ANNEXURE-II

SUPPLIER'S LOGO	SUPPLIER'S NAME AND ADDRESS	FIELD QUALITY PLAN		PROJECT :
		ITEM :	QP NO.:	PACKAGE :
			REV. NO.:	CONTRACT NO. :
		SUB-SYSTEM:	DATE:	MAIN-SUPPLIER:
			PAGE: …. OF….	

SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK #	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		REMARKS
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	10.

		LEGEND: * RECORDS, INDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)	एनटीपीसी NTPC	DOC. NO.:		REV……
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER		FOR NTPC USE			
SIGNATURE				REVIEWED BY	APPROVED BY	APPROVAL SEAL

FORMAT NO.: QS-01-QAI-P-09/F2-R1 1/1 ENGG. DIV./QA&I

ANNEXURE-III

एनटीपीसी NTPC	Project : Stage : Package : Supplier : Contractor No. :	LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB-SUPPLIER APPROVAL SUB-SYSTEM :	DOC. NO.: REV. NO.: DATE : PAGE : OF

S. N.	Item	QP/ Insp. Cat.	QP No.	QP Sub. Schedule	QP approval schedule	Proposed sub-supplier	Place	Sub-suppliers approval status / category	Sub-supplier Details submission schedule	Remarks

LEGENDS
SYSTEM SUPPLIER/SUB-SUPPLIER APPROVAL STATUS CATEGORY (SHALL BE FILLED BY NTPC)
A – For these items proposed vendor is acceptable to NTPC. To be indicated with letter "A" in the list alongwith the condition of approval, if any.
DR – For these items "Detailed required" for NTPC review. To be identified with letter "DR" in the list.
NOTED – For these items vendors are approved by Main Supplier and accepted by NTPC without specific vendor approval from NTPC. To be identified with "NOTED.'
QP/INSPN CATEGORY:
CAT-I : For these items the Quality Plans are approved by NTPC and the final acceptance will be on physical inspection witness by NTPC.
CAT-II : For these items the Quality Plans approved by NTPC. However no physical inspection shall be done by NTPC. The final acceptance by NTPC shall be on the basis review of documents as per approved QP.
CAT-III : For these items Main Supplier approves the Quality Plans. The final acceptance by NTPC shall be on the basis certificate of conformance by the main supplier.
UNITS/WORKS : Place of manufacturing Place of Main Supplier of multi units/works.

FORMAT NO.: QS-01-QAI-P-1/F3-R0 1/1 Engg. Div. / QA&I

ANNEXURE-IV

एनटीपीसी NTPC	Project : Stage : Package : Contractor : Contractor No. :	STATUS OF ITEM REQUIRING QP& SUB-SUPPLIER APPROVAL	DOC. NO.: REV. NO.: DATE : PAGE : OF

S. N.	Item / Service	QP/ Insp. Cat.	QP Sub. Schedule Approval schedule	Date of sub-missio n	Date of comm t Appl.	Status Code C/II/I	Proposed Sub-suppliers	Place of manufacturing works	Approva l Status	Sub-supplier detail submissio n schedule	Remarks

FORMAT 1/1 Engg. Div. / QA&I

ANNEXURE-V

एनटीपीसी NTPC	Project : Stage : Contractor : Contractor No. : System :	FIELD WELDING SCHEDULE (To be raised by the contractor) Welding Code: ……	DOC. NO.: REV. NO.: DATE : PAGE : OF

Sl. No.	DRG No. for Weld Location and Identification mark	Description of parts to welded	Matl. Spec.	Dimensions		Process of welding	Type of Weld	Electrode filler spec.	WPS. No.	Min. pre-heat	Heat treatment		NDT method/ Quantum	REF		Remarks
											Temp.	Holding time		Spec. No.	ACC Norm Ref.	

NOTES:

SIGNATURE

FORMAT	1/1	Engg. Div. / QA&I

S.No	Description of Drgs/Docs	No of Prints	No of CD ROMs/DVDs/Portable Hard Disk
1	Drawings, Data sheets, Design calculations, Purchase specifications and other documents		
	First submission and submission with major changes		
	▪ Layout (A0&A1 sizes)	4	-
	▪ Other Drawings/Documents (A0&A1 sizes)	2	-
	▪ P&ID (All sizes)	4	-
	a) Final drawings/documents (Directly to site)	6	2
	b) "As Built" Drawing/Documents (Directly to site)	6	2
	c) Analysis reports of Equipments / piping /structures components/system employing software packages as detailed in the specifications.	2	2
2	Erection Manual (Directly to site)	4 sets	2
3	Operation & Maintenance manual i) First Submission	1 set	--
	ii) Final Submission (Directly to site)	4 sets	2
4	Plant Hand Book i) First Submission	1	1
5	Commissioning and Performance Test Procedure manual i) First Submission	1 set	--
	ii) Final Submission (Directly to site)	4 sets	2

S.No	Description of Drgs/Docs	No of Prints	No of CD ROMs/DVDs/Portable Hard Disk
6	Performance and Functional Guarantee Test Report i) First Submission	2 sets	--
	ii) Approved Copies (Direct to Site)	4 sets	2
7	Project Completion Report (Directly to site)	6 sets	2
8	QA programme including Organisation for implementation and QA system manual(with revisions)	1	--
9	Vendor details in respect of proposed vendors including contractor's evaluation report.	2	--
10	Manufacturing QPs, Field QPs, Field welding schedules and their reference document like test procedures, WPS, POR etc i) For review/comment	1	--
	ii) Approved final copies of Field QPs, Field welding schedules and their reference document like test procedures, WPS, POR etc (Direct to Site)	4	2
11	Welding Manual, Heat Treatment Manuals, Storage & preservation manuals i) For review/comment	1 set	--
	ii) Approved copies (Direct to Site)	4 sets	2
12	QA Documentation Package for items / equipment manufactured and despatched to site	2 sets	2
13	QA Documentation Package for field activities on equipment/systems at site	2 sets	2

