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

Items/Components Sub Systems / Attributes / Characteristics	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.

ROUTINE TESTS	**Following routine tests shall be carried out on each drum of finished cables for all types (PVC / XLPE insulated) & sizes.**	
1)	Conductor Resistance test	
2)	High voltage test	
ACCEPTANCE TESTS	**Following Acceptance tests shall be carried out on each size of each type (PVC / XLPE insulated) of cables, in the offered lot.**	
A) For Conductor (as per sampling plan mentioned in IS: 1554 / 7098)		
	1)	Annealing test (Copper)
	2)	Tensile Test (Aluminum)
	3)	Wrapping Test (Aluminum)
	4)	Resistance test
B) For Armour Wires / Formed Wires (If applicable) (as per sampling plan mentioned in IS: 1554 / 7098)		
	1.	Measurement of Dimensions
	2.	Tensile Tests
	3.	Elongation Test
	4.	Torsion Test For Round wires only
	5.	Wrapping Test
	6.	Resistance Test
	7.	Mass of Zinc coating test For G S wires / Formed wires only
	8.	Uniformity of Zinc coating For G S wires / Formed wires only
	9.	Adhesion test For G S wires / Formed wires only
	10.	Freedom from surface defects
C) For PVC / XLPE insulation & PVC Sheath (as per sampling plan mentioned in IS: 1554 / 7098)		
	1)	Test for thickness
	2)	Tensile strength & Elongation before ageing (for tests after ageing see “D”)
	3)	Hot set test (For XLPE insulation)

D) Ageing test:				
	Criteria	**Condition**	**Test Requirements**	**Remarks**
PVC insulation & outer sheath:	Samples as per relevant IS, from each size of cables in the offered lot, shall be tested for tensile strength & elongation (before ageing). **Tensile & elongation testing shall preferably be done with a computerized machine.** The values will be compared with corresponding values mentioned in the Type Test report accepted by NTPC. These values of Tensile Strength & Elongation (before ageing) should be within +/ - 15% of the corresponding values of Type Test report. (Please note that test values should be more than the minimum values indicated in relevant standard).	All sizes which meet the criteria	The size which has maximum negative deviation from type test report values will be put on accelerated ageing test. The samples shall be aged in air oven at temperature of 130ºc+/- 2ºc for 5 hours and tested for TS & elongation. Acceptance norms shall be as per IS.	In case the size does not meet the requirement in accelerated ageing test **then all sizes (which had met the criteria) will be put on ageing test as per IS.**
		Sizes which do not meet the criteria	Every size will be put on ageing test as per IS.	----
XLPE insulation	Samples as per relevant IS, from each size of cables in the offered lot,will be put on ageing test as per IS.			

E) Following tests will be carried out on completed cables as per IS on each size of each type (PVC / XLPE insulated)		
	1)	Insulation resistance test (Volume resistivity method)
	2)	High voltage test

F) Following tests shall be carried out on only one size of offered lot (comprising of all sizes & types)		
	1)	Thermal stability test on PVC insulation and outer sheath
	2)	Oxygen index test on outer sheath

	3)	Smoke density rating test on outer sheath
	4)	Acid gas generation test on outer sheath
G) Flammability test as per IEC 60332 - Part- 3 (Category- B) on completed cables as per following sampling plan:		
		This test will be carried out using composite sampling i.e. irrespective of size; cables of one particular type (i.e. armoured PVC insulated, unarmoured PVC insulated, armoured XLPE insulated, unarmoured XLPE insulated) will be bunched together, as per calculations in line with the IEC. All sizes of PVC & XLPE insulated, armoured & unarmoured cables shall be covered. For one particular type, cables with OD less than or equal to 30 mm shall be clubbed together in touching formation while cables with OD greater than 30 mm shall be clubbed together leaving a gap equal to OD of cable having least diameter. Cable OD shall be taken as nominal overall diameter as per NTPC approved datasheet.
H) Following tests shall be carried on one length of each size of each type (PVC / XLPE insulated) of offered lot:		
	1)	Constructional / dimensional check, surface finish, length measurement, sequence of cores, armour coverage, Gap between two consecutive armour wires / formed wires, Sequential marking, drum / Batch (outer sheath extrusion batch)number marking on sheath
	2)	Measurement of Eccentricity & Ovality

SUB-SECTION-V-QE4

CONTROL CABLES

Control 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	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
Copper (IS-8130)	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		Y			Y						Y				
Core Laying							Y								
Armour wire/strip	Y	Y	Y												
Inner sheath	Y	Y													
Armouring		Y						Y							
Outer Sheathing		Y							Y						
Finished Cable (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.

ROUTINE TESTS	**Following routine tests shall be carried out on each drum of finished cables for all sizes.**	
1)	Conductor Resistance test	
2)	High voltage test	
ACCEPTANCE TESTS	**Following Acceptance tests shall be carried out on each size of cables, in the offered lot.**	
A) For Conductor (as per sampling plan mentioned in IS: 1554)		
	1)	Annealing test (Copper)
	2)	Resistance test
B) For Armour Wires / Formed Wires (If applicable) (as per sampling plan mentioned in IS: 1554)		
	1.	Measurement of Dimensions
	2.	Tensile Tests
	3.	Elongation Test
	4.	Torsion Test For Round wires only
	5.	Wrapping Test
	6.	Resistance Test
	7.	Mass of Zinc coating test For G S wires / Formed wires only
	8.	Uniformity of Zinc coating For G S wires / Formed wires only
	9.	Adhesion test For G S wires / Formed wires only
	10.	Freedom from surface defects
C) For PVC insulation & PVC Sheath (as per sampling plan mentioned in IS: 1554)		
	1)	Test for thickness
	2)	Tensile strength & Elongation before ageing (for tests after ageing see “D”)

D) Ageing test:				
	Criteria	**Condition**	**Test Requirements**	**Remarks**
PVC insulation & outer sheath:	Samples as per relevant IS, from each size of cables in the offered lot, shall be tested for tensile strength & elongation (before ageing). **Tensile & elongation testing shall preferably be done with a computerized machine.** The values will be compared with corresponding values mentioned in the Type Test report accepted by NTPC. These values of Tensile Strength & Elongation (before ageing) should be within +/ - 15% of the corresponding values of Type Test report. (Please note that test values should be more than the minimum values indicated in relevant standard).	All sizes which meet the criteria	The size which has maximum negative deviation from type test report values will be put on accelerated ageing test. The samples shall be aged in air oven at temperature of 130°c+/- 2°c for 5 hours and tested for TS & elongation. Acceptance norms shall be as per IS.	In case the size does not meet the requirement in accelerated ageing test **then all sizes (which had met the criteria) will be put on ageing test as per IS.**
		Sizes which do not meet the criteria	Every size will be put on ageing test as per IS.	----

E) Following tests will be carried out on completed cables as per IS on each size:		
	1)	Insulation resistance test (Volume resistivity method)
	2)	High voltage test
F) Following tests shall be carried out on only one size of offered lot (comprising of all sizes):		
	1)	Thermal stability test on PVC insulation and outer sheath
	2)	Oxygen index test on outer sheath
	3)	Smoke density rating test on outer sheath
	4)	Acid gas generation test on outer sheath

G) Flammability test as per IEC 60332 - Part- 3 (Category- B) on completed cable will be carried out as per following sampling plan:		
		This test will be carried out using composite sampling i.e. irrespective of size; cables of one particular type (i.e. armoured, unarmoured) will be bunched together, as per calculations in line with the IEC. All sizes of armoured & unarmoured cables shall be covered.
H) Following tests shall be carried on one length of each size (armoured & unarmoured) of offered lot:		
	1)	Constructional / dimensional check, surface finish, length measurement, sequence of cores, armour coverage, Gap between two consecutive armour wires / formed wires, Sequential marking, drum / outer sheath extrusion's batch number marking
	2)	Measurement of Eccentricity & Ovality

SUB-SECTION-V-QE5

CABLING EARTHING & LIGHTNING PROTECTION

MODULE NO. SQE-16

CABLING, EARTHING, LIGHTNING PROTECTION

ATTRIBUTES / CHARACTERISTICS ITEMS/COMPONENTS / SUB SYSTEMS	Dimension	Paint shade, paint thickness, adhesion	Pre-treatment of sheet	IP protection	Proof load*	Surface finish	Deflection test*	HV & IR	Galvanise Test (If Applicable)	Functional	Bought out items/Bill of material	Routine tests as per relevant standard & specification	Acceptance tests as per relevant standard & specification	Constructional feature as per NTPC Specification
Wall Mounted-Lighting Panel (IS-513, IS:5, IS:2629, 2633, 6745)	Y	Y	Y	Y		Y		Y		Y	Y	Y	Y	Y
Switch box/junction box/ Receptacles Panel (IS-513, IS:5, IS:2629, 2633, 6745)	Y	Y	Y	Y		Y		Y	Y	Y	Y	Y	Y	Y
Cable glands(BS-6121)	Y													Y
Cable lug	Y													Y
Lighting wire (IS-694)	Y											Y		
Flexible conduits	Y											Y		Y
Conduits (Galvanise & Epoxy) IS-9537 & IS-2629, 2633, 6745	Y		Y						Y			Y		Y
RCC Hume Pipe (IS-458)												Y		
Cable termination & straight through joint (IS 13573)	Y											Y		Y
Cable Trays, bends, tees, crosses, Flexible supports system & accessories IS-513, 2629,2633,6745	Y		Y		Y	Y	Y		Y			Y	Y	Y
Trefoil clamp	Y													Y
GI flats for earthing & lighting protection (IS 2062, 2629, 6745,2633)	Y		Y						Y			Y		Y
GI wire (IS-280)	Y											Y		
Fire Sealing System (BS –476)												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.* Deflection Test on cable trays and Proof Load test on cable trays support system will be as per details given in the NTPC technical specification & approved MQP. The above acceptance tests shall be done only on one sample from each size of offered lot. This test is not applicable on bends, tees & crosses.

3. Make of all items will be subject to NTPC approval.

SUB-SECTION-V-QE6

HT CABLES

MV (3.3 kV / 6.6. kV / 11 kV / 33 kV) 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 wires	Sequential marking/ Batch marking/ surface finish/ cable length	T.S & elongation before & after ageing on outer sheath & insulation	Thermal stability on outer sheath	Metallic (Cu) Screening (If applicable)	Anti termite coating on wooden drums	Constructional requirements feature as per NTPC specification	Routine & Acceptance Test as per relevant standard & NTPC specification	FRLS Test
Aluminum (IS-8130)	Y	Y	Y	Y		Y											
Semiconducting Compound	Y		Y			Y											
XLPE Compound (IS-7098 Part-II)	Y		Y			Y					Y						
FRLS PVC Compound (IS-5831, ASTM-D2843, IS10810(Part 58) ,IEC-60754 Part-1)	Y		Y								Y	Y					Y
Triple Extrusion & curing /Manufacturing of Core		Y			Y		Y										
Copper Tape	Y	Y	Y			Y											
Polyster tape	Y	Y															
Core Laying								Y									
Armour wire/strip	Y	Y	Y														
Copper tapping	Y	Y											Y				
Inner sheath	Y	Y															
Armouring		Y							Y								
Outer Sheathing		Y								Y							
Power Cable (Finished)								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.

