TECHNICAL SPECIFICATION

FOR

LIMESTONE GRINDING SYSTEM

CONFIDENTIAL

CUSTOMER : NTPC
PROJECT : DADRI 2 x 490MW
APPLICATION : FLUE GAS DESULPHURIZATION SYSTEM

BHARAT HEAVY ELECTRICALS LIMITED
(A GOVT OF INDIA UNDERTAKING)
Flue Gas Desulphurization Group
Ranipet

TECHNICAL SPECIFICATION FOR LIMESTONE GRINDING SYSTEM

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CONTENTS

PART –I

MAIN SUPPLY

1.0 PROJECT INFORMATION:

a.	Owner	NTPC
b.	Buyer	BHEL, Ranipet
c.	Process/Application	Flue Gas Desulphurization system

A) SITE CONDITIONS

1.	**Ambient Temperature and Relative Humidity**		
a.	**Average Site Condition (ASC)**		
	Ambient Temperature	:	27 deg C
	Ambient Temperature (Design)	:	45 deg C
	Relative Humidity	:	60 %

Note:
1) Reference site conditions shall apply for the Guarantee Values as well as for the Guarantee test/Performance test
2) Equipment and Material must be suitable for the range of ambient site conditions.

B) PROJECT LOCATION AND APPROACH

a.	Country	**India**
b.	State/Division	**Uttar Pradesh**
c.	District	Gautam Buddha Nagar

2.0 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 Limestone Grinding System (LGS) shall follow the latest applicable Indian/International (AISI / ASME/EN/Japanese) Standards.

3.0 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 guarantee testing of Limestone Grinding System (LGS) along with accessories which is furnished in the Flue Gas Desulphurization plant of DADRI 2 x 490 MW FGDF systems. The following points may be noted.

a. There are 2 units of each 490 MW and each unit is envisaged with one FGD system. The FGD system will be provided with common Limestone Grinding System (LGS).

Two (2) streams of Limestone Grinding System (1 working + 1 standby) shall be provided. This Limestone Grinding System (LGS) shall be located inside the Ball Mill Building. Building is in BHEL scope.

b. 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.

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-IV**)".

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.

4.0 PROVENNESS CRITERIA:

The Bidder shall offer only proven design which meets the Provenness criteria indicated in the **Annexure-I.** Necessary document evidences as per **Annexure-3K for qualification** shall be submitted along with the bid. If bidder doesn't meet the specified provenness criteria, they are denied to participate in this tender.

The Bidders are required to meet the Qualification Requirement (QR) for Wet Ball Mill system as per **Annexure-I & submit the Annexure to qualification requirement (Annexure-3K)**

5.0 TECHNICAL INFORMATION

S.No.	Description	Requirement
1.	**Quantity**	
	Quantity of Limestone Grinding system	2 streams (1 working + 1 standby)
2.	**Parameters**	
	Wet Ball Mill Design capacity	19.4 TPH
	Medium to be handled	Limestone
	Limestone Analysis	Refer Clause 5.1
	Type of WBM system	Horizontal
	Duty	Continuous
	Location	Inside Building

5.1 LIMESTONE ANALYSIS/CHARACTERISTICS

LIMESTONE CHARACATERSTICS:

Chemical Analysis(% by mass)			
1.	CaO	%	47-51.0*
2.	MgO	%	0.9-2.0
3.	Fe_2O_3	%	0.45-1.0
4.	Al_2O_3	%	1.19-2.1
5.	Si_2O_3	%	2.1-4.5
6.	Mn_2O_3	%	<0.12
7.	P_2O_5,	%	Traces
8.	Cl_2	%	<0.015
9.	Na_2O	%	<0.16
10.	K_2O	%	<0.01
11.	TiO_2	%	<0.02
12.	Total Sulphur	%	<0.1
13.	LOI	%	39.0-41.3
	Not used		
Physical properties			
1	Bond Index	kWh/sh.T	13
2	Granule size		Medium

5.2 WATER ANALYSIS

Process water (CW blowdown water) is to be used during the grinding process of limestone in Wet Ball Mill (WBM). Process water analysis is provided below.