PRODUCT	AREAS OF TRAINING REQUIEMENT			
	PRODUCT DESIGN	**Plant Visit**	**Visit to Manufacturer's Work**	**Operation & Maintenance of Plant**
FGD	Layout & model of FGD area, cable & piping trestles etc. **FGD** • Mass balance, Design, selection and sizing calculations of FGD • Training on factors affecting sizing/ efficiency of FGD system, equipments & auxiliaries • Materials for FGD & selection • Basic concepts, Design and sizing calculations on slurry systems including piping, valves, etc.. • FGD electrical system • FGD control system Erection strategies, erection procedures Performance as per applicable code and demonstration tests.	Familiarization with various system and equipment Performance, data collection analysis and review O&M feed back Operation history of various equipments and system Failure analysis	Manufacturing process of Absorber and equipments Welding process Testing facilities Product development in process Future plan for technology induction R&D work in progress	Control philosophy operation, notices, logic & protection schemes, O&M manual familiarization O&M issues. Familiarization of special maintenance techniques Special tool and tackles familiarization
MANMONTH	**2**	**0.5**	**0.5**	**6**
ZLD System (In Projects where ZLD System is provided by Contractor)	• Basic design features of ZLD system for FGD WWT Plant • Theory & principle of operation • Discussions on various measurement points, Types, Ranges and locations for the offered system • Latest technological trends in ZLD system for FGD WWT Plant and design aspects • Software and model test	Operational feedback O&M history/ problems related to ZLD system	Training on ZLD system for FGD Waste water System description, basic design and engineering Manufacturing process of ZLD system equipments Testing facilities	Trouble shooting and fault analysis Familiarization of special maintenance techniques Special tool and tackles familiarization
MANMONTH	**0.5**	**0.25**	**0.25**	**1**

CUSTOMER SPECIFICATION: QUALITY ASSURANCE

NTPC Limited

(A Government of India Enterprise)

LOT 1A PROJECTS

PART – B
(DETAILED TECHNICAL SPECIFICATION)

SUB-SECTION-V-Q
(QUALITY ASSURANCE)

SECTON – VI

TECHNICAL SPECIFICATION

FOR

FLUE GAS DESULPHURISATION (FGD)

SYSTEM PACKAGE

BIDDING DOCUMENT NO. : CS-0011-109(1A)-2

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.

1.06.0 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

1.07.0 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.

1.08.0 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.

1.09.0 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.

1.10.0 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.

1.11.0 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

1.12.0 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

1.13.0 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.

1.14.0 OTHER CRITICAL EQUIPMENTS:

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

SUB-SECTION-V-QM2

LIME & GYPSUM HANDLING

Lime & Gypsum Handling

1.01.00 Brakes and Clamps :

1.01.01 Final testing of brakes shall include load, HV/IR & heat run tests.

1.02.00 Monorails and Hoists

1.02.01 All electric hoist shall be tested as per IS 3938 and chain pulley block shall be tested as per IS 3832.

1.03.00 Hoppers & Liners

1.03.01 Rack & Pinion Gates/Flap Gates/Rod Gates

a) MPI/DP test shall be conducted on rack and pinion / rod / weld joint

b) Functional checks on the gates shall be carried out along with respective actuator, if applicable.

1.04.00 Storage Silo

1.04.01 All material shall be tested for Chemical & Mechanical properties as per relevant standard. MPI/DP test on welding shall be carried out. Fit up assembly checks shall be carried out at shop for all despatchable segments

1.04.02 Bag Filters : Leakage test shall be carried out for pressure parts. Pulsing and sequential test on bag filter shall be done.

1.05.00 Belt Conveyor System

The details of the checks to be carried out in the various equipments are to be submitted by the Contractor for Owner's approval. However, some indicative checks on different items are given below which should necessarily form a part of the Quality Assurance Plan to be agreed with the Owner.

1.05.01 Idlers

a) Check for run out and free movement shall be carried out on idlers. Run out shall be restricted as per IS:8598

b) Test for dust proofness, water proofness and dynamic friction factor of the Idlers shall be conducted at shop. The detailed procedures for the same shall be submitted for review and approval.

1.05.02 Belting

(a) Rubber cover of finished belt shall be checked for tensile strength and elongation at break before and after ageing. Rubber cover shall also be checked for abrasion, tear strength and hardness.

(b) For finished belts, checks for elongation at 10% nominal tensile strength, tensile and elongation at break in longitudinal (warp) direction and tensile in transverse (weft) direction shall be carried out.

(c) Adhesion test between ply to ply and cover to ply shall be carried out.

(d) Troughability test and Test for fire resistance shall be carried out.

(e) Test for procedure qualification for belt vulcanizing joint (at site) shall be done. Procedure for belt vulcanizing joint shall be discussed and finalized during FQP finalization.

(f) There will be a limitation on the no. of repairs allowed on the belts. Following will be the acceptance norm for the cover repairs.

i) The maximum size of a repair shall be limited to a size equivalent to one fifth the belt width. No single dimension shall exceed one fifth(1/5) of belt width.

ii) Small local repair by dough filling of size 25mm x 25mm to a limited extent shall not be counted of repairs. However, in case of cluster of repairs, same shall be counted as a patch repair.

iii) The maximum number of patch repair shall not exceed 5 per 100 mts. However, the total number of patch and dough filling repairs shall not exceed 10 per 100 meters.

(g) In addition to above, Steel Cord belt shall also be tested for following.

i. Cord dia and breaking strength

ii. Finished belt shall be tested for cord pull-out strength before and after aeging, peeling resistance.

iii. Dynamic cord pull out test

iv. Cord dia, pitch and number of cords

(h) In no case shall the cover thickness or the width of belt be less than that given in specification.

(i) For testing purpose, belt sample shall be taken from anywhere of the belt roll length offered

1.05.03 Belt Vulcanizing Machine

a) Check for tensile strength shall be carried out on a sample vulcanized belt joint for each type of belt in shop. However if such test has been done earlier, the report for same shall be submitted for verification.

b) Complete assembly shall be tested at shop for temp. and pressure developed

1.05.04 Pulleys

a) In addition to chemical, mechanical, hardness, microstructure as per applicable material specification, pulleys shaft forgings shall be subjected to ultrasonic testing.

b) 100% MPI/DPT on all welds shall be conducted and 10% RT/UT on butt welds shall be conducted.

c) Static balancing of pulleys shall be carried out after rubber lagging.

d) Checks on rubber lagging to include abrasion loss, shore hardness test, peel-off strength test and physical properties. Peel-off strength shall be 10 Kg/Cm, Abrasion loss shall be less than 250 cubic mm when tested as per DIN 53516.

1.05.05 Pull Chord & Belt Sway Switches

a. Acceptance tests

i) Over all dimension and functional test.

ii) HV & IR test

iii) Degree of protection test report.