ROUTINE TESTS	**Following routine tests shall be carried out on each drum of finished cables for all types & sizes.**	
1)	Conductor Resistance test	
2)	High voltage test	
3)	Partial discharge test **(for Screened cables only)**	
ACCEPTANCE TESTS	**Following Acceptance tests shall be carried out on each size of each type (voltage rating) of cables, in the offered lot.**	
A) For Conductor (as per sampling plan mentioned in IS: 7098 Part II)		
	1)	Annealing test (Copper)
	2)	Tensile Test (Aluminum)
	3)	Wrapping Test (Aluminum)
	4)	Resistance test
B) For copper tape / Wires (as per sampling plan mentioned in IS: 7098 Part II)		
	1)	Measurement of Dimensions
	2)	Conductivity check
B) For Armour Wires / Formed Wires (If applicable) (as per sampling plan mentioned in IS: 7098 Part II)		
	1.	Measurement of Dimensions
	2.	Tensile Tests
	3.	Elongation Test
	4.	Torsion Test For Round wires only
	5.	Wrapping Test
	6.	Resistance Test
	7.	Mass of Zinc coating test For G S wires / Formed wires only
	8.	Uniformity of Zinc coating For G S wires / Formed wires only
	9.	Adhesion test For G S wires / Formed wires only
	10.	Freedom from surface defects

C) For XLPE insulation & PVC Sheath (as per sampling plan mentioned in IS: 7098 Part II)		
	1)	Test for thickness
	2)	Tensile strength & Elongation before ageing (for tests after ageing see "D")
	3)	Hot set test (For XLPE insulation)

D) Ageing test:				
	Criteria	**Condition**	**Test Requirements**	**Remarks**
PVC outer sheath :	Samples as per relevant IS, from each size of each type (voltage rating) of cables in the offered lot, shall be tested for tensile strength & elongation (before ageing). **Tensile & elongation testing shall preferably be done with a computerized machine.** The values will be compared with corresponding values mentioned in the Type Test report accepted by NTPC. These values of Tensile Strength & Elongation (before ageing) should be within +/ - 15% of the corresponding values of Type Test report. (Please note that test values should be more than the minimum values indicated in relevant standard).	All sizes which meet the criteria	For PVC: The size which has maximum negative deviation from type test report values will be put on accelerated ageing test. The samples shall be aged in air oven at temperature of 130°c+/- 2°c for 5 hours and tested for TS & elongation. Acceptance norms shall be as per IS.	In case the size does not meet the requirement in accelerated ageing test **then all sizes (which had met the criteria) will be put on ageing test as per IS.**
		Sizes which do not meet the criteria	Every size will be put on ageing test as per IS.	----
XLPE Insulation	Samples as per relevant IS, from each size of each type (voltage rating) of cables in the offered lot, will be put on ageing test as per IS.			

E) Following tests will be carried out on completed cables as per IS on each size of each type		
	1)	Insulation resistance test (Volume resistivity method)
	2)	High voltage test
	3)	Partial discharge test (for Screened cables only)

F) Following tests shall be carried out on only one size of offered lot (comprising of all sizes & types)		
	1)	Thermal stability test on outer sheath
	2)	Oxygen index test on outer sheath
	3)	Smoke density rating test on outer sheath
	4)	Acid gas generation test on outer sheath
	5)	Flammability test as per IEC 60332 - Part- 3 (Category- B) on completed cable
G) Following tests shall be carried on one length of each size of each type of offered lot:		
	1)	Constructional / dimensional check, surface finish, length measurement, sequence of cores, armour coverage, Gap between two consecutive armour wires / formed wires, Sequential marking, marking of drum no. / Batch number of outer sheath extrusion
	2)	Measurement of Eccentricity & Ovality

SUB-SECTION-V-QE7

ELECTRIC ACTUATORS WITH INTEGRAL STARTERS

ELECTRICAL ACTUATOR WITH INTEGRAL STARTER

Test/Attributes Characteristics / ITEM/ COPONENT/ SUB SYSTEM ASSEMBLY/ TESTING	RPM ®	No Load Current ®	IR & HV Test®	Mounting Dimension®	All routine Test as per Standard & Specification®	Correct Phase Sequence®	Operation & Setting of limit Switch/Torque Switch®	Stall Torque/Current (A)	Hand Wheel operation/ Auto de clutch function (A)	Function of Aux. like Potentiometer, space heater, position indicator	EPT output ®	Grease leakage ®	Local/ Remote (Open-Stop-Close) Operation® Safety check (Single phasing, Phase correction, Tripping etc.) (A)
ELECTRICAL ACTUATOR WITH INTEGRAL STARTER(IS_9334)													
Motor	Y	Y	Y	Y	Y								
Final Testing	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note: 1) Detailed procedure of Burn-in and Elevated Temperature test shall be as per Quality Assurance Programme in General Technical Conditions

2) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the practices and procedure adopted along with relevant supporting documents.

® - Routine Test (A) - Acceptance Test Y - Test applicable

SUB-SECTION-V-QE8

HT SWTIGCHGEAR

QA TABLE FOR HT SWITCHGEAR

ATTRIBUTES / CHARACTERISTICS → / ITEMS, COMPONENTS, SUB-SYSTEM ASSEMBLY	Make, Type, Model, Rating & TC	Electrical Properties	Mechanical properties	Chemical Properties	Dimensions & Finish	Constructional, Functional & Operational Features as per NTPC Spec.	Item to conform to relevant Standards	Pretreatment as per IS 6005	Paint shade, thickness, adhesion & finish	Functional Checks	HV & IR Test	Degree of Protection Routine test as per NTPC spec.	CB Operation timing check	All Routine Tests as per relevant standard
CRCA steel sheet/ Aluzinc*/ Zincalum*/ Galvalum*	Y		Y	Y	Y		Y							
Aluminum Bus bar material (IS : 5082)	Y	Y	Y	Y	Y		Y							
Copper Bus bar material (IS : 613)	Y	Y	Y	Y	Y		Y							
Bus bar Support Insulator	Y	Y	Y		Y		Y				Y			
HT Circuit Breaker (IEC-62271-100)	Y				Y	Y	Y			Y			Y	Y
HT Contactors (IS : 9046 / IEC 60470)	Y				Y	Y	Y			Y				Y
Protection & Auxilliary Relays	Y				Y	Y	Y			Y				Y
HT CT's & PT's (IS : 2705 / 3156)	Y				Y		Y							Y
HT Fuses (IS : 9385)	Y				Y	Y	Y							
Surge Arrester (IEC : 99 –4)	Y				Y		Y							Y
LT Contactors (IS : 13947)	Y				Y	Y	Y			Y				
Control & Selector Switches (IS : 6875)	Y				Y	Y	Y			Y				
Indicating Meters (IS : 1248)	Y				Y	Y	Y			Y				Y
Indicating Lamps (IS : 13947)	Y				Y	Y	Y			Y				
Push Buttons (IS : 4794)	Y				Y	Y	Y			Y				
Control Transformer (IS : 12021)	Y				Y	Y	Y			Y				Y
LT Fuses (IS : 13703)	Y				Y	Y	Y							
Energy Meters (IS : 722)	Y				Y	Y	Y			Y				Y
Transducers (IEC : 60688)	Y				Y	Y	Y			Y				Y
Diodes	Y	Y				Y	Y			Y				
Terminal Blocks	Y	Y				Y	Y							
Synthetic Rubber Gasket (IS : 11149 / 3400)	Y	Y			Y		Y							
Breaker Handling Trolley	Y				Y	Y			Y	Y				
HT Switchgear Panel IEC-62271-200)	Y				Y	Y	Y	Y	Y	Y	Y	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.
3. Temperature rise test reports for diode plates with actual heat sink will be verified.

*. CRCA Galvanized steel with metal coating composed of Al (55%), Zn (43.4%) & Si (1.6%),

SUB-SECTION-V-QE9

LT SWTIGCHGEAR

SQE _10

LT SWITCHGEAR

(MCC, PCC, ACDB, DCDB, FUSE BOARDS, LOCAL PUSH BUTTON STATION, LOCAL MOTOR STARTERS)

ATTRIBUTES / CHARACTERIS-TICS → / ITEMS/ COMPONENTS/ SUB SYSTEM ASSEMBLIY	Make, Model, Type, Rating & TC	Dimensions & Finish	Electrical properties	Mechanical Properties	Chemical properties	Functional & Operational Features as per NTPC Spec.	Item to conform to relevant	Pretreatment as per IS 6005	Paint Shade, Adhesion, Thickness	Functional Checks	Milli-volt drop Test	IR – HV – IR Test	Degree of Protection Routine test as per NTPC spec	All Routine tests as per NTPC
Sheet Steel (IS : 513)	Y	Y		Y	Y		Y							
Aluminum Bus bar Material (IS : 5082)	Y	Y	Y	Y	Y		Y							
Copper Bus bar Material (IS : 613)	Y	Y	Y	Y	Y		Y							
Support Insulator	Y	Y	Y	Y			Y							
Air Circuit Breaker (IS: 13947)	Y	Y				Y	Y			Y	Y			Y
Energy Meters (IS : 13010, 13779)	Y	Y				Y	Y			Y				Y
Power & Aux. Contactors (IS : 13947)	Y	Y				Y	Y			Y				
Protection & Aux. Relays (IS : 3231) (IEC 60255 / IEC 61850)	Y	Y				Y	Y			Y				Y
Control & Selector Switches (IS : 13947)	Y	Y				Y	Y			Y				
CT's & PT's (IS 2705 / 3156)	Y	Y					Y							Y
MCCB (IS : 13947)	Y	Y					Y			Y				
Indicating Meters (IS : 1248)	Y	Y				Y	Y			Y				Y
Indicating Lamps (IS : 13947)	Y	Y				Y	Y			Y				
Air Break Switches (IS : 13947)	Y	Y				Y	Y			Y				
Control Terminal Blocks	Y	Y				Y	Y							

LT SWITCHGEAR

(MCC, PCC, ACDB, DCDB, FUSE BOARDS, LOCAL PUSH BUTTON STATION, LOCAL MOTOR STARTERS)

ATTRIBUTES / CHARACTERIS-TICS → / ITEMS/ COMPONENTS/ SUB SYSTEM ASSEMBLIY ↓	Make, Model, Type, Rating & TC	Dimensions & Finish	Electrical properties	Mechanical Properties	Chemical properties	Functional & Operational Features as per NTPC Spec.	Item to conform to relevant Standards	Pretreatment as per IS 6005	Paint Shade, Adhesion, Thickness &	Functional Checks	Milli-volt drop Test	IR – HV – IR Test	Degree of Protection Routine test as per NTPC spec	All Routine tests as per NTPC spec. & IS
Fuse (IS 13703)	Y	Y				Y	Y							
Control Transformer (IS : 12021)	Y	Y				Y	Y			Y				Y
Push Buttons (IS : 4794)	Y	Y				Y	Y			Y				
Transducer (IEC : 60688)	Y	Y				Y	Y			Y				Y
MCB (IS : 8828)	Y	Y				Y	Y			Y				
Breaker Handling Trolley	Y	Y				Y			Y	Y				Y
Synthetic Rubber Gasket (IS : 11149)	Y	Y		Y	Y		Y							
LT SWITCHGEAR (IS : 8623)	Y	Y				Y	Y	Y	Y	Y		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. Makes of all major Bought Out Items will be subject to NTPC approval.

