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| **Hindalco Renusagar U5 1 x 80 MW PF Captive Power Plant**  **Flue Gas Desulfurization Project (FGD) with GORETM SO2 Control System**  **FGD- BOOSTER FAN- TECHNICAL SPECIFICATION WITH DRIVE AND ACCESSORIES**  **`**   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **ISSUED FOR** | APPROVAL | INFORMATION | MANUFACTURING | CONSTRUCTION | AS-BUILT | | | | | | | | |
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| Flue Gas Desulfurization Project (FGD) with GORETM SO2 Control System | | | Gore Doc.No.: RPDU5.PG.030 | | | Page 1 of 8 | |
| **FGD- Booster Fan - Technical Specification with Drive and Accessories** | | | GORE Job No.: RPDU5 | | | Rev.: 1 | |
|  | | | File: 1.S21001-TS01-05HNC-227202 R1 | | | | |
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# INTRODUCTION:

This specification covers the design, engineering, manufacture, assembly, testing at manufacturer's works, supply and delivery to project site properly packed for transportation, including shop painting, freight, transit insurance, all taxes, duties, octroi, other charges/levies as applicable, supervision of erection, testing and commissioning at site of all materials and equipment inclusive of electrical as specified and as required for **Booster Fan and Electric Motor alongwith Variable Frequency Drive** (VFD as an alternative)**, Bearing Lubrication system , Multi-louvre Inlet Damper OR Radial Vane Control, Suction and Discharge Expansion joints, Instruments, Couplings, Baseframes, foundation bolts, Inlet and Outlet counterflanges withnuts, bolts, gaskets** etc complete with all materials and accessories for safe and trouble-free operation of the fan

1. **Codes and Standards**: The design, manufacture, inspection and testing of the equipment covered under this specification shall conform, in general, to the standards and codes (latest editions) mentioned below :
2. Bureau of Indian Standards (BIS)
3. American Gear Manufacturers Association(AGMA).
4. American National Standards (ANSI).
5. Steel Pipe Flanges & Flanged Fittings (ASME B 16.5)
6. ASTM. Standards for materials
7. API : American Petroleum Institute
8. ASME: American Society of Mechanical Engineers.
9. In case of any contradiction between the above standards and data specification sheets, the stipulations in the data sheets shall prevail and shall be binding on the Supplier/ Bidder.
10. **System Description** : The existing system of each unit has 2 x 50 % ID fans handling the flue gas and discharging through chimney. From the common discharge duct of the ID fans, new ducts will be put with isolation dampers and with a common header duct shall be made to carry the total flue gas at the inlet of one new Booster Fan (1 x 100%). The common discharge of booster fan shall be sent to the inlet of Mist Cooling unit for moisture saturation and reduction in temperature. In the Mist cooling Unit water shall be sprayed in mist form for evaporative heat exchange and thereby reducing flue gas temperature and achieving saturated condition. After the mist cooling unit, the flue gas shall be sent to the Reactor Tower to trap SOx. From the outlet of this reactor tower the flue gas shall be sent to the New Wet Stack. Thus there shall be 1 x 100% Booster fan the details of which is indicated in the following content of the specification.

# EQUIPMENT DESCRIPTION & OVERALL SCOPE OF SUPPLY:

This enquiry covers the design, manufacture, supply, inspection and testing at Vendors and /or Sub- Vendor’s works, packing and transportation from place of manufacture to site, of the following:

1. Booster Fan complete with Motor and accessories - 1 Set.
2. **Alternate Offer** - Booster Fan complete with Motor with VFD & Panel along with necessary

Accessories - 1 Set.

# II-a - The scope of supply is tabulated below:

|  |  |  |
| --- | --- | --- |
| **Description** | **Required (Y) / Not required (N)** |  |
|  | **Booster Fan** |  |
| Fan with split type casing | Y |  |
| Casing access door – raised type | Y |  |
| Inlet flange with counter flange, fasteners  and gasket. | Y |  |
| Outlet flange with counter flange, fasteners  and gasket. | Y |  |
| Vibration isolation non- metallic expansion joint at inlet | Y |  |
| Vibration isolation non- metallic expansion joint at outlet | Y |  |
| Drive Motor & its Control along with VFD as an alternative for DOL starter | **Y** | As per attached annexure |
| **Bidder shall give two offers – One with Fan & Motor with Accessories and Alternative Offer with Fan, Motor (suitable for VFD), Accessories and VFD Panel** | | |
| Inlet Multi Louver Damper or Radial Vane Control | Y |  |
| Pneumatic Actuator having provision of  manual operation for Damper with Positioner, Limit Switch etc. | Y |  |
| Separate Base for Pneumatic Actuator  with anchor Bolts. | Y |  |
| Common base frame for Motor and Fan. | Y |  |
| Foundation bolts for Motor base ,Casing, Inlet Box and Bearing base fixing | Y |  |