S.No	Constituents	Unit	Water quality
1.	Total Dissolved Solids	ppm	~2110
2.	Calcium as CaCO3	ppm	721
3.	Magnesium as CaCO3	ppm	286
4.	Sodium as CaCO3	ppm	358
5.	Potassium as CaCO3	ppm	
6.	Iron as Fe	ppm	1.7
7.	Fluoride as F	ppm	0.11
8.	Bicarbonate as CaCO3	ppm	688
9.	Chlorides as CaCO3	ppm	168
10.	Sulphate as CaCO3	ppm	512
11.	Nitrate as NO_3	ppm	0.55
12.	Silica	ppm	121
13.	pH		7.0 – 8.2
14.	Turbidity	NTU	55

5.3 WET BALL MILL SYSTEM - PROCESS DESCRIPTION

Limestone grinding system shall be designed to produce limestone slurry for continuous FGD operation. Employer envisages 2 streams (1 working + 1 standby) of common Limestone Grinding system for both the FGD units. Each stream shall be capable of independent operation.

Grinding of limestone

Limestone is fed by gravimetric feeder from limestone silo to wet ball mill. The limestone slurry from wet ball mill shall be discharged to mill overflow tank. Grinding water for the limestone ball mill shall be ratio controlled by the signal of gravimetric feeder to maintain specified solid content at outlet of mill hydro cyclone. Limestone slurry from mill overflow tank is pumped via mill circuit pump to hydro cyclone for classification.

Distribution of hydro cyclone overflow and underflow

Distribution of hydro cyclone overflow and underflow will be made by distribution (splitter) box provided under the hydro cyclone. In normal operation, hydro cyclone overflow will be sent to limestone slurry feed tank (A or B) and underflow return to inlet of ball mill. And at recirculation mode, both of the overflow and underflow will be returned to mill overflow tank.

The change of operation mode as summarized shall be established with pneumatic actuated valve or flap by remote signal.

Limestone grindings system shall comprise of:

i. 2 nos. of Limestone silo shut off gates
ii. 2 nos. of Gravimetric Feeders
iii. 2 nos. of wet horizontal ball mills
iv. Each mill shall be fed from an independent Limestone bunker (bunker in BHEL scope). Each mill shall be complete with the following items, as a minimum requirement:
    a. A bunker outlet gate
    b. A gravimetric limestone feeder along with its drive and all other auxiliaries
    c. 1 no. separator tank with agitator(s).
    d. 2x100% Mill circuit pump.
    e. 1 set of hydro-cyclone
    f. 1 set of distribution box
    g. A peripheral/central drive system with motor, speed reducer gearbox and other auxiliaries.
    h. An auxiliary motor for inching operation with speed reducer.
    i. Complete lubricating system with appropriate lubricating medium storage facility (i.e. 1 no. lube oil tank for storage of lube oil and/or 1 no. grease storage drum as required).
    j. Lube oil pumps, coolers, duplex oil filters, connecting piping and necessary load & remote indicating instruments. Each lube oil pump and cooler shall have a 100% identical stand-by.
v. All connecting pipes / chutes along with necessary valves between various systems of the mill and from hydro-cyclone to common slurry storage tanks shall also be in the scope of the contractor. Necessary pipes, pipe supports, trestles etc. as required for the routing of the pipes shall be under the contractor's scope. Any item not included above but necessary for safe and reliable operation of the milling system proposed by the contractor shall also be in the contractors' scope.

6.0 SCOPE OF SUPPLY

Scope for the bidders shall include Design, Engineering, Manufacturing, Packing, Supply, Supervision of Erection & Commissioning, Performance Guarantee Test and handing over of final Customer (NTPC).

Design: Includes basic engineering, detail engineering, preparation and submission of engineering drawings/calculations/datasheets/quality assurance documents/field quality plans, storage instructions, commissioning procedures, Erection & assembly Drawings, 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, PG test, training of customer's O&M Personnel and handing over to customer.

