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TECHNICAL SPECIFICATION
OF
BAG FILTER
FOR
LIMESTONE DAY SILO APPLICATION

RESTRICTED USE





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1.0 PROJECT INFORMATION

1. Owner	TSGENCO	
2. Buyer	BHEL, HPEP-Hyderabad	
3. Process/Application	Limestone Silo for Flue Gas Desulphurization system	
4. Project	Customer Name	Capacity of Bag Filter (M ³ /Hr.)
	TSGENCO, Kothagudem, 1X800 MW	1800
	TSGENCO, Bhadradi, 4X270 MW	1800

2.0 INTENT OF SPECIFICATION

1. This Specification and the attached Data sheets defines the minimum requirements for Limestone Silo Bag Filter system and Centrifugal fan for bag filter for use in the process of Limestone storage in Flue Gas Desulphurization (FGD)
2. In case of deviation, it shall be listed in the vendor's proposal under separate section titled as " list of deviations/exceptions to the enquiry documents.
3. Design, Manufacturing, Inspection and Testing of the Limestone Silo Bag Filter system and Centrifugal fan for bag filter shall comply with all the currently applicable statutes, regulation and safety codes in the locality where the equipment is to be installed. The Equipment shall also conform to the latest applicable Indian/British/American Standards. Nothing in this specification shall construed to relieve the contractor of the required statutory responsibility.
4. Compliance to this specification shall not relieve the vendor of the responsibility of furnishing equipment and accessories/auxiliaries of proper design, materials and workmanship to meet the specified requirements.
5. No component of the Bag Filter and centrifugal fan for bag filter, sourced from China, should be used.

3.0 SCOPE OF SUPPLY

1. Design, manufacture, testing and supply of Bag filter and Centrifugal fan for Bag filter for Limestone silo for the duty condition as specified in respective Technical Data Sheets.
2. Supervision of Erection and Commission of the equipment at BHEL site (As per clause No. 1.0) shall be under bidder's scope, cost for Supervision of Erection and Commission shall be included in the offer.
3. Suitable type of bags shall be selected for the type of material & temperature specified in respective data sheets and the bags life shall be guaranteed for two Years.
4. Base frame, all matting flange, gaskets, bolts and fastening required for the Bag Filter and centrifugal fan for bag filter shall be supplied by the Bidder.
5. In case the vendor considers requirement of additional instrumentation, controls, safety devices and any other accessories/auxiliaries essential for safe and satisfactory operation of the equipment, bidder shall recommend the same along with reasons in a separate section along with his proposal and include the same in his scope of supply.
6. The part items of the equipment should be identified by Tag Nos and should be packed as to minimize the possibility of damage during storage or transit. The equipment shall be protected for a storage of 12 months at site, if any extra precaution is to be taken by the Purchaser for storage beyond 12 months the same shall be explicitly indicated in the operation and maintenance manuals.
7. 10 copies Operation manuals containing all details of reference drawings and technical data shall be furnished by the Bidder.
8. Start-up and commissioning spares shall be included in the scope of supply.

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4.0. ELIGIBLE CRITERIA

1. Vendor should be a manufacturer of Bag Filter.
2. List of customer along with proven-ness certificate to whom Bag Filter of similar capacity supplied to silo/bunker application and are in successful operation for more than one year.
3. Previous inspection and test report to be furnished for the similar capacity or higher capacity.

5.0 BASIC DESIGN

This section covers the Design manufacturing and performance requirement of the Limestone Silo Bag Filter system including Centrifugal Fan for Bag Filter and accessories.

The extraction capacity of dust extraction/Bag Filter system shall be based on " American Conference of Governmental Industrial Hygienists" (ACGIH).

