furnish the minimum ball diameter below which the balls shall be replaced.

6.05.06 Facility shall be provided for on-load loading of steel balls to the mill.

6.05.07 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.

6.05.08 The lube oil system shall have 100% stand-by arrangement for lube oil pumps and oil coolers of each circuit with independent pump / cooler. Wherever required duplex oil filters shall be provided.

6.05.09 The mill auxiliaries like separator tanks, mill circuit pump, hydro cyclones and all connecting pipes handling limestone slurry shall have replaceable rubber linings.

6.06.00 Limestone Slurry Preparation / Storage Tank

6.06.01 The contractor shall provide two (2 nos.) slurry storage tank, common for all mills. Each tank shall be sized to meet 12 hours continuous limestone requirement of all the units operating at Design point. For tank volume calculation, solid concentration (by weight) in the slurry shall be assumed, not more than 20% or actual required whichever is lower.

6.06.02 The storage tanks shall be equipped with sufficient number of agitators, to avoid settling of limestone, as per the proven practice of the supplier. The agitators shall be designed to meet the requirements stipulated in Cl. No. 11.00.00 of this Sub-Section.

6.06.03 The limestone mill circulation tanks shall be installed indoor beneath the hydro cyclone stations. The slurry storage tank shall be located outdoor.

6.06.04 The slurry preparation tank shall be CS construction with replaceable chlorobutyl/bromobutyl rubber lining of minimum 5 mm thickness.

6.07.00 Limestone Slurry Supply Pumps & Piping

6.07.01 2x100% centrifugal type limestone slurry pump shall be provided for each unit. Each limestone slurry pump shall be sized to supply the limestone requirement of one (1 no.) unit, under the following conditions all occurring together.

(i)	Load	Design point
(ii)	Flow	110% of one absorber requirement with the limestone requirement at Design point.

	(iii)	Head	As per system requirement.
	(iv)	Margins	Flow 10% (minimum) Heads 15% (minimum)
	(v)	Solids Concentration	Max. 30% by weight or actual as per suppliers practice, whichever is minimum.

6.07.02 The limestone slurry pumps shall be designed to meet the requirements stipulated in Cl. No.8.00.00. of this Sub-Section.

6.07.03 The limestone slurry pipes shall be sized to minimize erosion and avoid settling of the limestone at part load operation. The slurry pipes shall be lined with replaceable wear resistant natural rubber lining of minimum 6 mm thickness. Additional thickness of 2 mm in rubber lining shall be provided at bends.

6.07.04 Automatic flushing equipment for all lime slurry pumps and pipes shall be supplied.

7.00.00 GYPSUM DEWATERING SYSTEM

7.01.00 A common gypsum dewatering system for all the units operating at Design point is envisaged. Contractor shall supply a two stage gypsum dewatering system, consisting of a primary stage of sets of hydro-cyclones and secondary stage of vacuum belt filters for dewatering of gypsum from absorber up to less than 10% moisture. All the equipments supplied shall be proven design with previous installations for similar capacities.

7.02.00 The Contractor shall provide 2x100% gypsum dewatering system with each stream sized to dewater 110% of the maximum gypsum produced by all the units operating at Design point. All other stipulations with respect to sizing and design of the dewatering system, auxiliaries and other systems shall be in line with this specification.

7.03.00 Primary Dewatering Hydro-cyclones

7.03.01 Each set of primary dewatering hydro-cyclone shall be sized to dewater the gypsum slurry produced by all the units operating at Design point with an additional 10% margin. The outlet water content in the gypsum shall be as per the requirement of the vacuum belt filters.

7.03.02 Each set of primary hydro-cyclone shall be provided with 10% spare hydro-cyclones. The capacity defined in the previous clause shall be met with spare hydro-cyclones out of service.