1.05.06 Zero Speed Switch, Under Belt Switch and Chute Blockage Switch

a Acceptance test

i) Burn in test at 50 degree C for 48 hours shall be done for electronic switches.

ii) Over all dimension and functional test shall be carried out.

iii) HV & IR

iv) Degree of protection test

1.06.00 Drive Equipments

1.06.01 Gear Boxes :

(a) In addition to checks for physical, chemical, hardness,microstructure as per relevant standard, the shaft and gear/pinion forgings shall be subjected to ultrasonic testing .

(b) MPI to be carried out on Gears/Pinions after machining. Case depth, hardness and MPI after hardfacing shall be checked to ensure freedom from defects.

(c) Gear reducer shall be checked for reduction ratio, backlash and contact pattern. No load shop trial run to be conducted on gear boxes to check for oil leakage, temperature rise, noise level and vibration .

1.06.02 Flexible Coupling

(a) Ultrasonic testing shall be conducted on forgings for gear sleeve and gear hub, if gear coupling is provided.

(b) MPI shall be carried out after machining to ensure freedom from cracks.

1.06.03 Fluid Coupling

(a) Dynamic balancing shall be carried out for the rotating parts.

(b) Check for leak tightness of the coupling shall be carried out.

(c) Functional test on fusible plug for each type of coupling shall be conducted at shop.

(d) All couplings to be run tested at shop on no load

(e) Check for temperature rise, torque-speed, torque-slip characteristics and over speed test shall be included during performance test of one coupling of each type preferably at full load.

1.07.00 Belt Scales

The details of the checks to be carried out in the various equipments are to be submitted by the Contractor for Employer's approval. However, some indicative checks are given below which should necessarily form a part of the quality assurance plan to be agreed with the Employer.

1.07.01 Mounting arrangement/Overall dimensional check shall be carried out on the Belt Scales.

1.07.02 Belt scale shall be calibrated with test weight/test chain in static at works and with test weight for dynamic condition at site.

1.07.03 All electronic modules shall be subjected to burn in test at 50 Degree C for 48 hours.

1.07.04 General check for load cell shall be carried out.

1.07.05 Test report for degree of protection on enclosure shall be furnished.

1.07.06 Accuracy/performance check shall be demonstrated at site.

1.08.00 Dust Control & Miscellaneous Systems(Dust Suppression & Dry Fog Dust Suppression System)

The details of the checks to be carried out on the various equipments are to be submitted by the Contractor for Owners approval. However some indicative checks on different items are given below which should necessarily form a part of the Quality Assurance Plan to be agreed with by the Owner.

1.08.01 Pumps

(a) All materials should be of tested quality and test certificates to be provided.

(b) DPT of machined shaft and impeller shall be done.

(c) Shaft forgings to be also subjected to ultrasonic testing.

(d) Impellers to be dynamically balanced to ISO 1940 Gr.6.3

(e) All pressure parts shall be hydraulically tested at 150% of the shut-off head or 200% of rated head, whichever is higher for 30 minutes. No leakage is allowed.

(f) All pumps to be performance tested as per Hydraulic Institute Standard/Indian Standard. Performance test to include check for noise, vibration level and temperature rise.

1.08.02 Valves & Specialities

(a) Valves and Specialities shall be tested as per relevant standards / codes.

(b) Seat Leakage and hydraulic test to be carried out as per relevant standards / codes.

1.08.03 Pipes and Fittings

Pipes and fittings shall be tested as per relevant standards/ codes

1.08.04 Air Compressor

a) All pressure parts shall be hydraulically tested at not less than 150% of design pressure for a duration of 30 minutes prior to painting.

b) All other parts including inter-connecting piping shall be hydraulically tested wherever possible, as per relevant codes.

c) Ultrasonic testing shall be carried out on all forgings and rotor for dia 50mm and above. MPI/DPT shall be done on machined area of the components.

d) During assembly all clearances and alignments shall also be checked and recorded

e) Rotor shall be statically and dynamically balanced

f) Performance Test(Shop Test)

i. Performance test on the compressor shall be carried out in accordance with ISO:1217/Eq. The test shall also include demonstration of loading and unloading mechanism(Capacity control) and operation of safety valve

ii. Vibration and Noise level measurement shall be done during shop performance test.

1.08.05 Air Receiver

a) Each finished vessel shall be hydraulically tested at 150% of the design pressure for a duration of 30 minutes

b) NDT on weld joints shall be as per respective code requirements or the minimum as specified below

i. 100% DPT on root run of butt welds

ii. 100% DPT on all finished butt welds and fillet welds

iii. 10% RT on butt welds which shall include all T-Joints

1.09.00 Dust Extraction and Ventilation System

1.09.01 Fan

(a) All materials should be of tested quality and test certificates should be provided.

(b) Dynamic balancing of the fan impellers to be carried out.

(c) Shop run test shall be conducted on all centrifugal fans including check for noise and vibration level.

(d) Performance test shall be conducted on one fan of each type at shop for capacity, pressure, efficiency and power consumption.

1.09.02 Valves and Specialties

Refer 1.08.02 above

1.09.03 Pipes and Fittings

Refer 1.08.03 above

1.09.04 Package Air-Conditioner

Each Unit shall be subjected to production routine Test excluding performance test carried out as per relevant standard. Performance test of PAC shall be carried out as per relevant standard on one unit of each type and rating at site.

1.10.00 Crushers

The details of the checks to be carried out for various components are to be submitted by the Contractor for Owner's approval. However, some indicative checks on different items are given below which should necessarily form part of the Quality Assurance Plan to be agreed with the Owner.

(a) All plates equal to or above 25mm thickness shall be ultrasonically tested.

(b) Shaft forgings and suspension bars to be checked for ultrasonic testing in addition to check for chemical, mechanical, hardness, microstructure etc. as per applicable material specification.

(c) Following minimum NDT requirements to be ensured for welds:

i) Butt welds - 10% UT/RT and 100% MPI/DPT.

ii) Fillet Welds - 10% MPI/DPT.

(d) Crusher rotor to be dynamically balanced. Procedure to be submitted for approval.

(e) No-load trial run test to be carried out at shop to check for speed(RPM),temperature rise, noise level and vibration .

1.11.00 Mobile Trippers

(a) Shaft and wheel forgings – Ultrasonic test in addition to check for chemical, mechanical, hardness, microstructure etc. as per applicable material specification shall be conducted.