LT BUSDUCT

ATTRIBUTES , CHARACTERISTICS → / ITEM, COMPONENTS, SUB SYSTEM ASSEMBLY ↓	Dimension & Surface Finish	Make, Type, Rating & TC	Electrical Properties	Mechanical Properties	Chemical Properties	Item to conform to relevant IS	WPS Approval, Welder Qualification	Weld Quality Check (DP test & x-ray	Paint Shade, Thickness, Adhesion &	Tightness by Torque measurement	Electrical Clearances	Galvanizing Test as per IS 2629/ 2633/	IR – HV – IR Test	Phase Sequence Check	Degree of Protection routine test as per NTPC spec.
Aluminum Sheets / Plates / Strips / Flexibles / tubes (IS : 5082 / 737)	Y	Y		Y	Y	Y	Y	Y							
CRCA Flats / ISMC (IS 2062)	Y	Y		Y	Y	Y									
Neoprene / Synthetic Rubber Gaskets (IS 11149 / 3400)	Y	Y		Y	Y										
Rubber Bellows (IS : 3400)	Y	Y		Y	Y										
Support Insulator (BS : 2782, IEC : 660, IS : 10912)	Y	Y	Y	Y											
Galvanized Structure & GI Earthing Flat (IS : 2629 / 2633 / 4749)	Y	Y				Y						Y			
Space Heater & Thermostat		Y	Y										Y		
LT Busduct (IS : 8623 PART 2)	Y	Y				Y	Y	Y	Y	Y	Y		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. Makes of all major Bought Out Items will be subject to NTPC approval.

SUB-SECTION-V-QE10

DIESEL GENERATORS

DIESEL GENRATOR SET SQE_18

DIESEL ENGINE

TESTS/CHECKS / ITEMS/COMPONENTS	Material Test	DP/MPI	UT(On forging and piston Bonding)	Balancing	Hydraulic/water fill test	Assy./fit up	Dimension	Functional/Operation test	Performance test as per BS-5514/or equivalent IS/ISO- Standard including Governing Test for 3 hors at full load and one hr at 10% overload	Fuel consumption, rated power measurement,rated speed	All other tests(if applicable) as per Spec./ relevant standard
Crank shaft	Y	Y	Y	Y							
Cylinder blocks/heads	Y				Y						
Liner/ Radiator	Y				Y						
Rotating/moving parts other than crank shaft	Y	Y									
Piston	Y	Y	Y								
Diesel Engine						Y	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 in line in case required as per agreement with NTPC.
2. Make of all major BOIs will be subject to NTPC approval.

ALTERNATOR

TESTS/CHECKS / ITEMS/COMPONENTS	Visual	Dimensional	Make/Type/Rating/TC/General Physical Inspection	Mech/Chem. Properties	NDT /DP/MPI/UT	Metallography	Electrical Characteristics	Welding/Brazing(WPS/PQR)	Heat Treatment	Magnetic Characteristics	Hydrualic/Leak/Pressure Test	Thermal Characteristics	Run out	Dynamic Balancing	All tests as per IS--4722	Vibration	Over speed	Tan delta, shaft voltage & polarisation index test
Plates for stator frame,end shield, spider etc.	Y	Y	Y	Y					Y									
Shaft	Y	Y	Y	Y	Y	Y			Y									
Magnetic Material	Y	Y	Y	Y	Y		Y			Y		Y						
Rotor Copper/Aluminium	Y	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	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									

ALTERNATOR

TESTS/CHECKS / ITEMS/COMPONENTS	Visual	Dimensional	Make/Type/Rating/TC/General Physical Inspection	Mech/Chem. Properties	NDT /DP/MPI/UT	Metallography	Electrical Characteristics	Welding/Brazing(WPS/PQR)	Heat Treatment	Magnetic Characteristics	Hydrualic/Leak/Pressure Test	Thermal Characteristics	Run out	Dynamic Balancing	All Routine tests as per IS-/IS-4722	vibration	Over speed	Tan delta, shaft voltage & polarisation index test
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,AVR. Brushes, Diodes,Space heater, antifriction bearing, cable glands, lugs, gaskets etc.	Y	Y	Y															
Alternator (IS 4722)	Y	Y	Y												Y	Y	Y	Y1

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 during QP finalisation.

2. Make of all major BOIs will be subject to NTPC approval.

Y1= for HT Machines only.

FINAL ASSEMBLY										
TESTS/CHECKS / ITEMS/COMPONENTS	Material Test	Dimension	WPS/PQR/Welding	NDT/DP/MPI/UT	Check completeness	Hydraulic/Leak/Pressure test	Functional Tests	All routine test as per Spec/ IS	No load test for 5 min & partial load for one hour of the DG set assembly	Clearances & Alignment
Base frame	Y	Y	Y	Y	Y					
Fuel Tank	Y	Y	Y	Y	Y	Y				
Battery								Y		
Battery Charger								Y		
Control Panel								Y		
Assembled DG Set		Y			Y		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 during finalisation of QP.
2. Make of all major Bought Out Items will be subject to NTPC approval.

SUB-SECTION-V-QE11

AUXILIARY TRANSFORMERS

AUXILIARY / LT TRANSFORMER

Attributes / Characteristics / Items/Components Sub Systems	Visual & Dimensional Checks	Mechanical properties	Electrical strength	Thermal properties	Chemical Composition	Compatibility with oil	NDT / DPT / MPI / UT	Ageing Test.	Voltage Ratio, Vector Group & Polarity, Magnetic Balance Test	Make / Type / Rating / Model / TC / General Physical Inspection.	Functional check	WPS & PQR	Routine Test as per relevant standard / NTPC Specification
Tank, H.V. & L.V. Cable Box / Flange throat	Y	Y					Y					Y	
Conservator / Radiator / Cooler / Pipes	Y	Y					Y						
Copper Conductor (IS:191)	Y	Y	Y		Y								
Insulating Material	Y	Y	Y	Y	Y	Y							
CRGO Lamination & Built Core	Y	Y	Y		Y	Y				Y			
Bushing / Insulator (IS:2544 / 5621)	Y	Y								Y			Y
Gasket	Y	Y			Y	Y		Y		Y			Y
Transformer Oil (IEC296)			Y										Y
OLTC / Off-Circuit Tap Changer	Y									Y			Y
Core Coil Assembly & Pre-tanking	Y								Y	Y			
Marshalling Box	Y									Y	Y		Y
WTI, OTI, MOG, PRD, Breather, Terminal Connector, Bucholz Relay, Valves	Y									Y	Y		
Welding (ASME Sect-IX)	Y						Y					Y	
Complete Transformer (IS:2026/ IEC-60076)	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-QE12

ELEVATOR

Passenger/ Service Elevators

TEST /CHECK / ITEM	Material Test	DPI/MPI	Ultrasonic Test	Dimensions/Physical	Functional/ Operational Test/ Run Test	Performance Test	Other Tests	All routine tests as per applicable standard	Plain shade, thickness & adhesion	Assembly/fit up
Shaft/ /Gears/Pinion/Pulley/Sheave	Y	Y	Y	Y						
Spring	Y	Y	Y	Y				Y		
Plates	Y			Y						
Wire rope				Y			Y5			
Safety device								Y		
Geared Machine					Y					
VVVF Drive					Y			Y		
Power, Control & Trailing Cables								Y4		
Control Panel				Y					Y	
ARD System					Y			Y		
Electrical motor								Y		
Controller assembly with VVVF drive					**Y**		Y3			
Complete Elevator				Y	Y1	Y1	Y2			Y

Y1 –Test to Be Done At Site

Y2 - Load/Overload Test to Be Done At Site as Applicable.

Y3 – Burn in test on electronic card

Y4 – Routine tests including FRLS tests as per Tech. Spec.

Y5- Test report as per relevant std.

NOTE: 1. This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the applicable practices and procedures followed along with relevant supporting documents during QAP finalization.

2. Makes of all bought out items shall be subject to NTPC approval

SUB-SECTION-V-QE13

VFD MODULE

VFD MODULE SQE_28				
ATTRIBUTES / CHARACTERISTICS / **ITEMS/COMPONENTS, SUB SYSTEM ASSEMBLY**	Visual & Dimensional checks	Make / Type / Rating etc.	Final Inspection as ISS / IEC	Remarks
HT Breaker (IEC 56)	Y	Y	Y	
DC Reactor	Y	Y		For details refer table for DC Reactor
Transformer	Y	Y		For details refer table for Transformer
Motor	Y	Y		For details refer separate table for Motor
VFD Panel	Y	Y		For details refer table for VFD

Note : 1) This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed alongwith relevant supporting documents during QP finalisation.

2) Make of all major Bought Out Items will be subject to NTPC approval.

DC REACTOR

ATTRIBUTES / CHARACTERISTICS / ITEMS/COMPONENTS, SUB SYSTEM ASSEMBLY	Visual	Dimensional	Mech. & Chem. Property	Electrical Characteristics	Pretreatment by Seven Tank	Painting by Stove Enameling	Final Inspection as per IS-2026	Welding/NDT
Winding Material (Aluminium)	Y	Y	Y	Y				
Insulation Material	Y	Y		Y				
Sheet Steel	Y	Y	Y					
Winding	Y	Y		Y				
Fabrication of Enclosures	Y	Y			Y	Y		Y
Assembly	Y	Y						
Routine Tests	Y	Y					Y	

Note : 1) This is an indicative list of tests/checks. The manufacturer to furnish a detailed Quality Plan indicating their practice & procedure along with relevant supporting documents during QP finalisation for all items.