7.03.03 The primary hydro-cyclone shall be installed directly above the belt filters. The overflow of the hydro-cyclones shall be taken to Hydro-cyclone Waste Water tank via secondary hydro-cyclone feed tank and secondary waste water hydrocyclone as

PART – B (DETAILED TECHNICAL SPECIFICATION)

SUB-SECTION- V-Q (QUALITY ASSURANCE)

(MECHANICAL)

SUB-SECTION-V-QM1

FLUE GAS DESULPHURISATION SYSTEM

FLUE GAS DESULPHURISATION SYSTEM

1.00.0	**FLUE GAS DESULPHURISATION SYSTEM**
1.01.0	**Mills:**
1.01.01	Raw material for shaft, coupling, gears and pinions, top and bottom races and other rotating components shall be subjected to UT. MPI/LPI shall be carried out to check surface soundness.
1.01.02	Wear-resistant parts shall be UT/RT tested to check soundness after suitable heat treatment. Check for chemical composition, hardness and microstructure shall be carried out.
1.01.03	Butt welds in the tube/separator/body casing of the mill shall be tested by RT and MPI. All other welds in main tube/separator shall be tested by MPI/LPI for acceptance. The tube shall be statically balanced.
1.01.04	All gearboxes shall be run tested for adequate duration to check rise in oil temperature, noise level and vibration. Check for leak tightness of gear case also shall be performed.
1.02.0	**Feeders:**
1.02.01	Any welds in the casing/pulley fabrication shall be checked with MPI.
1.02.02	Routine tests shall be done as per relevant Indian Standards or equivalent International Standards.
1.02.03	All major items like plates for casing, head pulley, tail pulley, pulley shaft and major castings shall be procured with respective material test certificates.
1.02.04	Calibration check shall be carried out on all feeders.
1.03.0	**Dampers:**
1.03.01	All the dampers shall be subjected to operational test/checks.
1.03.02	Gas tight Dampers shall be subjected to shop leakage test to demonstrate the guaranteed tightness as per NTPC Tech Specification.
1.04.0	**PIPING, VALVE AND SPECIALITIES:**
1.04.01	All pipes and fittings shall be tested as per applicable code.
1.04.02	All valves shall be hydraulically/Air tested for body, seat and back-seat (if applicable) as per relevant standard.
1.04.03	NDT on valves shall be as per relevant standard.
1.04.04	Valves shall be offered for hydro test in unpainted conditions.
1.04.05	Functional checks of the valves for smooth opening and closing shall also be done.

1.05.00 **TANKS / VESSELS:**

1.05.01 **Atmospheric tanks:**

i) All welds joints shall be DP tested and complete tanks shall be water fill tested.
ii) All atmospheric storage tanks fabricated and erected at site shall be subjected to tests (Hydro, NDT and Vacuum) according to design code as applicable.
iii) Rubber lining shall be tested for hardness and spark test, as applicable.

1.05.02 **Pressure vessels:**

1) NDT on weld joint shall be as per respective code requirements or the minimum as specified as below:

   i) 100% DPT on root run of butt weld, nozzle welds and finished fillet welds.
   ii) 10% DPT on all finished butt welds.
   iii) 10% RT (covering all 'T'/cross joints) of butt welds.

2) Butt welds of dished ends shall be stress relieved and subjected to 100% RT.

3) Each finished vessels shall be hydraulically tested to 150% of the design pressure for a duration of 30 minutes.

1.06.00 **HEAT EXCHANGER/HEATER:**

1.06.01 All material shall be tested for chemical and mechanical properties and NDT as per relevant standard.

1.06.02 NDT on welds and other checks shall be as per relevant code.

1.06.03 Air heaters shall be subjected to dimensional and clearance checks as per standard practice

1.06.04 Lub. oil system, drive system, soot blowing system etc. of Air heaters shall be checked suitably as per standard practice

1.07.00 **PUMPS:**

1.07.01 UT on shaft forgings (greater or equal to 40mm) and MPI/DPT shall be done on shafts and impeller to ensure freedom from defects.

1.07.02 The pump casing shall be hydraulically tested at 200% of pump rated head or at 150% of shut off head, whichever is higher. The test pressure shall be maintained for at least half an hour.

1.07.03 The pump rotating parts shall be subjected to static and dynamic balancing.

1.07.04 All pumps shall be tested at shop for capacity, head efficiency and brake horse power at rated speed as per relevant/applicable standard.