|  |  |  |
| --- | --- | --- |
| Grounding pads, Lifting lugs, eye bolts, protection guards etc. | Y |  |
| Load data for foundation design | Y |  |
| Method of starting | DOL / VFD (alternative) |  |
| Casing & Impeller liners | Y (If Required) |  |
| Drain Plug at Casing Outlet | Y |  |
| Bearing pedestals | Y |  |
| Bearings (Anti-friction) | Y |  |
| Shaft Seal | Y |  |
| RTDs for bearing temperature at DE& NDE for Fan | Y |  |
| RTDs for bearing and winding temperature for Motor as detailed in separate spec for Motor | Y |  |
|  |  |  |
|  |  |  |
| Bird screen @ inlet | N |  |
| Weather / Rain hood | N |  |
| Acoustic insulation | To be provided if req. to meet guaranteed noise level at 85 dBA at 3 M surrounding |  |
| Inlet silencer | N |  |
| Packers & shims | Y |  |
| Insulation Cleats | Y |  |
| Insulation & Cladding | N (only  engineering) |  |
| Commissioning spares | Y |  |
| External bearing lubrication (If required, then along with 2 nos. pumps, 2 nos. coolers, motors, strainers, tanks with level gauges, temperature gauges, flow indicator and interconnecting cables & piping.) | Y (If Required) |  |
| Recommended spares for 2 years  operation | Y |  |
| Balancing and Performance testing @  workshop | Y |  |
| Primer & final painting | Y |  |
| Recommended Maintenance Tools | Y |  |
| All inlet & outlet counter flanges, with nuts, bolts and gaskets | Y |  |
| Sets of special tools and tackles | Y |  |
| First fill of lubricants and oil | Y |  |
|  |  |  |

# II-b - The scope of services is tabulated below:

|  |  |  |
| --- | --- | --- |
| **Sl. No.** | **Description** | **Scope** |
| 1 | Engineering of equipment & submission of all necessary documentation, drawings, civil assignment detail and operation and maintenance manuals | Y |
| 2 | Inspection and testing of all equipment at manufacturer's shop | Y |
| 3 | Supply and application of painting at shop | Y |
| 4 | Packing for road transportation | Y |
| 5. | Transportation of all equipment including transit insurance up to site | Y |
| 6. | Supervision of Erection and commissioning of items supplied | Y |
| 7. | Witnessing of Performance test of equipment at site and fulfilment of Guaranteed Data /Parameters | Y |

# II-c - Exclusions :

|  |  |  |
| --- | --- | --- |
| **Sl. No.** | **Description** | **Exclusion** |
| 1 | Flue Gas ducts | Excluded |
| 2 | Power & Control Cable | Excluded beyond battery limit |
| 3 | Civil foundation works | Excluded |

**II-d- TERMINAL POINTS :**

* 1. Inlet flange of Vibration Isolation expansion joint at fan inlet along with fasteners and gaskets. Including counter flanges for Booster fan.
  2. Outlet flange of Vibration Isolation expansion joint at fan outlet along with fasteners and gaskets. Including counter flanges for fan.
  3. Coupling with fasteners.
  4. Motor- Power supply at Motor terminal box and for Alternate Offer at VFD incomer terminals (all HV cabling are excluded).

1. **DESIGN REQUIREMENTS FOR FAN**

Below mentioned technical points to be considered by the vendor while sizing the equipment.

* 1. The noise level to be attained is **85 dB(A) at 3 m** in any direction. This is to be attained either by acoustic treatment or by silencers.
  2. The selection of the type of fan should be such that dust do not settle on the impellers and create imbalance.
  3. No negative tolerance will be acceptable in flow and head of the Fans.
  4. All Fans will be tested at shop for Capacity, Head and Power and shall be guaranteed **WITHOUT ANY NEGATIVE TOLERANCE ON CAPACITY & HEAD AND POSITIVE TOLERANCE ON POWER** at reduced speed.
  5. No positive tolerance on Power consumption is allowed and the fan vendor is to include all tolerances and confirm final shaft power as guaranteed for the fan.
  6. The lowest natural frequency shall be 135 % of fan running speed.
  7. The fan vendor shall hence guarantee power consumption at fan shaft. At the time of fan test, the power consumption at motor terminals will be measured and based on motor efficiency test certificate, the shaft power consumption will be back calculated.
  8. Dynamic Balancing of rotor shall be as per ISO 1940/1, Gr.2.5.
  9. Casing thickness of any fan shall not be less than 5 mm.
  10. Mechanical Design of fan to be minimum 200 °C.
  11. **MOTOR AND ELECTRICALS SHALL BE AS PER ATTACHED ANNEXURE**.
  12. Vendor to consider minimum 25 mm of axial / 15mm of lateral movement for all non-metallic expansion joint at fan inlet and outlet.
  13. Non-metallic expansion joints to have bolsters and outer SS wire netting and dust guard.
  14. The fan shafts are to be carried in bearings on either side independent of the casings. All fans shall be of simply supported design.
  15. Fan bearing temperature detection shall be done by RTD and its cables shall be made available at local J/B for DCS.
  16. Bearings shall be Anti-friction type. Oil lubricated.
  17. Coupling shall be gear type with spacer having Aluminium cover.
  18. The fan impeller, casing design and their material selection shall consider the fly ash dust concentration and resultant erosion.
  19. Access and inspection doors shall be provided at suitable locations.
  20. Design and sizing calculations for fan to be submitted.
  21. Vendor to submit load data for foundation design for fan & motor separately.
  22. Sand blasting to be considered wherever required.
  23. The fan mechanical performance shall be as per VDI 2056 / ISO 10816: 1998 (Good Zone).
  24. All pneumatic actuator shall have hand wheel for manual operation.
  25. All Multi louver Dampers sealing efficiency to be minimum 99% and having tadpole sealing arrangement.
  26. **Performance Guarantee** – The following parameters shall be guaranteed –