(b) Following minimum NDT requirements to be ensured for welds:

i) Butt welds - 10% UT/RT and 100% MPI/DPT.

ii) Fillet Welds - 10% MPI/DPT.

(c) Shop trial run test shall be carried out and shall include check for noise level and vibration.

1.12.00 In-Line Magnetic Separators

i) Overall Dimensional, Visual check alongwith control panel.

ii) HV & IR.

iii) Operation, temperature rise, lifting capacity, force index and gauss strength.

1.13.00 Metal Detectors

i) Functional test including sensitivity, Burn in test, operation of liquid spray marker, detection of smallest piece of different materials as specified.

ii) Test report for Degree of protection test to be furnished.

1.14.00 Sampling Units

(a) Free carriage and cutter movement, speed of cutter and dust door closing and sealing shall be tested for samplers.

(b) "No load test" shall be carried out for crushers.

1.15.00 Elevators (Passenger cum goods elevator)

Refer QA table for passenger/service elevator.

1.16.00 Steel Structure

1.16.01 Only material which has been identified against mill sheet or test certificates shall be used for construction. Check testing shall be carried out in the absence of MTC. Correlation shall be maintained by Manufacturer. All plates above 40mm thickness shall be 100% ultrasonically tested.

1.16.02 Visual inspection of all welds shall be performed in accordance with AWS D.1.1.

1.16.03 NDT requirements of structural steel welds shall be as under:

a) 100% RT/UT on butt-welds of plate thickness >= 32 mm. Edge for field weld shall be examined by MPI for plate thickness >= 32mm.

b) For Plates of 10 mm < thickness < 32 mm - 10% RT On butt welds.

c) 10% Ultrasonic testing shall be carried out on full penetration welds (other than butt welds)

d) DP Test on Welds:

- 100% on Root Run & 10% on Final Welds of all butt welds
- At random 5% on fillet of built-up plate girders.

1.16.04 Girders/columns/Beams etc shall be trial assembled and match marked prior to dispatch. Trial assembly procedure at shop shall be submitted for NTPC review and approval.

1.17.00 Paddle feeder

1.17.01 Shaft and wheel forgings – Chemical, Mechanical, Hardness and Ultrasonic Test shall be conducted.

1.17.02 Following minimum NDT on Weld Joint shall be carried out

(a) Butt Welds - 10% UT/RT & 100% MPI/DPT

(b) Fillet Welds - 10% MPI/DPT

1.17.03 Shop trial run shall be conducted to check for movement and RPM of Paddle wheel & Travel wheel, function of P/F in locked rotor condition, noise and vibration etc.

1.18.00 Vibrating Screen Feeders

(a) Shaft forgings to be checked for ultrasonic testing in addition to check for chemical, mechanical, hardness, microstructure etc. as per applicable material specification

(b) Following minimum NDT requirements to be ensured for welds:

i) Butt welds - 10% UT/RT and 100% MPI/DPT.

ii) Fillet Welds - 10% MPI/DPT.

(c) Shop trial run test shall be conducted to checks for speed (RPM), amplitude (stroke), temperature rise and noise level.

1.19.00 APRON FEEDER

1.19.01 All plates equal to or above 25 mm thickness shall be ultrasonically tested.

1.19.02 Castings and forgings, forged/rolled bar/section shall be subjected to ultrasonically test in addition to check for chemical, mechanical, hardness, microstructure etc. as per applicable material specification.

1.19.03 Machined and hard faced surface of casting/forging and other hardened, stellited parts shall be subjected to DPT/MPI in addition to check for case depth, hardness as applicable for chain/sprocket/gear reducer/rollers/wheel/pan etc.

1.19.04 Suitable check for life time sealing of rollers for protection from dust and water shall be done

1.19.05 Following minimum NDT requirements shall be followed for welds:

i) Butt Welds in Tension- 100% UT/RT and 100% MPI/DPT.

ii) Butt Welds in Compression- 10% UT/RT and 10% MPI/DPT.

iii) Fillet Welds - 10% MPI/DPT.

1.19.06 For other items like drive system, motor, pulley, belt relevant portion of specification shall be applicable

1.19.07 No load trial run test shall be carried out at shop on completely assembled apron feeder to check for trouble free operation, temperature rise, Noise & vibration.

SUB-SECTION-V-QM3

EQUIPMENT COOLING WATER SYSTEM

	EQUIPMENT COOLING WATER SYSTEM												
	TEST / CHECKS / ITEM / COMPONENTS	Material Test	WPS/PQR/Welder Qualification	DPT/MPI	Assembly Fit Up	Visual & Dimensional Check	UT	RT	Hydraulic / Water Fill	Balancing	Type Test	Performance Test	Other Test
A	**PLATE TYPE HEAT EXCHANGER**		Y	Y[3]	Y	Y			Y				
A.1	Heat Transfer Plates	Y[1]		Y[2]		Y							Y[7]
A.2	Gaskets	Y				Y							
A.3	Cover Plates (Front & Rear)	Y[1]				Y	Y[5]						
A.4	Tie Rods	Y[1]		Y[4]			Y[6]						
B	**HORIZONTAL CENTRIFUGAL PUMP**				Y	Y						Y[10]	
B.1	Casing	Y[1]		Y[4]		Y			Y8				
B.2	Impeller	Y[1]		Y[4]		Y				Y[9]			
B.3	Shaft	Y[1]		Y		Y	Y[6]			Y[9]			

NOTES

1 One per heat / HT batch

2 DP Test shall be conducted for 10% of the lot of HT plates. However, in case of any defect, entire lot shall be tested and only defect free plates shall be accepted.

3 100% DP Test shall be conducted on butt welds and 10% DPT on fillet weld after final run.

4 100% DPT shall be carried out on machined surfaces.

5 UT shall be done on plates with thickness 25 mm or above.

6 UT shall be done on shaft / tie rod with diameter above 40 mm.

7 After pressing each HT plate shall be subjected to either of the following tests, as per Manufacturer Practice
a) Light Box Test b) Vacuum Test c) Air Chamber Test

8 All pressure retaining parts shall be hydrostatically tested at 200% of pump rated head or 150% of shut – off head, whichever is higher, for at least 30 minutes. No leakage is allowed.

9 Static and Dynamic Balancing shall be carried out on complete rotor assembly.

10 All pumps shall be tested at rated speed, for head, flow capacity, efficiency and power consumption for the entire operating range i.e. from shut off head to maximum flow. A minimum of 7 readings shall be taken to plot the curve, with one reading at design flow. Testing standard shall be HIS (Hydraulic Institute Standard) of USA.
Performance test shall be carried out with contract motor, wherever Liquidated Damages are to be ascertained based on performance test at shop.