1. The bag filter should be of adequate capacity and shall be fabricated in modular construction. The bag filter shall be arranged in single or double row as per system requirements.
2. The bag filter shall be of automatic reverse pulse jet cleaning type using jet of air to produce high-pressure wave, which remove the settled limestone particles from fabric and discharge into the silo. Contractor shall supply all accessories like orifice, pipe, solenoid valve, sequential timer etc.
3. The bag filter must ensure adequate collection efficiency to achieve maximum dust not exceeding 10 mg/Nm³ under any operating condition with 10 per cent bags plugged condition.
4. Effective/ filtering bag Area: The filtering bag area of bag filter shall be selected on the basis of 1.5 m³/min/m² air flow through filter media. 20% margin should be considered over and above the actual filter area requirement.
5. Complete interlock, protection, annunciation for Dust extraction system to be provided by the contractor and the same shall be approved by employer during detail engineering.
6. Capacity (m³/Hr.) : As per clause 1.0
7. Type : Pulse Jet Type
8. Inlet dust composition : Air + Limestone powder
9. Dust nature : Abrasive, Hygroscopic
10. Inlet dust concentration : 15-20 gm/Nm³
11. Outlet dust : <10 mg/Nm³
12. Conveyor velocity : ~1 m/s
13. Effective Filter Area (m²) : Provided by vendor as per design
14. Filter rate : 1.5 m³/min/m²
15. Design Pressure : ± 500 mmwc
16. Pressure drop across the filter should not exceed : 150 mmwc
17. Gas Temperature : 50 °C (max)
18. Opening on the Silo Top : 1400 mm X 1400 mm
19. Opening on the Silo Top Floor : 1500 mm X 1500 mm

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5.1 GENERAL

Sl. No.	Items	Description	Unit	Remark
1	Model No.	**		
2	Tag No.	**		
3	Country of Origin	**		
4	Manufacturer details	**		
5	Location of Bag filter system	Outdoor (Silo top)		
6	Duty	Continuous		
7	Quantity of bag filter required	2	No.	Per project

6. CONSTRUCTION DATA: To be provided by bidder/vendor

Sl. No.	Description	Units	Vendor to confirm
1	Bag type	Clampless	
2	Casing	M.S. fabricated.	
3	Bag Fabric	Polyester Needle Felt, Nonwoven or any other suitable material for a temperature range of 140°-150°C.	
4	Cage	G.I. wire	
5	Diameter of Bag	150	mm
6	Height of bag	**	
7	Bags guaranteed	The bags life shall be guaranteed for two Years	
8	Venturi	Aluminum (2thk min)	
9	No. of Bags, cages, ventures	**	No
10	No. of Solenoid valves / Size	5 (25NB, 24VDC)	No
11	Make of Solenoid valves	Asco/Mecair/Goyen	
12	Timer	8 way (24VDC)	No
13	Make of Timer	Xcaliber/Manik	
14	Max long term service temperature	150	Deg. C
15	Materials:		
	Housing	3Thk IS:2062	
	Plenum	3Thk IS:2062	
	Tube Sheet	5Thk IS:2062	
	Air Header, Pipes, Tubes	IS:1239(M) / B:36.1(sch40)	
	Gasket	Neoprene	
	Insulation	NA	
16	Compressed air requirement	**	Nm ³ /hr
17	Compressed air pressure	4-6	Kg/cm ²
18	Pressure Switch on Air Header	Required (as per AVL)	
19	Air Filter Regulator	Required (Shavo Norgren/Festo/Schreder)	
20	Differential Pressure Transmitter	Required (as per AVL)	
21	Silo top opening at conveyor floor	Refer Annexure-1	Vendor to indicate the Size of opening in the offer
22	Surface preparation & Painting	Surface preparation will be as per Table-1	

Bidder to provide all the data marked as **

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7.0 PAINTING PROCEDURE- As per approved painting schedule provided with the enquiry.

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SIGNATURE OF VENDOR:

NAME OF VENDOR:

SEAL OF VENDOR:

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8.0 CENTRIFUGAL FAN FOR BAG FILTER SYSTEM