i) Rated capacity,

ii) Rated Head,

iii) Efficiency at design point and

iv) Power consumption at the rated point at motor terminal.

Supplier shall demonstrate PG test for stipulated time as agreed with Purchaser and following shall be the minimum items.

Test to demonstrate fan capacity shall be carried out at shop. If fan is tested at reduced RPM, suitable curves for correcting the parameters must be submitted beforehand or the procedure for correction submitted beforehand.

1. **DATA / DOCUMENTS TO BE FURNISHED ( Y )**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SL. NO.** | **DETAILS OF DOCUMENTS** | **ALONGWITH** | | |
| **OFFER (3 Sets)** | **ORDER (3 Sets + soft copies)** | **SUPPLY (6 Sets+ soft copies as source files)** |
| 1 | SCOPE OF SUPPLY WITHOUT ANY AMBIGUITY | Y | ----- | ----- |
| 2 | DETAIL PERFORMANCE DATASHEET | Y | Y | ------- |
| 3 | FAN CHARACTERISTIC CURVES / CATALOGUES | Y | ------- | Y |
| 4 | MOTOR DATASHEET-REFER ANNEXURE | Y | Y | Y |
| 4A | VFD SLD, schemes, GA | GA+ scheme | Y | Y |
| 5 | GENERAL ARRGT. DRAWINGS | Y | Y | ------- |
| 6 | MOC | Y | Y | Y |
| 6A. | Measures to be taken to avoid erosion in Blades & Casings. Thickness & MOC of liners if used should be indicated clearly. |  |  |  |
| 7 | P&I DRAWINGS & PART LIST | Y | Y | ------- |
| 8 | DRIVE LIST & SLD | Y | Y | Y |
| 9 | UTILITY REQUIREMENT – COOLING WATER , INSTRUMENT AIR | Y | Y | Y |
| 10 | LOAD DETAILS (STATIC & DYNAMIC) FOR CIVIL FOUNDATION DESIGN BY OTHERS | Y | Y | Y |
| 11 | Guaranteed Performance Data and Power Consumption at full load / rated condition with Seal and signature of the company |  |  |  |
| 11A. | CONFIRMATION OF SOUND LEVEL | Y | Y | Y |
| 12 | QUALITY ASSURANCE PLAN | ------- | Y | Y |
| 13 | MATERIAL TEST CERTIFICATE | ------- | ------- | Y |
| 14 | PERFORMANCE TEST, GUARANTEE CERTIFICATE | ------- | ------- | Y |
| 15 | INSTALLATION, OPERATION & MAINTENANCE MANUAL | ------- | Y | Y |
| 16 | TWO YEARS O&M SPARES LIST TO BE SUGGESTED BY VENDOR | Y | ------ | -------- |
| 17 | LIST OF MANDATORY SPARES TO BE SUGGESTED BY VENDOR | Y | ------ | -------- |

# LIST OF APPROVED SUB-VENDORS

|  |  |  |
| --- | --- | --- |
| **Sl. No.** | **Description** | **Make** |
| 1 | Non-Metallic Expansion Joint | KE Burgmann / Keld Ellentoft /LBH |
| 2 | Couplings | Fenner /Rathi |
| 3 | Bearings | SKF/FAG |
| 4 | RTD | Pyroelectric/GIC /Waaree |
| 5. | Pneumatic Actuator. | Kelton. |

**VI. LIST OF PREFERRED MAKES: R-1**

|  |  |  |
| --- | --- | --- |
| **Sl. No.** | **Description** | **Make** |
| 1 | FAN | Andrew Yule / Howden / Boldrocchi / BHEL |
| 2 | MOTOR | As per Hindalco’s Vendors’ List |
| 3 | VFD | As per Hindalco’s Vendors’ List |
|  |  |  |
|  |  |  |