2) All major Bought Out Items will be subject to NTPC approval.

TRANSFORMER (OIL FILLED)

Attributes / Characteristics / Items/Components Sub Systems	Visual & Dimensional Checks	Mechanical properties	Electrical strength	Thermal properties	Chemical Composition	Compatibility with oil	NDT / DPT / MPI / UT	Ageing Test.	Voltage Ratio, Vector Group & Polarity, Magnetic Balance Test	Make / Type / Rating / Model / TC / General Physical Inspection.	WPS & PQR	Routine Test as per relevant test	Routine Test
Tank, H.V. & L.V. Cable Box / Flange throat	Y	Y					Y						
Conservator / Radiator / Cooler / Pipes	Y	Y					Y						
Copper Conductor (IS:191)	Y	Y	Y		Y								
Insulating Material	Y	Y	Y	Y	Y	Y							
CRGO Lamination & Built Core	Y	Y	Y		Y	Y							
Bushing / Insulator (IS:2544 / 5621)	Y	Y								Y		Y	
Gasket	Y				Y	Y		Y				Y	
Transformer Oil (IS:335 / IEC296)												Y	
Off-Circuit Tap Changer	Y									Y			
Core Coil Assembly & Pre-tanking	Y								Y				
Marshalling Box	Y	Y					Y					Y	
WTI, OTI, MOG, PRD, Breather, Terminal Connector, Bucholz Relay, Globe & Gate Valve,	Y									Y			
Welding (ASME Sect-IX)	Y										Y		
Complete Transformer (IS:2026/ IEC-60076)	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.

DRY TYPE TRANSFORMER

Attributes / Characteristics / Items/Components Sub Systems	Visual & Dimensional check	Mechanical properties	Electrical strength	Thermal Properties	Chemical Properties	NDT / DP / MPI	Voltage Ratio, Vector Group & Polarity	Make / Type / Rating / Model /TC / General Physical Inspection	WPS & PQR	Routine Test as per relevant standard	Measurement of capacitance & tan delta between winding	Routine Test
Enclosure door, H.V. & L.V. Cable Box / Flange Throat	Y	Y						Y				
Copper Conductor	Y	Y	Y		Y							
Insulating Material	Y			Y	Y							
CRGO Lamination & Built Core	Y											
Bushing /Insulator (IS:2544 / 5621)	Y							Y		Y		
Gasket	Y							Y		Y		
Off-Circuit Tap Changer	Y							Y				
Core Coil Assembly	Y						Y					
Marshalling Box	Y									Y		
WTI, Thermister, Terminal Connector	Y							Y				
Welding									Y			
Complete Transformer (IS:11171 / IEC 60076)	Y										Y	Y

Notes: 1) This is an indicative List of test/checks. The manufacturer is to furnish a detailed Quality Plan indicating his practice and procedure along with relevant supporting documents during QP finalization for all item.

2. All major Bought out Items will be subject to NTPC approval.

VFD PANEL

Attributes Characteristics / Item Components Sub System Assembly	Electrical Properties	Mechanical Properties	Chemical Properties	Dimensions / Finish	Type/ Rating/Functional check	HV/IR	Routine test as per relevant std.	Constructional Features	IS:6005 ,Seven tank process	Paint finish/ shade/thickness	Mountings / BOM/ Make, Completeness	Interlock Functional & Operation Testing / Simulation check	Degree of Protection Test	Final testing as per Relevant
Sheet Steel (IS-513)		Y	Y	Y										
Aluminum / Copper Bus-bar(IS-5082/IS-613/IS-1987)	Y	Y	Y	Y										
Support Insulator (BS-2782/IEC-660/IS-10912)	Y	Y	Y	Y										
Control / Selector Switch(IS-6875)					Y	Y	Y							
Contactor/ MCB(IS-13947)					Y	Y	Y							
O/L Protection relays(IS-3231)					Y		Y							
C.T /V.T/ Indicating Meter(IS-2705/3156/1248)					Y	Y	Y							
Fuse/ Fuse carrier(IS-13703)					Y	Y	Y							
Terminals/lugs/pvc wires(IS-13947//IS-694)	Y			Y	Y	Y	Y							
Timers(IS-3231)					Y	Y	Y							
Push Button/ Lamp/ (IS-6875)					Y	Y	Y							
Control Transformer (IS-12021)					Y	Y	Y							
Mimic, Annunciater					Y		Y							
GASKET(IS-11149)		Y	Y	Y	Y		Y							
Fabrication								Y						
Pretreatment & Painting									Y	Y				
VFD panel										Y	Y	Y	Y	Y

NOTE:

1. This is an indicative list of Test/ Checks. The manufacturer 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-QE14

STATION LIGHTING

STATION LIGHTING SQE_17

Item Components / Sub System / Assembly — Attributes / Characteristics	Make, Type , Rating/ TC	Dimension	Pre-Treatment of sheat	Paint Shade Thickness Adhesion & Finish	Galvanization Tests	IP Test	Bought Out Items/ Bill of Material	HV & IR	Functional Check as per spec.	Constructional Feature as per NTPC spec.	Routine Test as per relevant std and spec	Acceptance Test as per relevant std and spec	Item to conform to relevant standard
Luminaries (IS-10322 Part-5 Sec.1 (non –LED type)	Y					Y		Y			Y	Y	Y
Electronic Ballast	Y										Y	Y	Y
Lighting Wire (IS-694)	Y										Y		
Fans (IS-374)	Y										Y		
Pole (IS-2713)	Y			Y						Y	Y	Y	
Lamps (IS-9800, IS-9974)	Y										Y	Y	
Lighting Mast (with raise & lower lantern type)	Y	Y			Y					Y	Y	Y	
Wall Mounted Lighting Panel (IS-513, IS-5)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Switch Box/ Junction Box/Receptacles/ Local Push Button Station / Lighting Panel (IS-513, 2629, 2633, 4759, 6745)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Cable Gland (BS-6121)	Y	Y									Y		
Cable Lug (IS-8309)	Y	Y									Y		
Flexible Conduit	Y										Y		
Lighting Transformer (IS-11171)	Y									Y	Y		
Epoxy & Galvanised Conduit (IS-9537, 2629, 2633, 4759, 6745)	Y	Y									Y		Y

LED Luminaire quality requirements:

1) LED modules to conform to IS: 16103 part 2. Manufacturer to issue a certificate of compliance for the same.

2) Control gear to conform to IS 15885 part 2 section 13. Manufacturer to issue a certificate of compliance for the same.

3) LED luminaire to conform to IS 16107 part 2 section 1. Manufacturer to issue a certificate of compliance for the same.

4) LED luminaire marking to be as per IS 16107 part 2 section 1. Manufacturer to issue a certificate of compliance for the same.

5) Acceptance tests as per IS 16107 part 2 section 1 to be carried out on LED luminaire except long duration tests i.e. a) Chromaticity coordinates & correlated color temperature (CCT); b) Color rendering index (CRI). Manufacturer will submit a COC for above tests i.e. CCT & CRI

6) LED driver make, model, type & rating may be as per recommendations of LED module manufacturer.

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.

(CONTROL & INSTRUMENTATION SYSTEM)

SUB-SECTION-V-QC1

MEASURING INSTRUMENTS
(PRIMARY & SECONDARY

MEASURING INSTRUMENTS (PRIMARY AND SECONDARY)

TESTS / ITEMS	Dimensions (R)	Make, Model, Type, Rating (R)	Process / Electrical connection (R)	Calibration (R)	Test as per standard(R)	Insulation Resistance (R)	IBR Certification (if applicable)(R)	Hydro Test(R)	Material Test certificate ®
1. PR Gauge (IS-3624)	Y	Y	Y	Y	Y				
2. Temp. Gauge (BS-5235)	Y	Y	Y	Y	Y				
3. Pr./D.P.Switch(BS-6134)	Y	Y	Y	Y	Y	Y			
4. Electronic Transmitter(IEC-60770)	Y	Y	Y	Y	Y	Y			
5. Temp. Switch	Y	Y	Y	Y	Y	Y			
6. Recorder(IS-9319/ANSI C-39.4)	Y	Y	Y	Y	Y	Y			
7. Vertical indicators	Y	Y	Y	Y		Y			
8. Digital Indicators	Y	Y	Y	Y		Y			
9. Integrators	Y	Y	Y	Y					
10. Electrical Metering Instrument (IS-1248)	Y	Y	Y	Y	Y	Y			
11. Transducer (IEC-688)	Y	Y	Y	Y	Y	Y			
12. Thermocouples (IEC – 754 / ANSI-MC-96.1)	Y	Y	Y	Y	Y	Y			
13. RTD(IEC-751)	Y	Y	Y	Y	Y	Y			
14. Thermowell	Y		Y				Y	Y	Y

R-Routine Test A- Acceptance Test Y – Test applicable

: Note: **1) Detailed procedure of Environmental Stress Screening shall be as per Quality Assurance Programme in General Technical Conditions. Requirement of test and procedure (if required) finalized during QP finalization**

2) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted along with relevant supporting documents.

MEASURING INSTRUMENTS (PRIMARY AND SECONDARY)

TESTS / ITEMS	Dimensions (R)	Make, Model, Type, Rating (R)	Process / Electrical connection (R)	Calibration (R)	Requirement as per standard (R)	WPS approval (A)	Non-destructive testing (R)	Calculation for accuracy (R)	Insulation Resistance (R)	IBR Certification as applicable (R)	Hydro test (R)	Material test certificate (A)
15. Cold junction compensation box	Y	Y	Y	Y					Y			
16. Orifice plate(BS-1042)	Y	Y	Y	Y *	Y	Y **	Y **			Y	Y **	Y
17. Flow nozzle(BS-1042)	Y	Y	Y	Y *	Y	Y	Y			Y	Y	Y
18. Impact head type element	Y	Y	Y					Y				Y
19. Level transmitter/float type switch	Y	Y	Y	Y					Y	Y	Y	Y
20. Analysers	Y	Y	Y	Y								
21. Dust emission monitors	Y	Y	Y	Y								
*Calibration to be carried out on one flow element of each type and size if calibration carried out as type test same shall not be repeated.												
** If applicable												

R-Routine Test A- Acceptance Test Y – Test applicable

Note: 1) Detailed procedure of Environmental Stress screening test shall be as per Quality Assurance Programme in General Technical Conditions. Requirement of test and procedure (if required) finalized during QP finalization

2) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted along with relevant supporting documents.