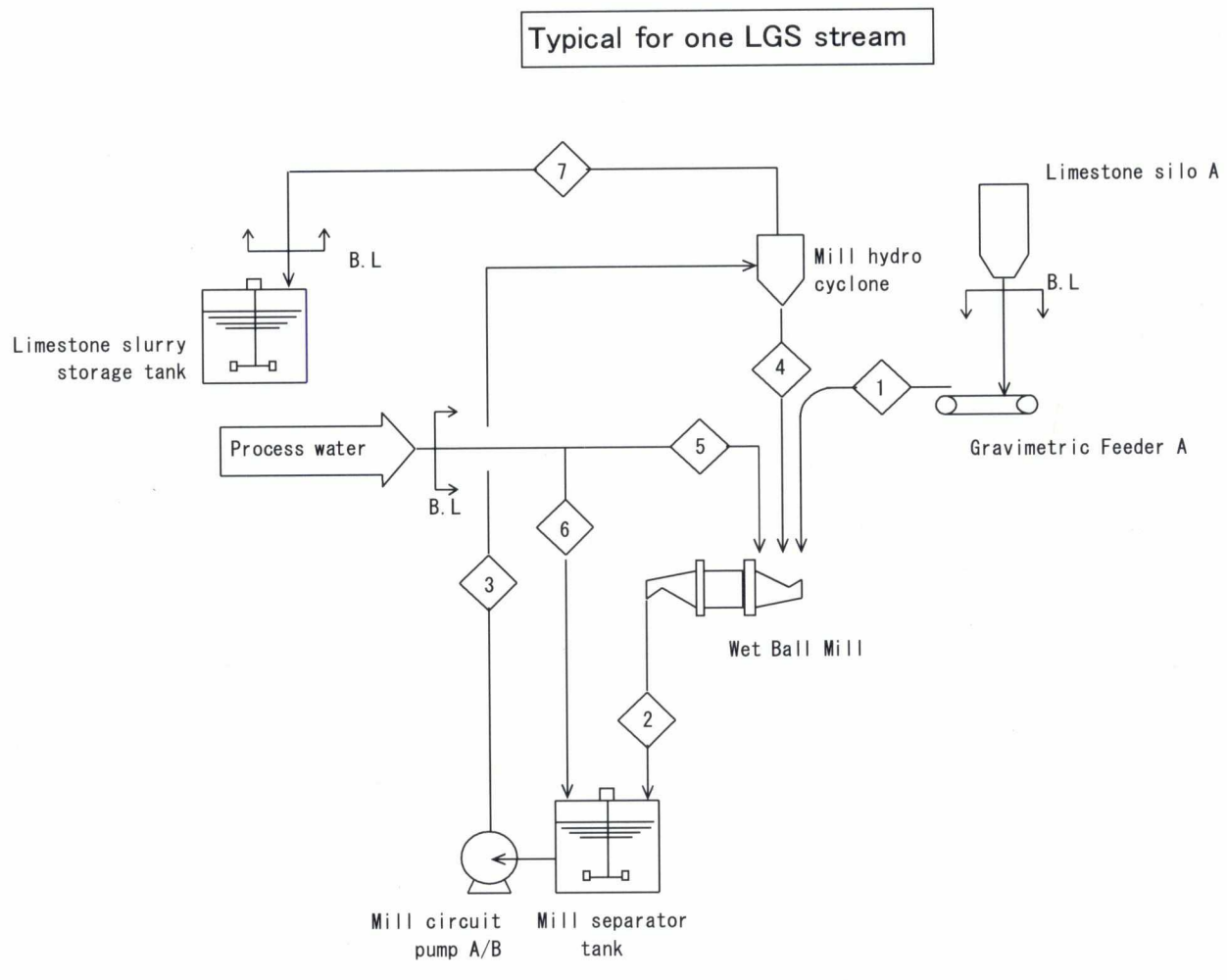
The scope of supply for **Limestone Grinding** system (LGS) shall include but not limited to the following:

S. No.	Item Description	Qty
1.	Limestone Storage Silo Shut-off Gate with chute	2 set
2.	Gravimetric limestone feeder along with its drive and all other auxiliaries	2 set
3.	Wet Ball Mill	2 set
4.	Mill Separator tank	2 set
5.	Mill Separator tank agitator(s)	2 set
6.	Mill circuit pumps with motor	4 set
7.	Distributor Box	2 set
8.	Mill Hydro-cyclone with complete accessories	2 set
9.	Peripheral drive system with motor, speed reducer gear box and other auxiliaries	2 set
10.	Auxiliary motor for inching operation with speed reducer	2 set
11.	Complete lubrication system with lube oil tank	2 set
12.	Lube oil pumps, coolers, duplex oil filters, connecting piping and necessary load & remote indicating instruments. Each lube oil pump and cooler shall have a 100% identical stand-by pump	2 set
13.	Complete interconnecting pipes / chutes along with necessary valves between various systems of the mill and from hydro-cyclone to common slurry storage tanks including companion flanges with gaskets and fasteners	2 set
14.	Base frames wherever applicable (including HT Motor base frame)	2 set
15.	Complete erection and assembly drawings	4 sets
16.	One complete set of instruments required for the LGS	1 set

17.	Cabling and wiring from local instrument to JB	1 set
18.	Initial ball charge	2 set
19.	Local Control Panel	1 set
20.	All LT Motor	1 set
21.	Foundation bolts	1 set
22.	Factory test	1 set
23.	Supervision of erection / commissioning	1 set
24.	Start-up & Commissioning spares	1 set
25.	Special tools & Tackles if appl	1 set
26.	Painting and Rust Prevention during shipment and construction	1 set
27.	Seaworthy Packing & Forwarding to Project Site office	1 set

6.1 PROCESS PARAMETERS:

6.1.1 PROCESS FLOW DIAGRAM WITH SCOPE DEMARCATION



6.1.2 PROCESS DATA

Stream no	<1>	<2>	<3>	<4>	<5>	<6>	<7>
Fluid	Lump limestone	Limestone ball mill over flow	Hydro cyclone feed	Hydro cyclone underflow return	Process water to ball mill	Process water to mill tank	Limestone product slurry
Total flow m^3/h	-						
Total flow kg/h	19400						
Temp °C	45	*1)			45	45	
Solid wt.%	100				0	0	30
Solid comp wt.% $CaSO_4.2H_2O$ $CaCO_3$ Fly ash Other Total	As per cl. no. 5.1				-	-	As per cl. no. 5.1
pH	--				7.0 – 8.2	7.0 – 8.2	
Cl^- mg/l as $CaCO_3$	--				168	168	

Note:
*1) Vendor shall consider additional heat generated by friction of balls inside mill and propose temperature.
Blank cells shall be filled by vendor

6.1.3 TERMINAL POINTS

1. Bidder's scope starts from limestone silo outlet. Limestone silo will be in BHEL scope. Necessary chute between silo outlet and gravimetric feeder is in bidder's scope.
2. Process water for limestone grinding will be provided at one location near wet ball mill building. Further piping from terminal point to LGS system are in bidder's scope.
3. Limestone product slurry shall be terminated by bidder at the inlet of limestone slurry storage tank. Limestone slurry storage tank in BHEL scope.
4. Cooling water for LGS equipment cooling will be provided at one location near wet ball mill building. Further piping from terminal point to LGS system are in bidder's scope and return line for equipment cooling shall be terminated by bidder at one location near plant boundary.
5. Service & instrument air will be provided at one location near wet ball mill building. Further piping from terminal point to LGS system utilities are in bidder's scope.