11 For Pipes, Valves and RE Joints refer LP Piping System requirements.

SUB-SECTION-V-QM4

AIR CONDITIONING & VENTILATION SYSTEM

AIR CONDITIONING AND VENTILATION SYSTEM FOR FGDS

CLAUSE NO	QA MODULE FOR AIR CONDITIONING AND VENTILATION SYSTEM
1.00.00	Air cooled Condensing Unit (Outdoor unit), Evaporating unit (Indoor unit)
1.01.00	Compressor of Condensing Unit shall be tested as per relevant standard
1.01.01	Condenser (Heat Exchanger) , Evaporator coils assembly shall be subjected to Hydraulic/Pneumatic pressure/leakage test as applicable and Electronic refrigerant leakage test along with all relevant test on tube as per applicable code..
1.01.02	Assembled Condensing unit (Outdoor Unit) shall be subjected to Leakage test,Vacuum test, Run test/Functional test as applicable
2.00.00	**FANS**
2.01.00	20% DPT of welding on fan hub, blades, casing and impeller as applicable shall be carried out.
2.02.00	DPT of fan shafts shall be carried out after machining.
2.03.00	UT of fan shafts (diameter equal to or above 50mm) shall be carried out.
2.04.00	Rotating components of all fans shall be dynamically balanced to ISO-1940 Gr. 6.3
2.05.00	All Fans shall be subjected to run test for 4 hrs. or till temperature stabilization is reached. Vibration, Noise level, Temp. rise and current drawn shall be measured during the run test.
2.06.00	One fan of each type and size will be performance tested as per corresponding BIS /AMCA for Air flow, Static Pressure, Speed, Efficiency, Power Consumption, Noise, Vibration and Temp. Rise.
3.00.00	**AIR HANDLING UNIT**
3.01.00	For Fans refer tests as mentioned at 2.00.00
3.02.00	One per type of assembled AHU (AHU casing and fan assembly) shall be subjected to free run test. Noise, Vibration and Temp. Rise of bearing shall be measured during run test.
3.03.00	All cooling coil shall be pneumatically tested and no leakage shall be permitted.
4.00.00	**CENTRIFUGAL PUMP**
4.01.00	UT on pump shaft (dia equal to or above 40 mm) and MPI/DPT on pump shaft and impeller after machining shall be carried out.
4.02.00	All rotating components of the pumps shall be dynamically balanced to ISO-1940 Gr. 6.3
4.03.00	A standard hydrostatic test shall be conducted on the pump casing with water at 1.5 times the shut off pressure on the head characteristics curve or twice the rated pressure whichever is higher, for a minimum duration of 30 minutes.
4.04.00	Standard Running Test

4.05.01	All pumps shall be tested in the manufacturer's works preferably with contract motor for capacity, efficiency, head and brake horse power. Pump shall be given running test over the entire operating range covering from the shut-off head to the maximum flow. The duration of test shall be minimum one (1) hr. A minimum of seven readings approximately equidistant shall be taken for plotting the curves with one point at design flow. Testing of pumps shall be in accordance with stipulations of Hydraulic Institute Standard (HIS) and/or as per applicable Indian Standard or equivalent. Acceptance norms shall be as per approved datasheet & HIS standard only.
4.05.02	Noise and vibration shall be measured at shop for reference purpose only.
4.05.03	Pumps shall be subjected to strip down examination visually to check for mechanical damages after testing at shop in case abnormal noise level and/or excessive vibration are observed during the shop test.
4.05.04	NPSH test shall be conducted with water as the medium, if required as per approved data sheets.
5.00.00	**LOW PRESSURE AIR DISTRIBUTION SYSTEM**
5.01.00	Functional test for fire damper along with solenoid shall be done.
5.02.00	Prototype tests report of fire damper (duly approved/accepted by ENGG) for each type and size as per UL-555 for fire rating shall be furnished.
5.03.00	Site Test- After completion, all ducting system shall be checked/tested for air leakages/tightness (smoke test) at site.
6.00.00	**INSULATION**
6.01.00	Insulation material shall be tested for all mandatory tests only as per relevant code/standard.
6.02.00	Thermal conductivity tests (for thermal insulation only) shall be done as per relevant code for the same density and thickness of material and validity of test shall be as per relevant standard.
7.00.00	**AIR FILTERS**
7.01.00	Pre/Fine filters shall be tested for initial and final pressure drop Vs flow and average synthetic dust weight arrestance as per the requirement of BS 6540/ASHARE-52-76/EN779. HEPA (Absolute) filters shall be tested as per applicable code.
8.00.00	**PIPES & FITTINGS**
8.01.00	All pipes and fittings shall be tested as per applicable codes / standard.
8.02.00	Site test- Pipes shall be tested at site hydraulically/pneumatically as per application requirement
9.00.00	**VALVES & SPECIALTIES**
9.01.00	Visual and dimensional check of valves as per relevant codes and approved drawing.
9.02.00	All the water line valves shall be hydraulically tested for body, seat and back seat (wherever provided) as per the relevant standard to which these valves are supplied irrespective of the working pressure for which these valves are selected. Check valves shall also be tested for leak tightness test at 25% of the specified seat test pressure.

9.03.00	Valves shall be offered for hydro test and pneumatic test in unpainted condition.
9.04.00	Functional check of the valves for smooth opening and closing shall be done.
10.00.00	**SPLIT/CASSETTE / WINDOW AC/ PAC**
10.01.00	Split/Cassette/ Window AC will be accepted on the basis of Manufacturer Standard Guarantee and Warrantee certificate.
10.02.00	PAC Each Unit shall be subjected to production routine Test excluding performance test carried out as per relevant standard.
10.03.00	Performance test of PAC shall be carried out as per relevant standard on one unit of each type and rating at site.
11.00.00	**Unitary Air Filter (UAF)**
11.01.00	Random 10% DPT on weld joints shall be carried out
11.02.00	Hydraulic test of pressure parts at 1.5 times the design. Pressure and water fill test of tanks shall be carried out
11.03.00	Trial assembly of Air washer/UAF for one of each size shall be done in shop.

