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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 - FGTR Washing Grid and Nozzles of SPC Modules - Technical Specification**  **`**   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **ISSUED FOR** | APPROVAL | INFORMATION | MANUFACTURING | CONSTRUCTION | AS-BUILT | | | | | | | | |
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| Hindalco Renusagar U5 1 x 80 MW PF Captive Power Plant | | | Drg. / Doc. No*.*: S21001- TS01 - 05HTD- 227213 | | | | |
| Flue Gas Desulfurization Project (FGD) with GORETM SO2 Control System | | | Gore Doc. No.: RPDU5.PG.041 | | | |  |
| **FGD - FGTR Washing Grid and Nozzles of SPC Modules - Technical Specification** | | | GORE Job No.: RPDU5 | | | | Rev. : 1 |
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CONTENTS – SECTION-1

**CLAUSE. NO. DESCRIPTION PAGE NO.**

A. GENERAL 3

A-a CODES AND STANDARDS 3

A-b SYSTEM DESCRIPTION 3

A-c SCOPE OF SUPPLY 4

A-d SCOPE OF SERVICES 4

A-e EXCLUSIONS 5

A-f TERMINAL POINT 5

B. DESIGN & CONSTRUCTION REQUIREMENT 5

C. NOT USED 6

D. NOT USED 6

E. DRAWINGS / DOCUMENTS TO BE SUBMITTED 6

F. LIST OF PREFERRED MAKE 7

**ANNEXURES**

ANNEXURE-I : TECHNICAL DATA SHEET

ANNEXURE-II : TENDER SCHEME DRG

ANNEXURE-IIA : TENDER LAYOUT DRG

ANNEXURE-III : COMMERCIAL TERMS & CONDITIONS

ANNEXURE-IV : QUALITY CONTROL PLAN

1. **General**  
   1) Hindalco Industries Limited (HIL)-Renusagar intends to install Flue Gas Desulphurisation Project (FGD) in their Unit-5 ,1 x 80 MW captive power Plant using **GORE TM** technology. The flue gas from the existing ID Fan outlet shall be taken to new Booster Fan suction and the discharge of the fan shall be taken to Mist Cooling Unit where water shall be sprayed in atomised form to cool the hot flue gas and also to saturate the same. The cold and moisture saturated flue gas shall be further taken for desulpharisation in the Flue Gas Treatment Reactor (FGTR). This FGTR unit will have Modules through which Flue gas shall pass and SOx will be trapped and dilute 10% H2SO4 acid solution shall be generated.The Flue gas exits through the Wet Stack located on top of the FGTR unit.

2) 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 accessories as specified and as required for **FGTR Nozzles and accessories** complete with all materials and accessories for safe and trouble-free operation of same.

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. International Organisation for Standardisation (ISO);ISO3585/3586/3587/4704
3. Bureau of Indian Standards (BIS)
4. British Standards (BS); BS EN 1595
5. American National Standards (ANSI).
6. Steel Pipe Flanges & Flanged Fittings (ASME B 16.5)
7. ASTM. Standards for materials
8. API : American Petroleum Institute.
9. ASME: American Society of Mechanical Engineers; ASME SEC VIII
10. 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.
11. **System Description** : The flue gas shall taken from the discharge duct of existing ID Fans and transferred to the inlet of new Booster Fan. The discharge from the 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 FGTR Reactor Tower to trap SOx. As SOx is trapped in the tower,10% dilute H2SO4 solution will be generated. The flue gas after treatment exits through the Wet Stack located at the top of the tower.

The FGTR unit is a vertical rectangular tower type structure having Catalyst modules at different levels stacked one above the other. The flue gas passes through these modules from bottom to top direction. In the process SOx and moisture separates from the flue gas as 10% H2SO4 solution. This acidic solution drops from the surface of modules and gets collected in the bottom hoppers of FGTR.

During this process the reactor modules’ surface may have acid droplets / dirt layers on it from the flue gas and will require to be washed and cleaned to maximize the use of catalyst surface. For the washing purpose an array of **Washing Nozzles** will be strategically located over and under the Modules. The matrix of Wash nozzles shall be located at different levels of stacked modules. While SOX and moisture is being trapped from the flue gas, the moisture saturation level of the flue gas will reduce and will be compensated by mist generation in the tower to maintain saturation. For this purpose, there shall be header matrix of **Misting Nozzles** strategically located to cover the sectional area of the tower so that the nozzles’ spray cone covers the flue gas. The grid of Misting nozzles are located at various levels for optimum results.

Hoppers are located at the bottom of the FGTR tower for collecting dilute acid solution generated from the process. This solution from the hopper shall be used for spraying through the above Washing & Misting nozzles via circulating pumps.

