	
	8	Scale	Linear, 270° arc graduated in metric units	Linear, 270° arc graduated in °C	Linear vertical	
	9	Range selection	Shall cover 125% of max. operating press	Shall cover 125% of max. operating temp	Shall cover max. Operating level.	
	10	Over range	125% of FSD	125% of FSD	-	
	11	Housing	Weather and dust proof as per IP-55	Weather and dust proof as per IP-55	CS/304 SS leak proof	
	12	Zero/span adjustment	Provided	Provided	--	
	13	Identification	Engraved with service legend or laminated phenolic name plate			
	14	Accessories	Blow out disc, siphon, snubber, pulsation dampener, chemical seal (if required by process) gauge isolation valve	SS Thermowell	Gasket for all KEL-F shield for transparent type vent and drain valves of Steel/SS as per CS/Alloy process Requirement.	
	Notes:-					
	*Bicolour type level gauges will be provided for applications involving steam and water except for condensate and feed water services.					
	Length of gauge glass shall not be more than 1400 mm. If the vessel is higher, multiple gauge glasses with 50 mm overlapping shall be provided.					
	Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application.					
	LOT-IB PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOCUMENT NO.: CS-0011-109(1B)-9		SUB-SECTION-III-C2 MEASURING INSTRUMENTS	PAGE 13 OF 34

Annexure- Inspection and Testing requirements

Annexure to Enquiry no:		Date
Sl.No	BHEL / Customer Requirement	##Specific confirmations by the manufacture
1	Quality Plan Requirement:	
	(i) MQP (Manufacturing Quality Plan) shall be submitted in attached format for BHEL/Customer review & approval. Typical MQP is attached for indicative purposes for guidance & use.	
	(ii) MQP shall invariably cover w.r.t Inward inspection including on Raw material Procurement, In process and Final inspection in elaborated way/details.	
	(iii) Bidder shall also to give specific confirmation that on need basis, their competent officials shall visit to BHEL/customer for finalization of Quality plan including test procedure/methodology during preaward / post award approval / detailed engineering in the event of an order.	
	(iv) No deviation on BHEL/Customer approved MQP is acceptable.	
	(v) Bidder shall agree to submit all cross referred documents other than codes/standards to BHEL/Customer/Consultant.	
	Important Notes shall be included in MQP : (a) Latest revision of Standards & Specification shall apply. Only International Standards are applicable. Indian & Chinese Standards are not applicable (b) Materials shall be procured in compliance to Functional Technical Specification. (c) Inspection shall be in compliance with Approved Quality Control Procedure for the Product. (d) NDT shall be carried out by Qualified Personnel with compliance to Approved NDT Procedures and Acceptance Norms, as per ASME Section V. (e) Gauges and measuring Instruments, with valid calibration only shall be used. (f) Cleaning and Painting of products shall be carried out as per Approved Painting Schedule. (g) Finished Products shall be packed to comply with Approved Packing Schedule. (h) Welding shall be carried out by Qualified Personnel with compliance to Approved NDT Procedures and Acceptance Norms, as per ASME Section V.	
2	Domestic / Inland Inspection will be carried out by BHEL/BHEL appointed Third Party Inspection Agency (TPIA) / Customer/Customer Appointed Inspection Agency/Consultant. This is applicable for all Stage inspection and Final Inspection identified as "W" - Witness or "CHP" - Customer Hold Point as per customer approved Quality Plan/ Technical specification / Approved Drawing/ Approved Data sheet / Scheme / PID / PFD / SLD (Process Instrumentation Diagram / Process Flow Diagram / Single Line Diagram) etc (As applicable).	
3	Inspection Agency for Foreign Bidders and also for Indian Bidder but importing from Foreign Sources : (1) Any one of the following Third Party Inspection Agency (TPIA) shall be appointed by the bidder and same shall be furnished by the bidder in techno commercial bid itself. (2) The details of TPIA with contact details like Name of the official, Phone no, Email id shall also to be submitted during pre/post award. However cost for such inspection agency shall be borne by the bidder only. Inspection charges for such inspection agency shall be indicated separately so that if BHEL/Customer is undertaking the inspection by on their own, then these charges non claimable by the bidder. List of TPIA 1.M/s Bureau Veritas 2.M/s TUV-Nord 3.M/s TUV-SUD 4.M/s TUV Rheinland 5.M/s Lloyds Register 6.M/s SGS 7.M/s Germanischer Lloyd 8.M/s QUEST 9.M/s Certification Engineers International 10.M/s Intertek 11.M/s IR Class Systems and Solutions 12.M/s DNV 13. M/s Fichtner 14. M/s ABS Inspection Services	