SUB-SECTION-V-QM5

ZERO LIQUID DISCHARGE SYSTEM

ZERO LIQUID DISCHARGE (ZLD) PLANT FOR FGD WASTE WATER

Items / Components \ Test/Check	Material Test	WPS/PQR/Welder	DPT/MPI	Assembly Fit up	Dimension	RT	Hydraulic test / Pneumatic test / Vacuum test	Performance Test	Test as per relevant Std / Appd. Data Sheets	Other Tests	Remarks
COMMON ITEMS:											
1. Horizontal Centrifugal Pumps				Y	Y			Y^1	Y		
1.1. Casing	Y^a		Y^b		Y		Y				
1.2. Impeller	Y^a		Y^b		Y					Y^d	
1.3. Shaft	Y^a		Y		Y					Y^c	
2. Vertical Pumps				Y	Y			Y^1	Y		
2.1. Casing	Y^a		Y^b		Y		Y				
2.2. Impeller	Y^a		Y^b		Y					Y^d	
2.3. Shaft	Y^a		Y		Y					Y^c	
2.4. Fabricated Parts	Y^a	Y	Y^b		Y	Y^2	Y				
3. Dosing/ Metering Pumps	Y^a				Y		Y	Y^1	Y		
4. Gate/ Globe/ Check Valves	Y^a		Y^b		Y		Y	Y	Y	Y^3, Y^6	
5. Dual Plate Check Valves	Y^a		Y^b		Y		Y	Y	Y	Y^6, Y^{12}	
6. Diaphragm Valves	Y^a				Y		Y		Y	Y^4, Y^3	
7. Butterfly Valves (Low Pr.)				Y	Y		Y	Y	Y	Y^3	
7.1 Body & Disc (Cast	Y^a		Y^b		Y						
7.2 Body and Disc (Fabricated)	Y^a	Y	Y^b		Y				Y	Y^2	

LEGENDS: Applicable tests are identified by 'Y'.

Y^a : One per Heat / Heat Treatment batch / Lot.

Y^b : On machined surfaces only. Also 100% on Butt Welds & 10% on Fillet Welds.

Y^c : UT shall be done for shafts with Dia 50 mm or above & Plates of Thickness 25 mm or above.

Y^d :Dynamic Balancing per ISO: 1940, Grade 6.3 minimum shall be conducted for rotating assy.

Y^1 : As per Pump governing standard. Tolerences as per HIS, USA.

Y^2 : Random 10% RT to be conducted on butt welds for Thk $\geq$10 mm.

Y^3 : Seat Leakage Test for actuator operated valves shall be done by operating the valve with job actuator.

Y^4 : Tests on Rubber Diaphragms shall be conducted per batch of Rubber mix for Tensile, Elongation, Hardness, Thickness, Bleed Resistance. In addition, Type Test for 50,000 cycles for each type of diaphragm shall also be conducted.

Y^6 : Blue Matching, Wear Travel for Gate Valves and reduced pressure test

ZERO LIQUID DISCHARGE (ZLD) PLANT FOR FGD WASTE WATER

Items / Components \ Test/Check	Material Test	WPS/PQR/Welder	DPT/MPI	Assembly Fit up	Dimension	RT	Hydraulic test / Pneumatic test / Vacuum test	Performance Test	Test as per relevant Std / Appd. Data Sheets	Other Tests	Remarks
7.3 Shaft	Y[a]		Y[b]		Y					Y[c]	
8. Plug/ Ball Valves (Low Pr.)	Y[a]		Y[b]	Y	Y		Y	Y	Y	Y[3]	
9. Blowers/ Compressors	Y[a]		Y[b]	Y	Y			Y	Y	Y[c], Y[d]	
10. Tanks/ Pressure Vessels	Y[a]	Y	Y[b]	Y	Y	Y[8]	Y		Y	Y[7]	
11. Rubber Lining	Y[a]				Y				Y	Y[9]	
12. Strainers	Y[a]	Y	Y[b]	Y	Y		Y		Y		
13. Pipe & Pipe Fittings	Y[a]	Y	Y		Y	Y[8]	Y		Y		
14. Agitators /Flash Mixer/ Flocculator	Y[a]	Y	Y[b]	Y	Y			Y		Y[10]	
15. Ventilation/Exhaust Fan	Y[a]		Y[b]	Y	Y			Y[11]	Y	Y[c], Y[d]	
16. Hoists & Cranes	Y[a]	Y	Y[b]	Y	Y	Y[8]		Y	Y		
17. Wrapping & Coatig Material	Y				Y				Y		
18. Package/ Split AC	Y							Y	Y	Y[14]	
ZLD PLANT:											
1. Clariflocculator / Reactor Clarifier / Plate or Tube Settler	Y[a]	Y	Y[b]	Y	Y				Y	Y[10]	
2. Chlorine Tonner / Chlorine Evaporator	Y[a]	Y	Y[b]	Y	Y	Y[8]	Y		Y		
3. Chlorinator / Ejector	Y[a]			Y	Y		Y	Y	Y		

for check valves shall be conducted as per relevant standards.

Y[7] : Heat Treatment of the Tank/Vessel shall be done per fabrication code requirement. Welded dished ends shall be stress relieved. Dished ends manufactured by cold working shall also be stress relieved as per the requirement of code.

Y[8] : RT as per fabrication code requirements. However, dished ends welds, if manufactured by using welded plates shall be subjected to 100% RT.

Y[9] : Rubber Lining Mix shall be subjected to Bleed Resistance Test on mould sample. Adhesion Test, Spark Test and Hardness Test for the Rubber lined jobs shall also be conducted.

Y[10] :Gear Boxes shall be checked for smooth No Load Operation at shop to verify noise and vibration levels. Gear Ratio and Kerosene Leak Test shall also be conducted.

Y[11] :One Fan of each type & size shall be routine performance tested as per corresponding code for air flow, static pressure, total pressure, speed, efficiency, power consumption, noise & temperature rise. Also all Fans shall be subjected to run test of 4 hours during which noise, vibration, temperature rise and current drawn shall be measured.

Y[12] :Dry cycle test on valve spring for 1, 00,000 cycles shall be carried out as type test, if not carried out earlier, for the similar MOC, size and type of spring.

Y[14] : Electronic leak test for condenser & evaporator unit.