8.1 TECHNICAL DATA FOR FAN

Sl. No.	Design Data:	Description	Units	Vendor to Confirm
1	Gas Handled	Air		
2	Corrosiveness	Non Corrosive		
3	Capacity Actual / Design	**		
4	Specific Gravity	1.2 (Air).		
5	Elevation Above Sea Level	As per clause 1.0	(m)	
6	Per. Relative Humidity	60-100%		
7	Minimum Temperature	4	(°C)	
8	Design Temperature	**	(°C)	
9	Maximum Temperature	55	(°C)	
10	Differential Pressure	200	(mm of H2O)	
11	Voltage	415	(V)	
12	Phase	3		
13	Frequency	50	(Hz)	
	Mechanical Data:			
14	Fan Type	Centrifugal		
15	Blade form Backward	Curved		
16	Wheel Diameter (mm)/Impeller Dia.	**		
17	Wheel Speed	**	(rpm)	
18	Drive arrangement	Belt Drive		
19	BKW / rpm	**		
20	Tip speed	**		
21	No. of stages	1		
	Casing			
22	Material	IS:2062		
23	Thickness(mm)	3mm ,with adequate		
24	Type Split	No		
25	Casing liner	**		
26	Access doors(Quantity & Size mm x mm)	1 No		
27	Discharge designation	Clockwise top vertical		
28	Inlet box position	Not applicable		
29	Insulation clits.	Not applicable		
30	Maximum Dia. of casing (mm)	**		
31	Arrangement type	**		
32	Fan Inlet Size (mm)	**		
33	Fan outlet size (mm)	**		
34	Flexible connection at Inlet	Yes		
35	Drain Plug	Yes		
	Impeller			
36	Material	MS		
37	Thickness(mm), side plates, Blade	5,3,5		

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38	Blades- Quantity(width at tip) mm	**		
	Shaft			
39	Material	EN-8 / **		
40	Diameter at bearing / hub,	**	mm	
41	Wheel position (Over hung or center hung)	**		
42	Bearing span, (mm)	**		
43	Shaft seal Description	**		
	Bearing			
44	Type	**		
45	Manufacturer	Timken India Limited. SKF India Limited National Engineering Industries FAG KRW		
46	Life L-10 rating in hr.	Not less than 50000		
47	Type of lubrication	**		
48	Cooling requirements	**		
	V-Belt drive			
49	Manufacturer	**		
50	Drive sheave diameter	**		
51	Driven Sheave diameter	**		
52	Speed ratio	**		
53	Centre to Centre distance	**	mm	
54	Number of Belt / Size	**		

8.2 GENERAL REQUIREMENT

Sl. No.	Items	Description
55	Equipment No.	
56	Service Condition.	Continuous
57	Equipment location	Top of the Limestone silo
58	Manufacturer	**
59	Equipment Model No.	**
60	Manufacturer location	**
61	Duty	Continuous
62	Quantity	2 Nos

8.3 MOTOR SPECIFICATION

Sl. No.	Items	Description
1	Service factor on installed KW	**
2	Installed motor KW. /V-ph-Hz.	**



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3	Motor mounting & preferred terminal box position	**
4	Make	BHEL approved sub vendor
5	Starting torque,% of full load	**
6	Break down Torque % of full load.	**
7	Allowable WK ² OF LOAD kg-m ²	**
8	Weight of fan W/O motor	**
9	Weight of motor	**
10	Duty Type	S1
11	Protection	IP55
12	Efficiency	IE3

8.4 OTHER REQUIREMENTS

Sl. No.	Items	Description	Vendor to confirm
1	Noise Level	Less than 85 dBA @ 1m	
	Tests	Yes	
2	Balancing Witnessed	Yes	
3	Mechanical Run-In Test	Yes	
4	Performance Test	Yes	
	Included Items		
5	Inlet Damper	Yes ,inlet butterfly damper, MOC - MS	
6	Common Base Plate MOC	Yes / MS	
7	Safety Guard at Rotating Part	Yes	
8	Vibration Isolation details	Yes	
9	Surface preparation & Painting	Surface preparation will be Power tool cleaning to St3 (SSPC-SP3). Painting -please refer Table- 1	
10	Documents Required		
10.1	Performance Curve	Yes	
10.2	Critical Speed Curve	Yes	
10.3	Torque Speed Curve	Yes	
10.4	Outline Drawings & Sectional Views	Yes	
11	Proposal Curve No.		
11.01	Static pressure @ rated flow ,mm H ₂ O@AM ³ /Hr.	**	
11.02	Peak static pressure, mm H ₂ O	**	
	Efficiency @ rated condition	**	
11.03	Discharge temperature °C	**	

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11.04	Power absorbed- Min/Nor/Rated (KW).	**	
11.05	First critical speed. (RPM).	**	
11.06	Maximum allowable Speed, RPM	**	
11.07	GD2 of rotating elements Kg-m ²	**	

All data, marked (**) are to be provided by manufacturer, other than data marked as (**) Bidder to confirm the value, in case of any deviation same shall be mention in each row.