1.07.05 Noise and vibration shall be measured during the performance testing at shop.

1.08.00	**STRUCTURES , DUCTS, HOPPERS:**
1.08.01	All materials shall be tested for chemical and mechanical properties as per relevant standard. All plates above 40mm shall be 100% Ultrasonically tested.
1.08.02	Visual inspection of all welds shall be performed in accordance with AWSD1.1.
1.08.03	NDT requirements of structural steel welds shall be as under: i) 100% RT/UT on butt-welds of plate thickness>= 32mm. ii) For plates of 25mm<=thickness<32mm-10% RT and 100% MPI. iii) For plates of thickness <25mm-10% MPI/LPI.
1.08.04	Edge for shop and field weld shall be examined by MPI for plate thickness >= 32mm.
1.09.00	**VACUUM BELT FILTER SYSTEM:**
1.09.01	Impeller, casing and shaft of vacuum pumps shall be tested for chemical and mechanical properties as per relevant standard. All plates above 40mm shall be 100% Ultrasonically tested.
1.09.02	UT on shaft (if greater or equal to 40mm) and impeller shall be carried out.
1.09.03	All vacuum pumps shall be tested at shop for capacity, power, pressure, efficiency, noise and vibration etc.
1.09.04	Filter cloths and belts shall be tested for physical properties as per relevant standard
1.09.05	Hydro cyclones shall be checked by visual, dimensional etc.
1.10.00	**SPRAY NOZZLES:**
1.10.01	Spray nozzles shall be tested for physical properties
1.10.02	Spray nozzles also shall be subjected to performance test.
1.11.00	**AGITATORS:**
1.11.01	Rubber lining shall be tested for hardness and spark test
1.11.02	Impellers shall be tested for dimensional and balancing check
1.11.03	Gear Boxes shall be tested for run test as per standard practice
1.12.00	**FANS:**
1.12.01	Rotor components shall be subjected to ultrasonic test at mill and magnetic particle inspection / liquid penetrant examination after rough machining.
1.12.02	Butt welds in rotor components shall be subjected to 100% RT and all welds shall be magnetic particle/dye penetrant tested after stress relieving.

1.12.03 All rotating components and assemblies of fan shall be balanced dynamically

1.12.04 Performance test shall be carried out on fans as per Technical specification/ Relevant standard

1.12.05 Test for Natural Frequency and hardness of Fans blades shall be carried out as per Technical specification/ Relevant standard

1.13.00 Thermal Insulation, Lagging & Cladding:

(a) **Lightly resin bonded mineral wool:**

LRB mattresses/sections of Rockwool/ Glasswool shall conform to & tested as per relevant clauses of Indian Standards and shall meet the requirements of NTPC data sheet. Type tests except Thermal Conductivity shall be regularly carried out once in three months, Thermal Conductivity Type Test shall be carried out minimum once in twelve months by the manufacturer. Requirements of various components like Binding wires, Lacing wires, Wire mesh, etc. shall be as per NTPC approved data sheet / as given in respective Sub-Section of Technical Requirements of Steam Generator & Auxiliaries.

(b) **Lagging & Cladding:**

All insulation shall be protected by means of an outer covering of Aluminium sheeting confirming to ASTM B-209-1060 temper H14 from reputed manufacturer meeting the requirements of NTPC data sheet.

1.14.00 OTHER CRITICAL EQUIPMENTS:

1.14.01 Checks/ NDTs shall be done as per relevant Indian Standards or equivalent International Standards.

TYPICAL QUALITY PLAN

MANUFACTURING QUALITY PLAN

ITEM : WET LIMESOTNE GRINDING MILL

SUB ITEM : MILL SLURRY STORAGE TANK

Sl.No.	Component/Operation	Characteristics	Cl	Type of Check	Quantum of Check		Reference Doc.	Acceptance Norm	Format of Record		Agency**			Remarks
					M	C / N					M	C	N	
1	2	3	4	5	6		7	8	9	D°	10			
1	Raw Materials													
1.1	Plates	Chemical, Mech. Properties, Dimension & Visual	MA	MTC Review /Visual	100%	100%	Approved Drawings	Approved Drawing & Material Specification	MTC/ Lab TC	√	P	V	V	
		Soundness of plate (Only for Thk >40 mm)	MA	UT	100%	100%	Approved Drawings	ASTM-A 435	MTC/Lab TC / UT Reports	√	P	V	V	Check Test shall be carried out only if correlated MTC is not avilable
1.2	Rolled Section	Chemical, Mech. Properties, Dimension & Visual	MA	MTC Review /Visual	100%	100%	Approved Drawings	Approved Drawing & Material Specification	MTC/ Lab TC	√	P	V	-	
1.3	Pipe	Chemical, Mech. Properties, Dimension & Visual	MA	MTC Review /Visual	100%	100%	Approved Drawings	Approved Drawing & Material Specification	MTC/ Lab TC	√	P	V	---	
2.0	In process control													
2.1	Welding Procedure Qualification	Procdure Qualification (Welding Strength)	MA	Document Review	100%	100%	ASME Sec .IX	ASME Sec .IX	WPS , PQR Record	√	P	V	V	
2.2	Welding Personnel Qualification	Personnel Qualification (WPQ)	MA	Document Review	100%	100%	ASME Sec .IX	ASME Sec .IX	WPQ Record	√	P	V	---	
2.3	Marking & Cutting	Dimension & Visual	MA	Measurement & Visual	100%	-	Approved Drawings	ApprovedDrawing & Loesche Approved Tolerance Sheet	-	-	P	-	-	
2.4	Fit-up inspection	Dimension & Visual	MA	Measurement & Visual	100%	-	Approved Drawings	ApprovedDrawing & Loesche Approved Tolerance Sheet	-	-	P	-	-	