Sl.No	BHEL / Customer Requirement	##Specific confirmations by the manufacture
4	Stage Inspection during manufacturing Process : Stage Inspection during manufacturing shall be carried out as per approved quality plan and all necessary documents shall be provided for review, verification and clearance for further processing. This inspection call shall be given well in advance (atleast 2 weeks before) to TPI/Bidder's own inspection agency to avoid delay in the manufacturing processes.	
5	Inspection before despatch for domestic supplier : Inspection before despatch at supplier's works shall be carried out by BHEL/BHEL appointed Inspection agency. Inspection shall be done as per approved Quality plan/ Technical specification/ Approved Drawing/ Approved Data sheet .	
6	Inspection at Foreign Source/Supplier: (a) As in sl no: 3. shall be ensured without fail (b) No material / items shall be despatched without getting the written communication from BHEL / Customer inspection carried out by BHEL/BHEL appointed Third Party Inspection Agency (TPIA) / Customer/Customer Apointed Inspection Agency/Consulatnat. This is applicable for all Stage inspection and Final Inspection identified as "W" - Witness or "CHP" - Customer Hold Point as per customer approved Quality Plan/ Technical specification / Approved Drawing/ Approved Data sheet / Scheme / PID / PFD / SLD (Process Instrumentaion Diagram / Process Flow Diagram / Single Line Diagram) etc (As applicable). Inspection before despatch for Foreign supplier : Inspection before despatch at supplier's works shall be carried out by bidder appointed inspection agencies having international presence at vendors and or vendor's sub vendor works. Inspection shall be done as per approved Quality plan/ Technical specification/ Approved Drawing/ Approved Data sheet by TPIA mentioned in Sl no: 03 at supplier's cost.	
7	Painting shall be done strictly as per BHEL/Customer approved painting schedule / scheme only. Paint Thickness / Paint shade shall be ensured as per BHEL / Customer approved painting schedule / specification / data sheet etc. No deviation is acceptable unless otherwise accepted by BHEL/Customer in writing. Any conflict if any among BHEL / Customer approved painting schedule / Spec / data sheet etc shall be brought to the notice to BHEL well in advance before proceeding including the BOI being procured for assy / skid like motors etc	
8	Specific conformation for document package in the event of an order (2 Hard copies & soft copy in PDF file) is to be given containing the following with proper linkages (i) Index Sheet (ii) MQP/RQP/Endorsement Sheet (As applicable) (iii) TCs identified by BHEL/ Customer for record for "CHP" / "W" and Verification portion ("V") as given in approved QP. (iv) Final inspection report + TC including Chemical + Mechnaical + HT + NDT etc (v) Third party Inspection report + TC (vi) Customer CHP/ MDCC (vii) Type test / Performance Test reports conducted (viii) Type test / Performance Test approval/ clearance obtained from BHEL/Customer (ix) BOM with As Build Drgs with actual make / rating used with BHEL/customer approved drawings.	
9	Packing / Seaworthy Packing shall be as per BHEL Packing schedule / approved drg / sketch. This shall be ensured to take care tarsnit / handling / transhipment in Road / Sea / Air. Photographs are to be submitted for BHEL review before despatching the material as per contract conditions.	
10	Outsourcing of test facilities: Bidder shall ensure all the testing facilities in house. However If any of the test facilities are not available with successful bidder, then bidder shall ensure the same at NABL accreadted third party lab / Govt / Govt Lab for major testing such as NDT, Electrical & Mechanical testing.	
11	Important Note: No deviation on the above requirement 01 to 10 is acceptable w.r.t Quality Requirement and those offers not meeting these specific customer requirement is liable for rejection and hence the bidder shall submit all the required documentary evidences in the offer itself.	
12	## Necessorily to be filled up by the bidder at the time of offer itself otherwise the offer may not be considered w.r.t Quality Requirement being customer specific requirement.	

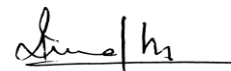
Quality plan given below is only indicative. Inspection will be done as per QP which will be approved during contract stage.