ZERO LIQUID DISCHARGE (ZLD) PLANT FOR FGD WASTE WATER

Items / Components \ Test/Check	Material Test	WPS/PQR/Welder	DPT/MPI	Assembly Fit up	Dimension	RT	Hydraulic test / Pneumatic test / Vacuum test	Performance Test	Test as per relevant Std / Appd. Data Sheets	Other Tests	Remarks
4. Chlorine Gas Filter	Y[a]			Y	Y		Y		Y		Note: The complete Piping system along with valves & fittings shall be hydraulically tested at 1.5 times design pressure or 2 times working pressure whichever is higher after erection at site.
5. Heat Exchanger	Y[a]	Y	Y[b]	Y	Y		Y		Y		
6. Centrifuge	Y[a]	Y	Y[b]	Y	Y		Y	Y	Y		
7. Filter Membrane					Y				Y		
8. RO Pressure tube	Y[a]				Y		Y		Y		
9. Pressure / Vacuum Relief valve / Pressure Regulating Valve	Y[a]			Y	Y		Y	Y	Y		

SUB-SECTION-V-QM6

COMPRESSOR AIR SYSTEM

1.00.00 **AIR COMPRESSOR SYSTEM**

1.01.00 AIR COMPRESSORS :

a) All pressure parts shall be hydraulically tested at not less than 150% of design pressure prior to painting and lining, if applicable. The test pressure will be maintained for 30 minutes.

b) All other parts including inter-connecting piping shall be hydraulically tested wherever possible, as per relevant codes.

c) Ultrasonic testing shall be carried out on all forgings and shafts (if dia.> 40mm). MPI/DP test will be done on machined areas of the above components.

e) During assembly all clearances and alignments shall also be checked and recorded.

f) Rotor shall be statically and dynamically balanced.

1.01.01 PERFORMANCE TEST (SHOP TEST) :

a) Performance test on the compressors shall be carried out in accordance relevant standard. The test shall also include demonstration of loading and unloading mechanism (Capacity control) and operation of safety valves.

b) Power consumption at motor input terminal at rated capacity as well as at fully unloaded condition of all the compressor shall be measured.

c) Vibration and noise level measurement will be done during shop performance test.

d) Test shall be carried out on all compressors with contract drive motor where power consumption for compressors has been indicated as a guaranteed parameter

e) Clearance on Type test requirements from Employer's Engg. Shall be reviewed prior to final clearance.

1.02.00 AIR RECEIVER, HEAT EXCHANGERS, MOISTURE SEPERATORS, AIR DRYING PLANT:

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

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

(i) 100 % DPT on root run of butt welds.

(ii) 100% DPT on all finished butt welds and fillet welds

(iii) 10% RT on butt welds which shall include all T- joints.

c) Tube to Tube sheet joint of the heat exchangers shall be subject to Mock-up test as per the relevant standards.

d) Reactivation blowers shall be tested for FAD, temp. rise, noise & vibration. Rotating parts shall be dynamically balanced.

e) Completely assembled ADP shall be pneumatically tested at design pressure for a duration of 5 minutes. Functional and sequential operation testing of the completely assembled ADP shall be demonstrated at shop. Other accessories shall be tested as per relevant code and sections. Dew point measurement shall be done.

1.04.00 H.O.T. CRANE :

a) Chain pulley Blocks shall be tested as per IS: 3832.

b) Following NDT requirements shall be met :

(i) 100% RT of Butt welds in tension and 10% RT of butt welds in compression.

(ii) DP at random on all weldments.

Deflection, load, overload & travel check on HOT crane assembly shall be carried out as per IS:3177.

1.05.00 PIPINGS, VALVES, AND FITTINGS

a. All pipes and fittings shall be tested as per applicable code.

b. All valves shall be hydraulically tested for body, seat and back-seat (if applicable) as per relevant standard. Check valves shall also be tested for leak tightness test at 25% of the specified seat test pressure.

c. Valves shall be offered for hydro test in unpainted condition.

d. Functional checks of the valves for smooth opening and closing shall also be done.

All forgings, dia ≥ 40 mm shall be Ultrasonic Tested irrespective of the type, size & rating of the valve.

SUB-SECTION-V-QM7

FIRE DETECTION & PROTECTION SYSTEM

1.00.00 FIRE DETECTION & PROTECTION SYSTEM

1.01.00 HYDRANT SYSTEM: Shop Tests

1.01.01 Hydrant Valve:

(a.) All valves shall be hydro tested for body and seat.

(b.) Capacity test / flow test shall be done as per relevant standard.

1.01.02 Water Monitor, Hoses, Branch Pipes, Couplings and Nozzles:

(a.) All tests including hydraulic test shall be done as per relevant Indian / International standard.

1.02.00 HIGH / MEDIUM VELOCITY WATER SPRAY : Shop Tests

1.02.01 For Pipes, Fittings, Valves and specialties, requirements are indicated separately.

1.02.02 Deluge Valves and Spray Nozzles

(a.) All valves shall be hydro tested for body and seat.

(b.) Performance test / functional test of 'Deluge Valves' and 'Spray Nozzles' shall be carried out.

1.02.03 **Detectors:** All 'Detectors' shall be tested as per relevant Indian / International Standards. Detectors shall also meet the requirements of UL / FM / LPC/VDS etc.

1.03.00 PIPING, VALVE AND SPECIALITIES

1.03.01 SHOP TESTS

(a.) All pipes and fittings shall be tested as per applicable code.

(b.) DPT of pipe welds (in case of rolled and welded pipes only) shall be carried out for root and finished welds.

(c.) All strainers shall be subjected to hydraulic pressure test for leakage and Pressure drop v/s Flow for each type and size.

(d.) All valves shall be hydraulically tested for body, seat and back seat (if applicable) as per relevant standard. Check valves shall also be tested for leak tightness test at 25% of the specified seat test pressure.

(e.) Valves shall be offered for hydro test in unpainted condition.

(f.) Functional checks of the valves for smooth opening and closing shall also be done.

(g.) Anti-corrosive protection shall be tested as per applicable code.

1.04.00 PORTABLE & MOBILE FIRE EXTINGUISHERS

1.04.01 SHOP TEST

(a.) All fire extinguishers shall be tested as per relevant standard.

(b.) Performance / function test shall be carried out on sampling basis as per relevant code / standard.

1.05.00 SITE TESTS:

(a.) Fire Extinguishers: A performance demonstration test at site of five (5) percent or one (1) number, whichever is higher, of each type and capacity of the extinguisher shall be carried out by the contractor. All consumables and replaceable items require for the contractor without any extra cost to employer would supply this test would be supplied by the Contractor without any extra cost to employer.