LEGENDS : CL : Class (MA : Major, MI : Minor)

** M : Manufacturer / Sub-contractor,
C : BHEL / Nominated Inspection agency. N : Customer
CHP: NTPC shall identify in column "N" as "W"
P : Perform, W : Witness, V : Verification, ND : NDT Lab.
R : Test/Dimensional Reports
* Records, Identified with Tick (√) shall be essentially Included in QA Documentation

SIGNATURE	REVIEWED BY	APPROVED BY	APPROVAL SEAL

MANUFACTURING QUALITY PLAN

ITEM : WET LIMESOTNE GRINDING MILL

SUB ITEM : MILL SLURRY STORAGE TANK

Sl.No.	Component/Operation	Characteristics	Cl	Type of Check	Quantum of Check		Reference Doc.	Acceptance Norm	Format of Record		Agency**			Remarks
					M	C / N					M	C	N	
		3	4	5	6		7	8	9	D°	10			
3.0	NDE	soundness check of all longitudinal and circumferential butt weld	MA	RT & Visual	100% 10%	10%	Approved Drawing / ASME SEC.V	ASME Sec.VIII . Div-1	RT Report	√	P	V	V	RT film review by NTPC/BHEL
		Soundness check of all butt weld	MA	DPT & Visual	100%	10%	ASME SEC.V	ASME Sec.VIII . Div-1	DPT Report	√	P	V	V	
4.0	Final Inspection													
4.1	Final Inspection of Individual Part	Dimension, Alignment , Orentation , template check & Visual	MA	Visual and measurement	100%	10%	Approved Drawing	Approved Drawing & Approved Tolerance Sheet	Report	√	P	W	W	
4.2	Haet Treatment (As applicable)	Thermo couple location & Calibration Record	MA	Time - Temoerature graph varification	100%	100%	Approved Drawing	Approved Drawing & Heat treatment procedure	Graph	√	P	V	V	
4.3	Water fill test of Tanks (As Applicable)	Absence of leakage	MA	Visual check	100%	100%	Approved Drawing / Procedure	Approved Drawing / Procedure	Report	√	P	W	W	If tanks are supplied in partial condition for site assembly water fill test is not applicable at vendor shop.
4.5	Surface Preparation	Surface Profile	MA	Visual and measurement	100%	100%	NTPC Approved Painting Procedure		Report	√	P	V	---	Random area.
4.6	Rubber Lining, If applicable	Shore Hardness	MA	Visual and measurement	100%		Data sheet / Manufacturer Standard		Report	√	P	W	W	
		Spark Test	MA	Visual and measurement	100%	100%	Data sheet / Manufacturer Standard		Report	√	P	W	W	10% For NTPC.
4.7	Painting	Colour shade, Dry film Thickness & Adhesion	MI	Visual and measurement	100%	100%	NTPC Approved Painting Procedure		Paint Report	√	P	V	---	
5.0	Release for Dispatch													
5.1	Packing / Shipping	Packing condition	MI	Visual / sturdiness	100%	100%	Approved Packing Procedure	Approved Packing Procedure	Packing list , packing photo	√	P	V	---	
5.2	Final Document Dossier	Review of record	MI	Document Review	100%	100%	As per QCP Stages		Final Dossier	√	P	V	---	COC shall be submitted for Items not covered in MQP

LEGENDS : CL : Class (MA : Major, MI : Minor)

** M : Manufacturer / Sub-contractor,
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* Records, Identified with Tick (√) shall be essentially Included in QA Documentation

Drawings / Data sheet identified in MDL are NTPC approved, documents not in MDL are OEM approved.

SIGNATURE	REVIEWED BY	APPROVED BY	APPROVAL SEAL