7.0 GENERAL REQUIREMENTS:

S.No.	Description
1.	All connecting pipes / chutes, pipe supports, trestles, valves, motor (other drives) etc. along with necessary valves from chute to mill and from hydro-cyclone to common slurry storage tanks and wherever required within the system shall be in the scope of the supplier.
2.	Descriptions in the drawings, in the documents, and in the displays shall be in English
3.	Any item not included above but necessary for safe and reliable operation of the milling system proposed by the supplier shall also be in the suppliers' scope.
4.	The equipment shall be designed to withstand the corrosive and moist environment in which these are proposed to operate.
5.	Noise level produced by any rotating equipment individually or collectively shall not exceed 90 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 WBM drive assemblies shall be submitted as part of the proposal data.
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.	Suppliers shall suitable specify their delivery schedule along with the offer and Standard code specified shall be strictly adhered.
10.	All instruments such as pressure transmitters, density transmitters (especially at hydro-cyclone outlet), and other necessary transmitters wherever necessary shall be supplied by the suppliers
11.	Supplier shall provide the loading of item and other factors which shall be required for effective civil construction.
12.	Tanks, pumps, hydro-cyclone etc. are to be designed by vendor based on their experience considering the required milling capacity of each Ball Mill System
13.	**CHUTES:** Minimum clear cross section of chute: 600 mm x 500 mm (inside both ways). Minimum clear cross section of Discharge debris chute: 500mm X 500mm (inside both ways)
14.	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

S.No.	Description
	layout for the equipment. The bidder shall provide the header piping for LGS 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.
15.	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.
16.	Corrosion allowance: Corrosion allowance for entire equipment shall be in accordance with latest applicable Indian / International standard.
17.	Unless otherwise specified , flanges shall be in accordance with ANSI B16.5 Class 150
18.	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.
19.	Rotation arrows shall be cast in or attached with stainless steel plate on each item of rotation equipment at a readily visible location.
20.	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.
21.	Skid Mount/Transportation: Equipment shall be fabricated as skid mount design as much as practical to minimize erection at the site.
22.	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.
23.	Provide double nuts for anchor bolts
24.	Bidder shall provide allowable vibration level on foundation in foundation drawings and/or general arrangement drawings.
25.	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.
26.	Bidder shall provide the mating flanges with the necessary gaskets.
27.	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.

S.No.	Description
28.	Bidder to provide capacity of crane or hoist required for material handling and the details of heaviest component to be handled.
29.	The list of all Bought out items with makes and country of origin to be mentioned along with offer to be submitted.
30.	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.
31.	Material of construction for all equipment/components shall be subject to NTPC/ BHEL approval during detail engineering. Accordingly bidder shall consider MOC for all equipment/component as per best engineering practice, global standard and global references.
32.	Bidder to provide sub vendor list and Bidder shall strictly adhere to NTPC approved vendor list. In case bidder proposes an additional vendor for an item or vendor approval is required for any new item, acceptance shall be subject to approval by NTPC/ BHEL before placing order and bidder shall submit relevant documents as per **Attachment-XX-Sub-Supplier Questionnaire.**
33.	It shall be the complete responsibility of the successful bidders to obtain "Sub Vendor Approval" from BHEL / 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/ BHEL, the same may be replaced with another NTPC/BHEL approved sub-vendor only, without any price implications to BHEL.
34.	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/ 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

S.No.	Description
	f. Bidder should also coordinate in getting the MDCC's (Material Dispatch clearance certificate) and all types of IC's (Inspection Certificates) from the NTPC along with BHEL.
35.	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.
36.	During detail engineering, bidder to strictly adhere to BHEL/NTPC drawing formats, document numbering, quality plan & FQP formats
37.	The identification and numbering of equipment, systems, items, etc. of supply, as well as of all documents and drawings shall be in accordance with reference Designation System for Power Plants - KKS system.
38.	Complete detail engineering drawings, calculations, selection of components etc. shall be reviewed & subject to approval of BHEL/NTPC during detail engineering
39.	Bidder shall furnish necessary inputs & drawings of all equipment in editable Auto CAD/ MS-Word /Excel format.
40.	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.
41.	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 (NTPC) shall also be in the scope of the bidder.
42.	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"
8.0	**DESIGN AND CONSTRUCTION**
8.1	**CHUTE**
a.	The minimum valley angle of chutes shall be 60 degrees from horizontal. Transfer chutes shall be adequately sized and sloped to ensure smooth flow of Limestone without any accumulation anywhere.
b.	Chutes shall be made of minimum 20 mm thick TISCRAL / SAILHARD/ LSLAS07 or equivalent material. All chutes should have one inspection door at every floor and for the ones in between the floors (more than 1.5 meter above the operating floor level) suitable access for trouble free maintenance shall be provided. For sealing of inspection