SUB-SECTION-V-QC2

PROCESS CONNECTION & PIPING

Process, Connection & piping FOR C&I SYSTEMS

TESTS / ITEMS	Visual ®	GA, BOM, Layout of component & construction feature®	Dimension ®	Paint Shade/thickness ®	Flattening, flaring, hydrotest, hardness check as per ASTM standard	Component Ratings ®	Wiring ®	Make, Model, Type, Rating®	IR & HV ®	Review of TC for instrument/devices (R)	Accessability of TBs/Devices ®	Illumination,grounding ®	Tubing ®	Leak/Hydro test(A)	Chemical/physical properties of material (A)	Proof pressure test,Dismantling & reassembly test,Hydrulic impulse and vibration test (R)	Tests as per standards & specification
Local Instrument enclosure	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y			
Local instruments racks	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y			
Junction Box	Y	Y	Y	Y *		Y		Y	Y								
Gauge Board	Y	Y	Y	Y		Y		Y		Y			Y	Y			
Impulse pipes and tubes	Y		Y		Y			Y							Y		
Socket weld fittings ANSI B-16.11	Y		Y					Y							Y		Y
Compression fittings	Y		Y					Y						Y	Y	Y	
Instrument valves & Valve manifolds	Y		Y					Y						Y	Y		
Copper tubings ASTM B75	Y							Y									Y

*-applicable for painted junction boxes.

Note: R-Routine Test A- Acceptance Test Y – Test applicable

Note: This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted alongwith relevant supporting documents.

SUB-SECTION-V-QC3

INSTRUMENTATION CABLES

INSTRUMENTATION CABLE

TESTS / ITEMS	Conductor Resistance ® & (A)	High Voltage ® & (A)	Insulation Resistance ® & (A)	Constructional detail, dimensions (A)	Outer-Sheathe/core marking, end sealing (A)	Thermal Stability (A) +	Visual, Surface finish (A) +	Electrical Parameters ** (A) +	Persulphate Test (A) +	Overall/Coverage/Continuity (A)	Swidesh chimney Test (SS-4241475) (A) ++	FRLS Test * (A) ++	Tensile & Elongation before & after aging (A) ++	Vol. Resistivity. at room & Elevated Temp. (A) ++	Spark test report review ®
1. Instrument cable twisted and shielded															
Conductor(IS-8130)	Y			Y			Y								
Insulation(VDE-207)				Y	Y	Y	Y						Y		Y
Pairing/Twisting				Y	Y		Y								
Shielding				Y			Y			Y					
Drain wire	Y			Y			Y		Y	Y					
Inner Sheath				Y	Y	Y	Y					Y	Y		
Outer Sheath				Y	Y	Y	Y					Y	Y		
Over all cable	Y	Y	Y	Y	Y		Y	Y			Y			Y	
Cable Drums(IS-10418)				Y			Y								

Note : High Temp. cables shall be subjected to tests as per VDE-207(Part-6) Compensating cables shall be checked for Thermal EMF/Endurance test as per IS 8784.

Note : This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating his practice & Procedure along with relevant supporting documents during QP finalization for all items.

Note : ® - Routine Test A - Acceptance Test Y - Test Applicable

Note : Sampling Plan for Acceptance test shall be as per IS 8784 (As applicable)

- * FRLS Tests: Oxygen / Temp Index (ASTM D-2863), Smoke Density Rating (ASTM – D 2843), HCL Emission (IEC-754-1)
- ** Characteristic Impedance, Attenuation, Mutual Capacitance, Cross Talk (As applicable)

\+ Sample size will be One No. of each size/type per lot.

++ Sample size will be One No. sample for complete lot offered irrespective of size/type.

SUB-SECTION-V-QC4

CONTROL DESK PLC PANEL SMOKE DETECTOR FIRE ALARM & CONTROL SYSTEM

CONTROL DESK, PLC PANEL, SMOKE DETECTOR, FIRE ALARM & CONTROL SYSTEM

TESTS / ITEMS	Visual ®	GA, BOM ,Lay Out of components ®	Dimensions ®	Paint Shade/Thickness/Adhesion ®	Alignment of Section ®	Component Rating/ Make / Type ®	Wiring ®	IR & HV ®	Review of TC for instruments/ Devices/ Recorders, Indicators/ osaic Items/ Transducers ®	Accessibility of TBS/ Devices ®	Illumination ®	Functional Check for Control Element ,	Mimic ®	Test as per IEC 1131 ® *	Test as per Std ® & (A)
1. Control Desk	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
2. Annunciation/ Control/ PLC Panel	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y			Y	Y
3.Smoke Detectors (UL-268,EN-54 PT-7), Heat Detectors(UL-521/EN 54 PT-5) Annunciation/ Control Panel (UL -864, EN-54, PT-2)															Y

Note: 1) Detailed procedure of Environmental Stress Screening test shall be as per Quality Assurance Programme in General Technical Conditions

2) This is an indicative list of test/ checks. The manufacturer is to furnish a detailed quality plan indicating the Practice and Procedure alongwith relevant supporting documents.

- *Applicable for PLC
- Y - Test Applicable , ® - Routine Test (A) - Acceptance Test

SUB-SECTION-V-QC5

POWER SUPPLY SYSTEM

POWER SUPPLY FOR C&I SYSTEMS (UPS/BATTERY/BATTERY CHARGER/ACDB/DCDB)

ITEMS \ TESTS	Visual/dimension/rating/ Paint Adhesion/ Thickness (R)	General arrangement/BOM/make of components /Mimic ®	Efficiency ,regulation(R)	Input voltage variation (A)	Out put voltage and frequency adj.range(A)	Premilinary light load test(R)	Load transfer retransfer test (R) *	AC input faliure and return test (R)	Parralel operation and current divison(R)	Relative harmonic content(R)	Restart with PRI A.C and battery (separately)(R)	System transfer and retransfer (R)*	Asynchronous transfer(R)	Ripple content(R)	Load limiter operation (R)	IR/HV(R)	Tests as per standard &specification (R)&(A)
UPS/CONVERTER (IEC-146 PT-4)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
VOLTAGE STABILISER	Y	Y	Y	Y	Y					Y		Y				Y	
LEAD ACID BATTERY(TUBLAR)-IS-1651																	Y
LEAD ACID BATTERY (PLANTE)-IS-1652																	Y
NICKEL CADMIUM BATTERY(IS-10918/IEC-623)																	Y
SMF BATTERY																	Y
ACDB/DCDB	Y	Y														Y	Y
BATTERY CHARGER	Y	Y	Y	Y	Y				Y					Y	Y	Y	Y

R-Routine Test A- Acceptance Test Y – Test applicable

* Transfer time and Over shoot /under shoot during load & system transfer shall be recorded .

Note: 1) Detailed procedure of Environmental Stress Screening test shall be as per Quality Assurance Programme in General Technical Conditions

2) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted alongwith relevant supporting documents.

SUB-SECTION-V-QC6

CONTROL VALVE ACTUATORS AND ACCESSORIES

CONTROL VALVE ACTUATORS AND ACCESSORIES.

TESTS / ITEMS	Make,model, tag (r)	Dimension®	Surface finish®	Heat treatment®	Material test certificates®	Ibr certificates®	Hydraulic test®	Ut/radiography for >900 lb rating®	Mpi/dp®	Pressure resistance®	Seat leakage®	Timing open/close®	Linearity/hysterisis®	Functional test, review for make and tc of accessories®
CONTROL VALVE AND ACTUATOR														
Overall	Y	Y	Y			Y	Y				Y	Y	Y	Y
Body		Y	Y	Y	Y			Y	Y	Y				
Bonnet		Y	Y	Y	Y									
Trim		Y			Y			Y*						
Pneumatic actuator	Y	Y								Y				
Electro pneumatic positioner	Y													Y

R- ROUTINE TEST A - ACCEPTANCE TEST Y - TEST APPLICABLE

Y* - **UT ON SPINDLE DIA >= 40 MM.**

NOTE : **1)** Detailed procedure of environmental stress screening test shall be as per quality assurance programme general technical conditions

2) This is an indicative list of tests/checks. the manufacture is to furnish a detailed quality plan indicating his practice & procedure along with relevant supporting documents during QP finalisation for all item.

SUB-SECTION-V-QC7

ELECTRICAL ACTUATOR WITH INTEGRAL STARTERS

ELECTRICAL ACTUATOR WITH INTEGRAL STARTER

Test/Attributes Characteristics / ITEM/ COPONENT/ SUB SYSTEM ASSEMBLY/ TESTING	RPM ®	No Load Current ®	IR & HV Test®	Mounting Dimension®	All routine Test as per Standard & Specification®	Correct Phase Sequence®	Operation & Setting of limit Switch/Torque Switch®	Stall Torque/Current (A)	Hand Wheel operation/ Auto de clutch function (A)	Function of Aux. like Potentiometer, space heater, position indicator	EPT output ®	Grease leakage ®	Local/ Remote (Open-Stop-Close) Operation® Safety check (Single phasing, Phase correction, Tripping etc.) (A)
ELECTRICAL ACTUATOR WITH INTEGRAL STARTER(IS_9334)													
Motor	Y	Y	Y	Y	Y								
Final Testing	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note: 1) Detailed procedure of Environmental Stress Screening test shall be as per Quality Assurance Programme in General Technical Conditions. Requirement of test and procedure finalized during QP finalization

2) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the practices and procedure adopted along with relevant supporting documents**.**

® - Routine Test (A) - Acceptance Test Y - Test applicable

(CIVIL WORKS)

SUB-SECTION-V-QD1

SAMPLING, TESTING AND QUALITY ASSURANCE FOR CIVIL WORKS

1.0.0 INTRODUCTION

1.1.0 This part of the specification covers the sampling, testing and quality assurance requirement (including construction tolerances and acceptance criteria) for all civil and structural works covered in this specification including excavation and filling, cast in situ concrete and allied works, fabrication and erection of structural steel works, masonry / sheeting and allied works, finishing items etc.

1.2.0 This part of the technical specification shall be read in conjunction with other Parts of the technical specifications, general technical requirements & erection conditions of the contract. Wherever IS code or standards have been referred they shall be the latest revisions.

1.3.0 All tests required for all materials (bought by Contractor) and workmanship shall be done / got done by the contractor at his own cost. The rate for respective items of work or price shall include the cost for all works, activities, equipment, instrument, personnel, material etc. whatsoever associated to comply with sampling, testing and quality assurance requirement including construction tolerances and acceptance criteria and as specified in subsequent clauses of this part.