 Ranipet	MANUFACTURER'S NAME AND ADDRESS M/S BHEL: BAP: RANIPET 632 406 TAMIL NADU		STANDARD QUALITY PLAN ITEM: OXIDATION BLOWER SYSTEM: FGD								QP NO		FGS:722	
											REV. NO:		00	
											DATE:		12.02.2019	
											PAGE NO:		Page 1 of 2	
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	B					M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	** 10.			11.

1.1	Blower parts – (Casing Impeller Shaft etc.)	Chem.& Mech. Dimensions Surface Defects	MA MA MA	Review of MTC Measurement Visual	1/Heat 100% 100%		Appd. Dwg./Datasheet		TC & IR	√	P P P	V - -	V - -	
1.2	Shaft	UT	MA	Testing	100%		ASME Section-V	Tech. Spec./ Manufacturer UT Procedure	UT Report	√	P	V	V	
2.0	CASING													
2.1	Machining of Components	Dimensions Surface Defects	MA	Measurement Visual	100% 100%		Appd.Dwg.		IR		P	-	-	
2.2	Hydro test of Casing	Hydro test 1.5times of Max work pr for 30 min	MA	Measurement & Visual	100%		Appd. Dwg	No leakage	IR	√	P	V	V	
3.0	ROTATING COMPONENTS													
3.1	Machining of components	Dimensions Surface Defects(Rotor & Shaft)4	MA	Measurement MT/PT	100% 100%		Appd. Dwg.		IR		P	V	V	
3.2	Assembly	Dimensions Completeness	MA	Measurement Visual	100% 100%		Appd. Dwg.		IR		P P	-	-	
3.3	Rotor Assembly	Dynamic balance test	MA	Measurement Visual	100%		ISO 1940	G 2.5	IR	√	P	V	V	
4.0	Blower Inspection													
4.1	Assembly	Dimensions, Completeness	MA	Measurement Visual	100%	100%	Appd. Dwg.		IR	√	P	W	W	Inspection at manufacturer works. *1 No. for NTPC 100% for
4.2	Performance Test	Volume, Power & Discharge Pressure	MA	Measurement	100%	100%	ASME PTC10	Approved data sheet / drawing	TR	√	P	W	W	
4.3	Mechanical Run	Noise	MA	Measurement	100%	100%	ANSI S5.1:1971	-DO-	TR	√	P	W	W	

LEGEND: * RECORD, IDENTIFIED WITH "TICK" (√) UNDER COLUMN 'D' SHALL BE SUBMITTED TO CUSTOMER AS A QA DOCUMENTATION PACKAGE.
M: MANUFACTURER / SUB SUPPLIER, **C:** MAIN CONTRACTOR(BHEL)/BHEL AIA
N: CUSTOMER/CONSULTANT **P:** PERFORM **W:** WITNESS **V:** REVIEW OF RECORDS
MA: MAJOR AND **MI:** MINOR

PREPARED BY



Rakesh Kumar Madhu,(SEr/QA)

REVIEWD & APPROVED BY

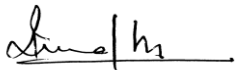


K C Gandhi Parimalam,(DGM/QA)

 Ranipet		MANUFACTURER'S NAME AND ADDRESS M/S BHEL: BAP: RANIPET 632 406 TAMIL NADU		STANDARD QUALITY PLAN										
				ITEM: OXIDATION BLOWER SYSTEM: FGD							QP NO		FGS:722	
											REV. NO:		00	
											DATE:		12.02.2019	
											PAGE NO:		Page 2 of 2	
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	B					M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	** 10.			11.

	Test	Vibration Level	MA	Measurement	100%	100%	ISO 10816-7	-DO-	TR	√	P	W	W	BHEL
		Bearing temperate rise,	MA	Measurement	100%	100%	Approved Drawing /Data Sheet		TR	√	P	W	W	
5.0	BOUGHT-OUT PARTS (Gear Box)													
5.1	Heat Treatment of Gear Wheel	Hardness	MA	Measurement	100%		Approved Data Sheet/Drawing		TR	√	P	V	V	
5.2	Assembly	Dimensions Completeness	MA	Measurement Visual	100% 100%		Appd.Dwg.		IR		P P	-	-	
6.0	FINAL BLOWER PACKAGE INSPECTION													
6.1	Final Complete Assembly	Dimensions, Completeness	MA	Measurement Visual	100%	01 No	Appd. Dwg		IR	√	P	W	V	
7.0	PAINTING													
7.1		Surface treatment and inspection	MI	Visual	100%		NTPC Approved Painting Schedule		IR	√	P	V	-	
7.2		Paint Quality – Colour & DFT Check	MI	Visual Measurement	10%				IR	√	P	V	-	
8.0	Review of QA Documents	Verification of QA Documents	MA	Verification	100%		As per Appd. MQP		IR	√	P	V	-	
9.0	Inspection before Delivery													
9.1	Packing	Size, appearance & Firmness	MI	Measurement Visual	100%		As per Appd. "Packing Procedure"		IR		P	-	-	