Note: Pulsing and Sequential test to be performed on the Bag Filter.

Note: Any component which required for making the system complete/operational will be in bidders scope.

SIGNATURE OF VENDOR - - - - -

NAME - - - - -

DESIGNATION - - - - -

9.0 WARRANTY

The Bidder warrants that the equipment/ items shall be free from defects in the design, engineering, materials and workmanship of the Equipment supplied and of the work executed. The Defect Liability Period shall be Eighteen (18) months from the date of supply or Twelve (12) months from the date of commissioning, which ever first occurs. If during the Defect Liability Period any defects were found in the design, engineering, materials and workmanship of the 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.

10.0 INSPECTION & TESTING

The General inspection requirements to be considered are as below:

- Bidder shall furnish written copies of shop production, fabrication, quality and test procedures and drawings for review by BHEL/Customer prior to manufacture. Inspection shall be carried out as per BHEL/customer approved quality plan.
- The Bidder shall furnish performance test procedure along with measurement standard. The procedure will be reviewed and approved by the BHEL/Customer.
- Final inspection and release by the BHEL/ Customer is a mandatory requirement unless specially waived.
- Bidder should furnish performance guarantee as per applicable standard guarantee for the design, manufacture, material and safe operation of the equipment's.
- BHEL/customer shall witness the test at Bidder's works and a notice of minimum three (3) weeks shall be given for attending the inspection.
- Bidder to arrange all calibrated gauges, Instruments during inspection.
- Bidder to arrange Instruments and all accessories for the measurement at site using Impact method.

11.0 START UP & COMMISSIONING SPARES

Start-up & Commissioning Spares shall be part of the main supply of the Bag filter. Start-up & commissioning spares are those spares, which may be required during the start- up, and commissioning of

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the equipment/system. Bidder shall indicate the list in their technical offer & supply an adequate stock of such start up and commissioning spares to site for successful erection, start up and commissioning. The spares must be available at site before the equipment are energized.

12.0 SUPERVISION OF ERECTION, TESTING AND COMMISSIONING

1. Erection of Bag Filter will be done by owner as per vendor's Erection Manual and check List. Supervision of Erection and Commissioning of the all Bag Filter at Site (Site details as per clause No-1.0) is in bidder's scope. Bidder has to quote for 7 working days towards supervision of erection and commissioning & testing and trial runs at Sites.
2. TA/DA, boarding and lodging shall be borne by the bidder and shall be inclusive in the above clause.

13.0 DOCUMENTATION

13.1 INFORMATION TO BE FURNISH ALONG WITH THE TECHNICAL OFFER

- a) Principle of operation of Bag filter and logic
- b) General arrangement drawing of Bag filter along with Centrifugal fan.
- c) Overall dimension of the Bag and Motor
- d) Total weight including individual weight of the system.

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14.0 DOCUMENTATION/DETAILS TO BE FURNISHED AFTER PURCHASE ORDER

- a) Detailed Assembly/Exploded view of all components to be furnished. List of spares to be mentioned in the GA. Manufacturing Action to be initiated after the approval from BHEL/ Customer.
- b) Filtration area, Velocity at the exit
- c) All connection flange dimension (Instrumentation air inlet, clean air vent flange & bottom hopper flange)
- d) Detailed assembly drawings of the system bringing out the constructional features.
- e) Details of inspection door-size, nos, type and location.
- f) Details of bag removal and head room required.
- g) Details of maintenance procedure.
- h) Details of maintenance while the system is working.
- i) Air header to bag cleaning tube connection details.
- j) Static charges earthing details.
- k) Details of electronic programmed controller for sequential control bags and sequence of cleaning min & max.
- l) Requirements of compressed air.
 - Quantity, Max & Min.
 - Quality (moisture, oil content pressure etc.,)
- m) Details of lifting hooks, eyes etc.,
- n) Distance between metal side walls and the nearest bag rows.
- o) Connecting Ducting drawing between Bag Filter and centrifugal fan (if fan is mounted separately on the silo, all Ducting will be in the scope of the vendor).
- p) Data sheet to be furnished for review and approval.
- q) Quality plan to be submitted for approval, Inspection and Testing.
- r) All the above mentioned documents to be submitted before 15 days from the placement of PO.

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