In addition to the above, there is a requirement of addition of fresh make up water to maintain the concentration of acid solution. For these a header matrix of **Make up Water Nozzles** shall be installed at suitable level in the tower.

Filtered water shall be fed through these make up water nozzles to the tower.

1. **Scope of supply , and supervision of erection and commissioning :**

The scope for FGTR Nozzles & accessories plant shall consist of :

1) All Washing Nozzles complete assembly.

2) All Misting Nozzles complete assembly.

3) All Make-up Water Nozzles complete assembly.

4) Set of special tools and tackles.

5) Mandatory spares if specified. Price of same shall be evaluated.

6) Erection and Commissioning spares.

7) List of recommended spares with Unit Rate for three (3) years of trouble-free operation. The Price of Recommended spares shall not be evaluated.

1. **Scope of services** :

The following services shall be provided by the bidder for all equipment and accessories listed above:

1) Complete design and engineering required for nozzle selection, nozzle orientation and layout to suit the FGTR module arrangement drawing along this specification and ensure complete coverage area for the flue gas.

2) Detail engineering for all headers, supports etc & submission of all necessary documentation, drawings, and operation and maintenance manuals.

3) Inspection and testing of all equipment at manufacturer's shop.

4) Packing for road transportation as applicable.

5) Transportation of all equipment including transit insurance up to site.

6) Supervision of Erection and commissioning of items supplied.

7) Witnessing of Performance test of equipment at site and fulfilment

of Guaranteed Data /Parameters.

1. **Exclusions :**

Following items are out of scope of Bidder:

1. Erection at site.
2. Piping and supports.
3. **Terminal Point :**

The terminal point shall be as follows.

1. Nozzle inlet and outlet.
2. **Design and construction requirements and important considerations**

1)For selection and sizing of equipment the technical data sheet (Annexure-1) may be referred.

2) Material of construction – The material of construction shall be minimum as indicated in the technical datasheet. However the bidder may select higher grade based on requirement of the specific function as deemed suitable.

**3) Washing Nozzles – It may be noted the GORE(US) uses BETE ‘MP’ series nozzles for Washing Purpose. The catalogue of the same is attached with this specification.**

**4) Misting Nozzle - It may be noted the GORE(US) uses BETE ‘L’ series nozzles for Misting Purpose. The catalogue of the same is attached with this specification.**

**5) Make up water Nozzle – Suitable nozzles shall be selected by the bidder for this purpose.**

4) **Low pressure water at nozzle inlet is desirable.**

5) Adequate margin shall be considered for selection and sizing of equipment.

6) **PG Test and** **Performance Guarantee** – Supplier shall demonstrate PG test for stipulated time as agreed with Purchaser and following shall be the minimum items :

a) Nozzle capacity at given upstream pressure– As per Technical datasheet annexed.

b) Nozzle coverage area at given height – As per Technical datasheet annexed.

1. **Not used**
2. **Not used**
3. **Documents/Drawings to be submitted along with the bid as “Must Items” for a responsive bid.**

**E-1** **Along with Bid**

1. Scope of supply without any ambiguity.
2. PFD/ P&ID, Brief Datasheet, Technical Particulars of offered item(s).
3. Nozzle Datasheet.
4. MOC of all items.
5. Layout drawings for Nozzles and headers.
6. QAP.
7. Guaranteed Performance Data.
8. Price Schedule.
9. Delivery Schedule.
10. Details of Commissioning manpower.
11. Document submission schedule as per Deliverable List (post order) in Annexure.
12. Terms of Payment.
13. **Deviation List if any. Without any deviation list, bid shall be construed exactly as per requirement of Scope Document / Technical Data Sheet.**
14. Catalogue of all equipment.
15. List of commissioning and maintenance spares.
16. Recommended Spare parts list for Three (3) year’ operation.

**E-2 Post Order**

1. Design Calculation, Operation & Control Philosophy,Technical Datasheet,Technical Particulars of offered item(s) along with its constructional features and Performance detail.
2. Dimensional General arrangement Drawings.
3. Cross sectional Drawings with partlist and MOC.
4. Nozzle layout drg, Piping and support structure General arrangement and detail drawings.
5. Operation & Maintenance Manual.
6. QAP showing the Customer / Third Party Inspector (TPI) Hold Points.
7. Weight data for erection & loading data (static & dynamic) for civil design by other.
8. Material Test certificates shall be furnished.

**F:** **LIST OF PREFERRED MAKE :**

**Spray Nozzles** : Lechler (India) / Spraytech / BETE / As per Hindalco’s Vendors’ List