S.No.	Description
	doors labyrinth type arrangement to be provided.
c.	Complete chute work in the region of flap gates shall be fabricated from 20 thk TISCRAL or equivalent. In case of vertical chute (valley angle more than 80 degree) complete chute, work shall be of 20 mm thick TISCRAL or equivalent material. While finalizing the chute work inside the building, arrangement for shifting and replacing chute legs, proper handling arrangement/wall openings, trolleys, hoists shall also be provided. While fabricating the chute, no welds in between shall be allowed.
8.1.1	**CHUTE BLOCKAGE SWITCHES**
a.	One no. chute blockage switch of proven type (subject to approval of the employer) shall be provided
b.	Chute blockage switch shall trip the feeding conveyor in case of Chute blockage and protect the feeding conveyor equipment.
8.2	**SILO SHUT OFF GATE VALVE**
a.	A bunker outlet chute shall be provided for feeding limestone from bunker to the feeder. The size of the opening chute shall be sufficient to ensure proper flow of the limestone. There shall be no reduction of section in the bunker outlet chute from bunker to feeder. The inlet chute shall be provided with suitable poke doors/holes in order to remove jamming/blockage. A motorized bunker shut-off gate shall be provided at the inlet to each feeder
b.	All parts of the gate in contact with limestone shall be of stainless steel construction.
c.	The shut-off gates and its actuator shall ensure 100% closing of the gate even with 'bunker full of limestone'.
d.	Facility shall be provided to open/close the bunker outlet gate, through actuator, from remote as well as local
e.	In addition, a hand wheel with proper access shall also be provided for manual operation of the gate. The force at the rim of the hand wheel shall not exceed 35 kg with bunker full of limestone.
8.3	**GRAVIMETRIC FEEDER**
a.	Gravimetric feeders shall be sized to **21.35 TPH**.
b.	The limestone feeder belt shall be of seamless rubber construction. It should be possible to adjust the belt tension from outside without opening the feeder body.
c.	All parts in contact with limestone except belt shall be of stainless steel construction.
d.	The feeder shall have adequate instrumentation to detect 'loss of flow'.

S.No.	Description
e.	The feeder shall have a motor/pneumatic operated gate at the outlet
8.4	**WET BALL MILL**
a.	There shall be two numbers wet Ball mills for grinding of limestone. Each mill shall be sized to meet the following conditions, all occurring together.

i.	Design capacity	19.4 Tonnes Per Hour (TPH) dry
ii.	Input Limestone Size	1" (max.)
iii.	Product Size	30 wt% slurry with output Fineness of 90% or higher through 325 mesh
iv.	Mill Wear Part Conditions	Near Guaranteed Wear Part Life.
v.	Ball consumption per ton of limestone throughput	700 g/Ton (Max.)
vi.	Limestone bond index	13 (min) kWh/sh.T)
vii.	Limestone analysis	As per cl. no. 5.1

b.	The milling system shall be designed to withstand for daily stop and daily start operation.
c.	All integral auxiliaries of the mills like hydro-cyclones, separator tank & mill circuit pumps shall be sized to meet the above conditions(a). A 100% stand-by pump shall be provided for the mill circuit pump.
d.	All parts of the mill including mill body, trunnion, hydro-cyclones, integral pipes, mill circuit pumps and other parts in contact with limestone slurry shall be provided with replaceable rubber wear liners. The wear liners or wear parts shall have a minimum guaranteed wear life of not less than 8000 hrs without reversal of the liners. The guaranteed capacity and fineness of the mill shall not be affected within the guaranteed life of the mil wear parts.
e.	The material of the balls shall be chosen to ensure that the balls do not lose their original shape and to ensure minimum ball consumption. The contractor shall also guarantee ball consumption per ton of limestone throughput. The contractor shall furnish the minimum ball diameter below which the balls shall be replaced.
f.	Facility shall be provided for on-load loading of steel balls to the mill.
g.	The ball mill shall be driven by a motor through a peripheral gear/ central drive system. An auxiliary motor shall also be provided for inching of mills after trip and during maintenance.
h.	The lube oil system shall have 100% stand-by arrangement for lube oil pumps and oil