1.4.0 The Contractor shall provide the facilities whatsoever required and also bear the cost for all sampling, testing and quality assurance in the field and in the laboratory. The Contractor shall carry out all sampling and testing in accordance with the relevant Indian standards and / or international standards and this technical specification. Where no specific testing procedure is mentioned, the tests shall be carried out as per the best prevalent engineering practices and to the directions of the Engineer. All sampling shall be done in the presence of the Engineer or his authorised representative. The Contractor shall establish the QA&QC laboratory at site and all field tests shall be done in the presence of the Engineer and / or his authorised representative. The tests which cannot be carried out in the field laboratory shall be done at a laboratory of repute such as CSMRS, NCBM, IITs, National Test House, Kolkata etc. as agreed by the Engineer. The test samples for such test shall be jointly selected and sealed by the engineer and thereafter these shall be sent to the concerned laboratory through the covering letter signed by FQA representative of the engineer. The cost of transportation and other associative cost including the test charges shall be borne by the contractor. These cost shall deemed to be included in the respective item of work in the contract. If the Engineer desires to witness such tests at laboratory, Contractor shall arrange to conduct the test in his presence.

1.5.0 The recommendations and suitability of material for concreting and other building materials like brick, cement, aggregates etc., shall be ascertained by contractor prior to start of work.

Preliminary evaluation of aggregate and its evaluation for potential alkali-aggregate reactivity as per following scope of work shall be done:-

A. Evaluation of Aggregates:

I. To carry out different tests on coarse aggregate sample i.e. specific gravity,

water absorption, sieve analysis, deleterious material; soundness, crushing value, impact value, abrasion value, elongation index and flakiness index, as per IS: 2386.

II. To carry out different tests on fine aggregate sample i.e. specific gravity, water absorption, sieve analysis soundness, deleterious material, silt content, clay content and organic impurities as per IS: 2386.

III. To prepare evaluation report based on test results of I) and ii) above and to advise regarding suitability of fine and coarse aggregates.

B. Evaluation of Aggregates for Potential Alkali-Aggregate Reactivity:

Evaluation for Potential Alkali-Aggregate reactivity as per following scope of work:

I. To carry out petrographic analysis and accelerated Mortar bar Test on aggregate samples (1N NaOH at 80 deg. Centigrade for 14 days as per ASTM 1260, or the method established/ developed by CSMRS for 22days test.

II. To prepare a report based on test results of I) above and to advise regarding suitability of aggregates and further testing required if any.

The contractor shall initiate the action with regard to the above mentioned evaluation of aggregates and other building material, so as to ensure timely completion of these tests thereby not affecting any project work. All records shall be submitted, unless specified otherwise, as per the format developed by the Contractor and approved by the Engineer.

1.6.0 The Contractor shall enclose a comprehensive list of bought out items (BOIs) envisaged in the contract for carrying out fabrication/ manufacturing/ erection/ construction/ commissioning activities, procurement of forged, cast, semi-finished and finished components/equipment etc and shall indicate the names of reputed manufacturers for each of them in their bid proposal. The items envisaged by the Contractor to be procured from these manufacturers shall meet the specification requirement. An indicative list of major bought out items (not exhaustive) for civil works is enclosed at **Annexure-I**, for which the contractor shall submit the requisite details / lists of manufacturer's in their bid proposal.

1.7.0 The list of manufacturers / sub-vendors of each of the BOIs identified / indicated by the Contractor shall be discussed / reviewed by the NTPC during post bid discussions and the list of proposed manufacturers / sub-vendors for each of the BOI shall be agreed/ approved. The list of manufacturers for all the BOIs envisaged in contract shall be included in the bid proposal and the same shall be discussed for finalization during the post bid discussions before placement of award. Where the manufacturers are placed in "DR" (Details required) category, the details of the manufacturers / sub-vendors placed in the "DR" category shall be submitted to the NTPC for approval within the period agreed at the time of post bid discussions. The Contractor's proposal shall include vendor's site facilities, expertise, facilities established at the respective works, the process capability, process stabilization, QC systems followed, experience list, etc. along with his own technical evaluation for identified sub-Contractors proposed. The formats for furnishing above details shall be given to the Contractor at post bid discussion stage. Monthly progress reports on sub-Contractor detail submission / approval shall be furnished on format no. QS-01-QAI-P-02/F1. The NTPC shall furnish other relevant formats for information/ clarification for manufacturers / sub-vendors approval to the Contractor at the time of post bid discussions (Main supplier's evaluation report Format No:

QA-01-QAI-P-04/F1-R0 and Sub supplier questionnaire Format no: QA-01-QAI-P-04/F2-R0). Such manufacturers / sub-vendors approval shall not relieve the Contractor from any obligation, duty or responsibility under the contract.

1.8.0 Structural steel and Reinforcement steel supply if in the scope of the contractor shall be procured from Main Steel Producers enlisted by NTPC from time to time. Currently, Main Steel Producers enlisted by NTPC are SAIL, JSW Steel Ltd, Jindal Steel & Power, Tata steel Ltd. (for Reinforcement steel/TMT bars), RINL (for long products/Rolled sections and Reinforcement steel/TMT bars), Essar Steel India Ltd. (for Flat products/ Steel Plates), Electosteel steel Ltd. (for Reinforcement steel/TMT bars) and Monnet Ispat and Energy Ltd. (for long products/Rolled sections and Reinforcement steel/TMT bars). Subsequent, if any new Main Steel Producer/s are enlisted, they may also be considered for procurement during execution of the contract if proposed by the Contractor.

1.9.0 The Field Quality Plans shall detail out all the equipment, the quality practices and procedures etc. to be followed by the Contractor's "Site Quality Control Organisation", during various stages of site activities starting from receipt of materials/equipment at site.

The contractor shall furnish complete QA & QC programme (QAP) for the work envisaged which may include the following:-

- The organisation structure for the management and implementation of the proposed Quality Assurance Programme.
- Documentation Control System
- The procedure for procurement of materials and source inspection.
- System for site controls including process controls.
- Control of non-conforming items and systems for corrective action
- Inspection and test procedures for site activities
- System for indication and appraisal of inspection status
- System for maintenance of records
- System for handling, storage and delivery.
- Quality Plan detailing out quality practices and procedures, relevant standards and acceptance levels for all types of work under the scope of this contract.

The Contractor shall appoint a dedicated, experienced and competent quality management representative on site, preferably directly reporting to the Project Manager, supported by experienced personnel, to ensure the effective implementation of the approved quality assurance programme.

The onsite quality management representative shall have the organisational freedom and authority to implement the requirements of these quality assurance arrangements, free from commercial and programme restraints.

The QA & QC setup of the contractor shall consist of qualified and experienced engineers, with their supporting staff. The QA&QC set up in addition to requisite mechanical & electrical engineers shall consist sufficient graduate civil engineers & supervisors to take care of quality assurance activities of both site & laboratory. An

indicative QA & QC organization chart is attached at **Annexure-III**. The deployment of man power for QA & QC set up shall be affected on the basis of agreed manpower deployment schedule, which shall be prepared by the contractor based on the L-2 network and the same shall be submitted to the Engineer-in-charge for acceptance.

Based on the schedule of work agreed with the Engineer-in-charge and the approved FQP, the Contractor shall prepare a schedule of tests and submit them to the Engineer-in-charge and organise to carry out the tests as scheduled/ agreed.

The QA&QC laboratory shall have all necessary equipment, instruments and shall be managed by a qualified / experienced person. An indicative list of test equipment is attached at **Annexure-II**. All these testing equipment shall be provided by the contractor at his own cost. The contractor shall maintain the equipment in good working condition along with valid calibration certificates, for the duration of the contract. Any other equipment though required for testing but not listed in the equipment list shall be provided / arranged by the contractor at his own cost.

QA&QC laboratory building shall be constructed by the Contractor at their own cost. The laboratory building shall be constructed and installed with the appropriate facilities. Temperature and humidity controls shall be available wherever necessary during testing of samples.

1.10.0 The contractor shall prepare and obtain approval of the Owner of the Field Quality Plan (FQP) well before the start of the work. This FQP shall cover for all the items / activities covered in the contract/schedule of items and required for completion of the work.

1.11.0 All materials / components and equipment covered under the scope of work which are to be manufactured at shop/ factory of the vendor/subvendor shall be covered under a comprehensive quality assurance programme. The detailed quality plan for manufacturing shall be drawn up by the contractor and will be submitted to the owner for approval in the prescribed format for manufacturing quality plan.

Manufacturing Quality Plan (MQP) shall detail out all the components and equipment, various test/inspection, to be carried out as per the requirements of this specification and standards mentioned therein. The quality practices and procedures followed by Bidder's/Sub-Bidder's/ sub-supplier's Quality Control Organization shall include , the relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of material procurement, manufacture, assembly and final testing / performance testing . The quality plan shall be submitted in electronic media e.g. CD or E-mail in addition to hard copy, for review and approval. After approval the same shall be finally submitted in compiled form on CD.

1.12.0 The contractor shall store and handle the materials as per the requirements of the relevant standards at his own cost.

1.13.0 All the equipment shall be duly calibrated by NABL/ NPL accredited laboratories/accreditation agencies.

1.14.0 The Contractor shall submit to the NTPC Field Welding Schedule for field welding activities in the format No.: QS-01-CQA-W11/F1, this format shall be furnished to the Contractor at pre-award stage. The field-welding schedule shall be submitted

to the NTPC along with all supporting documents, like welding procedures, heat treatment procedures, NDT procedures etc. at least ninety days before schedule start of erection work at site. The Contractor shall submit Welding Procedure Specification (WPS) in the format No: QS-01-QAI-W-06/F1 for NTPC approval/ acceptance, this format shall be furnished to the Contractor during post bid discussion stage.

All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section IX/BS-4870 or other International equivalent standard acceptable to the NTPC.

All welding/brazing procedures shall be submitted to the NTPC or its authorized representative for approval prior to carrying out the welding/brazing.

All brazers, welders and welding operators employed on any part of the contract either in the Contractor's/ sub-Contractor's works or at site or elsewhere shall be qualified as per AWSD1.1/ASME Section-IX or BS-4871 or other equivalent International Standards acceptable to the NTPC.

Welding procedure qualification and Welder qualification test results shall be furnished to the NTPC for approval. However, where required by the NTPC, tests shall be conducted in presence of NTPC/authorized representative.

No welding shall be carried out on cast iron components for repair.

All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes.

All Non-destructive examination shall be performed in accordance with written procedures as per International Standards and as mentioned elsewhere in the technical specification; The NDT operator shall be qualified as per SNT-TC-IA (of the American Society of non-destructive examination). NDT shall be recorded in a report, which includes details of methods and equipment used, result/evaluation, job data and identification of personnel employed and details of co-relation of the test report with the job. The records of RT (Films) and UT (inspection records or printed reports if possible) shall be documented and produced to NTPC.