Note : Motor for Oxidation Blower is Separate MQP will be submitted for same.

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00	18-11-2019	Fresh Release	<i>S. Shanmuga Sundaram</i> Shanmuga Sundaram	<i>P. Naveen Reddy</i> P. Naveen Reddy
REV	DATE	DESCRIPTION	Prepared	Checked & Approved

S. No	Description	Requirement		
1.	Project Location	Patna District, Bihar State, India		
2.	Quantity	Unit-1 (1 Working + 1 Standby) ; Unit-2 (1 Working + 1 Standby) Unit-3 (1 Working + 1 Standby) Total = 6 Nos		
	Parameters			
	Operating Points	(1) Design Point -1	(2) Design point -2	(3) Guarantee Point
	Blower capacity	11730 Nm³/hr-wet	6024 Nm³/hr-wet	4496 Nm³/hr-wet(min)
	Discharge pressure(min)	9350 mmWC	8000 mmWC	6470 mmWC
	Efficiency	72%	-	Bidder to specify
	Relative humidity	60%	60%	60%
	Suction temperature	45.0° C	45.0° C	27° C
	Atmospheric pressure	1006.46 hPa		
	Discharge temperature	<70° C		
	Type of Blower	Single stage, integrally geared, single or dual vane centrifugal type oxidation blowers complete with integral gearbox, lube oil system, instrumentation and accessories. The blower will be used for supplying a variable volume of air to the absorber reaction tank.		
	Duty	Continuous		
3.	Cooling water (for blower)			
	Inlet temperature	38° C		
	Outlet temperature	43° C		
	Pressure loss	< 0.15 MPa		
	Supply pressure	0.3 MPa		
4.	Air Composition (Wet)	Design point	Guarantee Point	
	H ₂ O	5.71 vol%	2.12%	
	O ₂	19.71 vol%	20.46%	
	N ₂	Balance	Balance	
5.	Cooling system for reducing the temperature of air at the blower outlet to <70 deg Celsius	Quenching with water injection arrangement to be provided. Water analysis is given in Table -Water Analysis Below		
6.	Power loading for power consumption	@ 1899 USD Per KW		
7.	Penalty/Liquidation damages for power consumption	@ 1899 USD Per KW		
8.	Blower Driver	Motor (in BHEL Scope)		
9.	Mandatory Spares	1. Impeller Assembly - 01 no. 2. Bearings (1 no. of each type) - 1 set		

9.	POWER SUPPLY	
	The following voltage levels shall apply:	
	3.3 kV $\pm 6\%$, 50 Hz	Voltage for motors equal to / bigger than 160KW and for power distribution within the plant.
	415 V $\pm 10\%$, 50Hz	Standard voltage for power supplies to small electric power consumers and motors below 160 KW lighting and domestic power outlets
	Bidder shall design and supply the equipment suitable for satisfactory operation under above mentioned power supply condition.	

WATER ANALYSIS:

The following water to be used for quenching the Oxidation air if discharge temperature is more than 70 deg C:

S. No	Constituents	Unit	Water quality
1.	Total Cations as CaCO_3	ppm	2140
2.	Total Anions as CaCO_3	ppm	2140
3.	Calcium as CaCO_3	ppm	1103
4.	Magnesium as CaCO_3	ppm	506
5.	Sodium and Potassium CaCO_3	ppm	528
6.	Iron as Fe	ppm	1.65
7.	Total Alkalinity as CaCO_3	ppm	1232
8.	Chlorides as CaCO_3	ppm	586
9.	Sulphate as CaCO_3	ppm	322
10.	Silica	ppm	55
11.	pH		7.0-8.5
12.	Turbidity	NTU	55