(b.) Piping Protection:

(1.) Thickness, Holiday by spark test, Adhesion test shall be carried out as per relevant standard.

(2.) Complete piping shall be Hydro pressure tested, at 1.5 X DP or 2 X MWP whichever is higher, before protection.

(c.) Welding of Pipes:

(1.) ERW Black / rolled welded:

100% DPT on root of butt and finish weld of butt and fillet.

RT on 10% randomly selected joints shall be carried out (for underground piping).

(2.) GI Pipes

Welding on GI Pipes in general shall not be done. Welding of GI Pipes, if permitted by design, (butt / socket / fillet weld) shall be done strictly as per approved drawing and procedure approved by NTPC Engineering. For all such welds 100% DP test and random 1% RT shall be done.

(ELECTRICAL)

SUB-SECTION-V-QE1

MOTORS

MOTOR

TESTS/CHECKS / TEMS/COMPONENTS	Visual	Dimensional	Make/Type/Rating /General Physical Inspection	Mech/Chem. Properties	NDT /DP/MPI/UT	Metallography	Electrical Characteristics	Welding/Brazing(WPS/PQR)	Heat Treatment	Magnetic Characteristics	Hydraulic/Leak/Pressure Test	Thermal Characteristics	Run out	Dynamic Balancing	Routine & Acceptance tests as per IS-325/IS-4722 /IS- 9283/IS 2148/IEC60034\IEC 60079-I/ IS-12615	Vibration	Over speed	Tan delta, shaft voltage & polarization index test	Paint shade, thickness & adhesion
Plates for stator frame, end shield, spider etc.	Y	Y	Y	Y	Y				Y										
Shaft	Y	Y	Y	Y	Y	Y			Y										
Magnetic Material	Y	Y	Y	Y			Y			Y		Y							
Rotor Copper/Aluminium	Y	Y	Y	Y			Y		Y										
Stator copper	Y	Y	Y	Y			Y		Y			Y							
SC Ring	Y	Y	Y	Y	Y		Y	Y	Y										
Insulating Material	Y		Y	Y			Y					Y							
Tubes, for Cooler	Y	Y	Y	Y	Y				Y		Y								
Sleeve Bearing	Y	Y	Y	Y	Y				Y		Y								
Stator/Rotor, Exciter Coils	Y	Y	Y				Y	Y											
Castings, stator frame, terminal box and bearing housing etc.	Y	Y	Y	Y	Y			Y											
Fabrication & machining of stator, rotor, terminal box	Y	Y			Y			Y	Y										

Wound stator	Y	Y					Y	Y											
Wound Exciter	Y	Y					Y	Y											
Rotor complete	Y	Y					Y						Y	Y					
Exciter, Stator, Rotor, Terminal Box assembly	Y	Y					Y												
Accessories, RTD, BTD,CT, Space heater, antifriction bearing, gaskets etc.	Y	Y	Y																
Complete Motor	Y	Y	Y												Y	Y	Y	Y1	Y

Note: 1. This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed along with relevant supporting documents during QP finalization. However, No QP for LT motor upto 50KW.

2. Additional routine tests for Flame proof motors shall be applicable as per relevant standard
3. Makes of major bought out items for HT motors will be subject to NTPC approval.
4. Y1 = for HT Motor / Machines only.

SUB-SECTION-V-QE2

MEDIUM VOLTAGE BUS DUCTS

SQE-06

Medium Voltage BUS DUCT

Attributes / Characteristics Items/Components Sub Systems	Visual & Dimensional Checks	Electrical / Mechanical / Chemical Properties	WPS & PQR	NDT (RT / DP / MPI / UT)	Painting Quality & Adhesion Test	Galvanising Test as per IS: 2629 / 2633 / 6745	Electrical clearance & Creepage distance	Functional/Operational check	Make / Type Rating / Model / TC / Embossing/Printing of make & batch /General Physical Inspection	Trial Assembly at works.	Routine Test as per relevant standard / NTPC Specification
Enclosure / Cubicle	Y	Y		Y	Y		Y				Y
Bus bar Conductor / Flexible Connector & Dis-connector Link	Y	Y		Y							
Galvanised Steel Structure & Plate (Steel as per IS:2062)	Y					Y					
Epoxy / Seal-off Bushing & Epoxy / Porcelain Post / Support Insulator	Y	Y					Y		Y		Y
Welding of enclosure & conductor	Y		Y	Y							
Gasket, Silica gel Breather, Elastomer Spring Head		Y						Y	Y		
Complete Bus Duct & Cubicles IS:8084	Y				Y		Y			Y	Y

Note:

1) This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.
2) All major Bought Out Items will be subject to NTPC approval.

SUB-SECTION-V-QE3

LT POWER CABLES

LT Power Cables

Attributes / Characteristics / Item / Components / Sub System Assembly	Make, Type & T.C as per relevant standard	Dimension/surface finish	Mechanical properties	Chemical Composition	Spark Test(as applicable)	Electrical properties	Hot Set Test/ Eccentricity & Ovality	Lay length & Sequence	Armour coverage, cross over, looseness, gap between two	Sequential marking/ Batch marking/ surface finish/ cable length	T.S & elongation before & after ageing on outer sheath & insulation	Thermal stability	Anti termite coating on wooden	Constructional requirements feature as per NTPC specification	Routine & Acceptance Tests as per relevant standard & NTPC specification	FRLS Tests
Aluminum (IS-8130)	Y	Y	Y	Y		Y										
XLPE Compound (IS-7098)	Y		Y			Y	Y				Y					
PVC insulation Compound (IS: 5831)	Y		Y			Y					Y	Y				
FRLS PVC Compound (IS-5831, ASTM-D2843, IS10810(Part 58), IEC-60754 Part-1)	Y		Y								Y	Y				Y
Extrusion & curing /Manufacturing of Core (PVC / XLPE)		Y			Y		Y					Y				
Core Laying								Y								
Armour wire/strip	Y	Y	Y													
Inner sheath	Y	Y														
Armouring		Y							Y							
Outer Sheathing		Y								Y						
Power Cable (Finished) (IS-5831, ASTM-D2843, IS10810(Part 58), IEC-60754 Part-1, IEC 60332 part III cat B)								Y	Y	Y	Y	Y		Y	Y	Y
Wooden drum(IS-10418) /Steel Drum		Y											Y	Y		

Notes:

1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.
2. Make of all major Bought out items will be subject to NTPC approval.