1.15.0 The Contractor shall associate themselves with the reputed specialized blasting agency such as CMRI, NIRM for trials blasts, design blasts, blasting pattern, monitoring of blast during the blasting operations at site. The blasting operation shall remain in charge of a responsible, competent, authorized and experienced supervisor (Man-In-Charge) and thoroughly acquainted workmen. All blasting work shall be done as per approved blasting scheme/ design/ pattern in line with the technical specification requirements and all statutory laws, rules, regulations, relevant standards pertaining to the acquisition, transport, storage, handling along with use of explosives shall be strictly followed by the Contractor.

The Contractor shall install and operate equipments (such as tri-axial seismograph) for continuous monitoring and control of blast induced vibrations, noise level/ air pressure, dust, silica and noxious gases during all blasting operations in line with

the Technical Specification requirements in association with the specialized blasting agency.

The contractor shall submit the un-priced copy of the award on the specialized blasting agencies to NTPC, highlighting the scope of services/ work awarded to them by contractor. The services of such specialized blasting agency shall be available through out the period in which the blasting work is undertaken at site.

1.16.0 **ASSOCIATED DOCUMENT FOR QUALITY ASSURANCE PROGRAMME:**

i. Field Quality Plan Format No.: QS-01-QAI-P-09/F2-R1
ii. Indicative list of Field Quality Laboratory and Survey equipment list (Annexure-II)
iii. Indicative QA&QC Manpower requirements (Annexure-III)
iv. Indicative Field Quality Plan for Civil Works (Annexure-IV)
v. Indicative Field Quality Plan for Structural Steel Works (Annexure-V)
vi. Manufacturing Quality Plan Format No.: QS-01-QAI-P-09/F1-R1
vii. Status of items requiring Quality Plan and sub supplier approval. Format No.: QS-01-QAI-P-02/F1-R0
viii. List of items requiring quality plan and sub supplier approval. Format No.: QS-01-QAI-P-01/F3-R0
ix. Field Welding Schedule Format No.: QS-01-CQA-W-11/F1-R0
x. Welding Procedure Specification (WPS) Format No.: QS-01-QAI-W-06/F1-R0
xi. Main supplier's evaluation report Format No: QA-01-QAI-P-04/F1-R2
xii. Sub supplier questionnaire Format no: QA-01-QAI-P-04/F2-R1

(Note: The field quality plan attached is indicative and the contractor shall prepare the field Quality plan covering the entire scope of work in the contract and submit the same to corporate QA for acceptance/approval. However any addition or deletion in the scope of work, during detailed engineering shall be accordingly added/ deducted from the Field Quality Plan)

2.0.0 GENERAL QA REQUIREMENTS

2.1.0 **STORAGE AND HANDLING OF COMMON BUILDING MATERIALS**

All materials shall be stacked and stored by the Contractor as per IS-4082 and as per the requirements specified in NTPC Technical Specification.

2.2.0 **EXCAVATION AND FILLING WORKS**

The contractor shall submit a work methodology covering various items of works for all stages of excavation and filling works. This methodology shall broadly include the quantity wise and classification wise identification of source of excavation and filling, suitability tests as per specification requirements, method of stockpiling, transportation, placement, spreading , compaction, equipment, list of protocols, in-situ tests, third party lab test if required, acceptance checks for final clearance.

For blasting work at site if required, the contractor shall associate themselves with the reputed specialized blasting agency such as CMRI, NIRM for trials blasts, design blasts, blasting pattern, monitoring of blast during the blasting operations at

site. The contractor shall install and operate equipment (such as tri-axial seismograph) for continuous monitoring and control of blast induced vibrations, noise level/ air pressure, dust, silica and noxious gases during all blasting operations in line with the technical specification requirements in association with the specialized blasting agency. The contractor shall submit the un-priced copy of the award on the specialized blasting agencies to NTPC, highlighting the scope of services / work awarded to them by contractor. The services of such specialized blasting agency shall be available through out the period in which the blasting work is undertaken at site. The blasting operation shall remain in charge of a responsible, competent, authorized and experienced supervisor (man-in-charge) and thoroughly acquainted workmen. All blasting work shall be done as per approved blasting scheme/ design/ pattern in line with the technical specification requirements and all statutory laws, rules, regulations, relevant standards pertaining to the acquisition, transport, storage, handling along with use of explosives shall be strictly followed by the contractor.

Tolerance for finished surface level shall be within 20 mm of the level shown in the drawing. For an unimportant area, tolerance up to +75mm shall be acceptable at the discretion of the engineer. However, these tolerances shall be applicable for localized areas only.

Acceptance criteria shall be

a) When only one set of sample is tested, then all individual samples collected and tested should pass without any deviation

b) For retest of any sample two additional samples shall be collected and tested, and both should pass without any deviation.

c) Where a large number of samples are tested for a particular test then 9 samples out of every 10 consecutive samples tested shall meet the specification requirement.

2.3.0 MASONRY AND ALLIED WORKS

The execution, finishing, testing and acceptance of masonry related works shall be as per the provisions of technical specifications / relevant practices IS code. Local depressions on account of faulty workmanship, broken / chipped edges shall not be acceptable.

All masonry shall be built true and plumb within the tolerances prescribed as below. Care shall be taken to keep the perpends properly aligned. Unless specified otherwise the tolerances in construction of masonry works shall be as below:

Sl. No.	Type of Check	Tolerance
	Deviation in verticality in total height of any wall of a building	Shall not exceed ± 12.5mm (more than one storey) ± 6mm per 3m height (within a storey)
	Deviation from the position shown on the plan of any brickwork	Shall not exceed 12.5mm (more than one storey)

	Relative displacement between load bearing walls in adjacent storeys intended to be in vertical alignment	Shall not exceed 6mm
	Deviation of bed joint from horizontal in any length, and it	Shall not exceed 6mm (upto 12m) Shall not exceed 12.5mm total (in any length over 12m)
	Deviation from the specified thickness of bed-joints, cross-joints or perpends	Shall not exceed $\pm$ 3mm
	Finished plastered surface	Deviation not more than 4 mm when checked with a straight edge of 2 m length placed against the surface
	The average thickness of plaster	Not be less than the specified thickness
	The minimum thickness over any portion of the surface	Not less than the specified thickness by more than 3 mm for plaster thickness above 12mm and 1 mm for ceiling plaster

2.4.0 CONCRETE WORKS

For concreting works provisions of technical specifications and IS: 456 shall apply. A detailed methodology for concrete works shall be submitted by the contractor to NTPC for approval. The methodology may require change / modification based on the site conditions, for which suitable revisions shall be submitted.

The methodology for concrete works shall broadly contain the suitability of source of aggregates, cement, admixture, water and reinforcement steel, etc. The available concrete mix design recommended from a specialist institute, results of trial mix carried out at site, method / control of batching, mixing, transportation, layer wise placement, compaction, fixing / removal of form work, staging, fixing of water stops at appropriate locations along with specials, expansion joints, contraction joints and construction joints, cover blocks and method of curing, methodology of repair of newly placed hardened concrete, testing and sampling of concrete during production and placement and acceptance checks for final clearance.

The equipment, deployment of manpower and machinery shall arranged by the contractor to ensure the continuous rate of placement of specified grade of concrete so as to prevent segregation, bleeding, formation of cold joints, temperature control for concreting in extreme weather conditions and for mass concreting works.

Exposed surfaces of concrete shall be kept continuously in a damp or wet condition for at least seven days from the date of placing concrete in case of ordinary Portland cement, not be less than 10 days for concrete exposed to dry and hot weather conditions, at least 10 days or period may be extended to 14 days where mineral admixtures or blended cements are used. Approved curing compounds may be used in lieu of moist curing with the permission of engineer-in-charge.

Reinforcement steel shall conform to relevant IS codes. Lapping / spacing of reinforcement shall be so staggered that under no circumstances more than 50% of bars at any cross section shall be lapped. Corrosion resistance Steel shall be used for the foundations wherever specified in the technical specification. Sample test for 3% of the number of mechanical bars grips subject to a minimum of three, shall be carried out up to the yield strength of reinforcement of bars.

Test shall be conducted for the water tightness of the liquid retaining structures as per technical specifications, IS 3370 and IS 6494.

All the materials, equipments, processes used in pre cast concrete work shall conform to the requirements for the cast-in-situ concrete.

If fly ash is used in concrete, source of supply shall be checked for suitability as per IS 3812 (Part-I). Routine tests for retention of particles on 45µ sieve and loss on ignition shall be carried out on each lot of fly ash before its use. The storage of fly ash shall be similar to that of cement. Separate Silo for fly ash shall be provided in the batching plant. Validation of Mix design using fly ash shall be carried out by an approved specialist agency, before start of concrete production.

The acceptance criteria of concrete shall be in accordance with clause no.16 of IS 456. However in exceptional circumstances and that too in non-critical areas, the engineer may accept concrete work which is marginally unacceptable as per the criteria laid down in IS 456. For such accepted work, payment shall be made at a reduced rate pro rata to the concrete cube strength obtained, against that stipulated.

All records of concreting, reinforcement, testing of materials, as-built dimensions, the details of the rectification, etc, shall be maintained as given below. Four copies of such record in a bound form shall be submitted to owner for their record and future reference.

i. Testing data / report of aggregates including petrographic examination & potential reactivity of aggregate and repeated temperature cycle tests wherever specified
ii. Mix design details and record of trial mixes carried out at site
iii. Testing records of admixture as per IS-9103 / ASTM C494 including third party test reports.
iv. Approved scheme for concreting
v. Hourly records of concreting including pour card
vi. Protocol indicating the dimensional tolerance and details of inserts
vii. Records giving the details of rectification giving the location of grouting, the quantity of grout used at each location, type of grout used
viii. Bar bending schedule
ix. Location and details of mechanical anchoring used for reinforcement
x. Protocol giving the details of checking of reinforcements before concreting and conformance to the reinforcement details as shown in the construction drawings
xi. Photographs showing the areas where rectification works have been carried out. Photographs should be taken before and after rectification
xii. Temperature control record of concrete at the time of placement if applicable.

xiii. Details of curing, staging and fixing / removal of formwork, checklist for formwork as per Clause 9.9 and Annexure-C of IS 14687 including all machine foundations

xiv. Batching Plant shall be calibrated regularly at least once in a 3 months. Computerized output shall be taken for each batch of production of concrete. For concreting works of ash pipe pedestals, mixer with weight batcher may be used. Production and supply of concrete from batching plant shall conform to the provisions of IS 4926

xv. Dimensions (length, cross sectional dimensions, straightness, squareness, and flatness) and tolerances for pre cast members as per NTPC Technical Specification. Load test on Pre cast members (except pre- cast tiles to be laid in the reservoir) shall be carried out @ 1% up to 1000 nos., @0.5% from more than 1000 nos. precast members of one type. The load test shall be carried out as per the provisions of IS-456 and relevant IS code.

TOLERANCES				
Description of Item/ Structural Element			**Max (mm)**	**Min (mm)**
Cast In Situ Concrete				
1.	Faces of concrete in foundations and structural members against which back fill is placed		+25	-10
2.	Eccentricity of footing as percentage of footing width in the direction of placement		2% but limited to 50mm	
3.	Top surfaces of slabs and of concrete to receive base plates to be grouted		+5	-5
4.	Alignment of beams, lintels, columns, walls, slabs and similar structural elements		+5	-5
5.	Cross sectional dimensions of walls, slabs and similar structural elements		+5	-5
6.	Deviation from specified dimensions of cross-section of columns and beams		+12	-6
7.	Alignment of holding down bolts without sleeves		+1.5	-1.5
8.	Alignment of holding down bolts with sleeves		+5	-5
9.	Level of holding down bolt assemblies		+10	-10
10.	Embedded Parts (in any direction).		+5	-5
11.	Level of embedment for equipment support		+1.5	0
12.	Level of embedment for other embedded parts		+5	-5
13.	Centers of pockets or holes with greatest lateral dimension not exceeding 150mm		+10	-10
14.	Variation in steps • Riser • Tread		 +1.5 +3.0	 -1.5 -3.0
Pre- Cast Concrete				
15.	Length:	+/- 0.1 percent	+/- 5	+ 10
16.	Straightness or Bow	1/750 of the length	+/- 5	+/- 10
17.	Cross-sectional dimensions	+/- 3 mm or +/- 0.1 percent whichever is greater		
18.	Squareness:	When considering the squareness of the corner the length of the two adjacent sides being checked shall be		

TOLERANCES				
Description of Item/ Structural Element			**Max (mm)**	**Min (mm)**
		taken as the base line. The shorter side shall not vary in length from the perpendicular by more than 5 mm.		
19.	Flatness:	The maximum deviation from a 1.5m straight edge placed in any position on a nominal plant surface shall not exceed 5 mm.		
	Placing of reinforcement and for cover (Cover blocks shall be of same grade of concrete in which these would be embedded)		Clause 12.3.1 and 12.3.2 of IS 456	
	Formwork		Clause 9.6 of IS 14687 and 11.1 of IS 456	
	Batching		Clause 10.2.2 of IS 456	

2.5.0 STRUCTURAL STEEL WORK

For structural steel works provisions of technical specifications and IS: 800 shall apply. A detailed methodology for structural steel works shall be submitted by the contractor to NTPC for approval. The methodology may require change / modification based on the site conditions, for which suitable revisions shall be submitted.

The contractor shall submit the welding procedures specification (WPS), heat treatment procedures, NDT procedures etc. at least ninety days before scheduled start of erection work at site. All welding and brazing shall be submitted to the NTPC and carried out as per procedure drawn and qualified in accordance with requirements of ASME Section IX/BS-4870 or other International equivalent standard acceptable to the NTPC.

All brazers, welders and welding operators employed on any part of the contract either in the contractor's / sub-contractor's works or at site or elsewhere shall be qualified as per AWSD1.1/ASME Section-IX or BS-4871 or other equivalent International Standards acceptable to the NTPC.

The records of welding procedure qualification and welder qualification test results shall be furnished to the NTPC for approval. However, where required by the NTPC, the tests shall be conducted in presence of NTPC / authorized representative.

No welding shall be carried out on cast iron components for repair. All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes.

All Non-destructive examination shall be performed in accordance with written procedures as per International Standards and as mentioned elsewhere in the technical specification. The NDT operator shall be qualified as per SNT-TC-IA (of the American Society of non-destructive examination). NDT shall be recorded in a report, which includes details of methods and equipment used, result/evaluation, job data and identification of personnel employed and details of co-relation of the test

report with the job. The records of RT (Films) and UT (inspection records or printed reports if possible) shall be documented and produced to NTPC.

Low hydrogen electrode (AWS E-7018) for welding of High/Medium tensile steel, for M.S (IS 2062 Gr. A/Gr. B, IS 8500) sections thickness above 20mm shall be used. Preheating and Post weld heat treatment requirements shall be complied as specified in the technical specification / approved WPS.

The requirements of pre-heating shall be

Thickness of thickest part at the area of welding / heat affected zone	Welding using other than low hydrogen welding electrodes IS 2062	Welding using low hydrogen welding electrodes or submerged arc welding IS 2062
Upto 20 mm (including)	None	None
Over 20 mm to 40 mm (including)	Not allowed	200 C
Over 40 mm to 63 mm (including)	Not allowed	660 C
Over 63 mm	Not allowed	1100 C

The following tests / checks shall be carried out for structural steel works

SL. NO.	TESTS / CHECKS	QUANTUM / STANDARD
	Physical and chemical properties of material if supply in the scope of contractor	As per relevant codes, review of correlated mill test certificates or check testing in absence of MTC
	Ultrasonic test on plates above 40mm	As per ASTM A435
	Welding procedure & welders qualification test	AWSD1.1/ASME Section-IX or BS-4871 or other equivalent International Standards
Fillet Weld		
	Macro-etch examination on production test coupons for main fillet welds	Minimum one joint per built up beams, columns and crane girder etc.
	Tension member of crane girder	Dye penetration test on 25% weld length
	All other fillet welds	DPT on 5% of weld length with minimum 300mm at each location
Butt Weld		
	DPT	100% after back gouging on all butt welds
	Mechanical testing of production test coupons	Minimum one joint per built up beam, column and crane girder.
	Radiography test on butt welds (In case of failure of any welds in SPOT/RT or UT the % of retesting shall be doubled at that particular location. Acceptance criteria of NDT on welds shall be as per AWS D1.1. Wherever RT is not feasible UT to be carried out with the approval of the	100% RT on butt welds of tension flange (bottom flange) of crane girders 10% RT weld length of each welder on butt welds,

SL. NO.	TESTS / CHECKS	QUANTUM / STANDARD
	engineer)	
	Ultrasonic testing on full penetration welds (other than butt welds)	100% UT on the web to flange joint of crane girder 10% UT on other full penetration joints
	Control assembly check in shop before erection	1st and further every 10th set of identical structure
	Dimensional tolerances during fabrication and erection	as per IS-7215 and IS-12843
	Surface Preparation and Paint thickness	SA 2 1/2 , By elcometer random after each coat, each member

2.6.0 PAINTING WORKS

Painting works shall be carried out as per the provisions of technical specifications. A detailed methodology for painting works shall be submitted by the contractor to NTPC for approval. The methodology may require change / modification based on the site conditions, for which suitable revisions shall be submitted.

The methodology for painting works shall broadly contain the source of approved brand of paints, shot / sand blasting as specified, minimum acceptable size of shot used for blasting, application of primer, intermediate coat and final coat, experience of applicator, etc. testing of painting work and acceptance checks for final clearance.

2.7.0 SHEETING WORKS

All bought out items shall be procured from the manufacturer's approved by engineer and tested as per relevant IS Codes/ Specification. Raw material of colour coated sheets shall meet the chemical & physical properties as per relevant standards / codes referred in the approved data sheet. It shall be tested for colour match, bare metal thickness, weight of Z/AZ coating, thickness of painting system, reverse impact, T-Bend adhesion, scratch resistance, salt spray test for 1000 Hrs and any other test / properties as specified in the technical specifications. Colour coated sheets shall be marked with video jet printing at the interval not more than 2m bearing manufacturer's name, date and time of manufacturing. Fasteners shall also be tested for 1000 hrs salt spray test as per the requirement of technical specifications.

Bonded Mineral Wool Insulation shall meet the requirements of thickness, density, thermal Conductivity, all other tests as per the technical specifications and IS-8183.

For sheet installation no gas cut opening shall be allowed at the site, whenever opening is specified these shall be properly cut in the factory and shall be filled with lipping / flashing for true shape / dimension etc. The sheets/ packets shall be stacked neatly clear off the ground at an angle to the ground, over a base pallet to provide drainage. Water / moisture should not be allowed to stagnate on surface, or in between layers. This can damage the coating, and cause corrosion.

2.8.0 TILE WORKS

The contractor shall submit the work methodology which shall include the type, grade and make of materials along with their technical data sheets, details, etc, clearance from E-I-C regarding leak proofness and damp proofness of parent concrete surface, surface preparation, the procedure of application, curing, testing and acceptance.

The agencies having adequate experience to execute the acid / alkali resistant lining works shall be engaged for executing the acid / alkali resistant lining works after obtaining the approval from the E-I-C.

The execution, finishing, testing and acceptance of tile works shall be as per the provisions of technical specifications. The material for tile works shall be procured from the NTPC approved brand / source. Local depressions on account of faulty workmanship, tiles / natural stones with cracked or broken / chipped edges shall not be acceptable.

The tests shall be carried out on acid resistant bricks / tile- water absorption, compressive strength, resistance to acid, flexural strength, dimensions and all other tests as per IS 4860 and IS 4457, bitumastic ready mixed paint as per IS 158, bitumastic as per IS 9510, potassium silicate, resin type and sulphur type mortars as per IS 4832, part I, II and III, surface preparation for painting as per IS 2395, epoxy painting shall be carried for required coating thickness and dry film thickness.

2.9.0 FIRE PROOF DOORS

Fire Proof doors shall be tested for the requirements mentioned in the Technical Specification. The type test of the doors shall be carried out at CBRI Roorkee for minimum 2 hours fire rating and its Fabrication drawing shall also be approved by CBRI, Roorkee. DFT of paint of Fire Proof Doors and its fittings and fixtures as per BOQ shall be checked. The doors shall be finished with suitable fire retardant painting system

2.10.0 WATER PROOFING

The execution, finishing, testing and acceptance of water proofing works shall be as per the provisions of technical specifications. The material for the works shall be procured from the NTPC approved brand / source and the works shall be executed by the authorized applicator of the supplier.

Water proofing shall be tested for water tightness by creating a pond of water minimum 25 mm height on area of 6 m x 6 m, for the period of 48 hrs on fully dried elastomeric membrane surfaces. Minimum 5% area of the roof shall be subjected to water tightness test. Such test necessarily be conducted on vulnerable areas like drain channel / drain head. No dampness shall be visible on the underneath side of roof (i.e. ceiling), parapet and well junctions etc. which have been subjected for testing. The above testing shall be carried out prior to application of wearing course.

2.11.0 PILING WORK (If Applicable)

For piling works provisions of technical specifications, approved drawings, BOQs and relevant IS codes / standards shall apply. The piling works shall be executed by the agency meeting the qualifying requirements as specified. A detailed

methodology for piling works shall be submitted by the contractor to NTPC for approval. The methodology may require change / modification based on the site conditions, for which suitable revisions shall be submitted.

The methodology for piling works shall broadly contain the method of boring, stability of bore hole, termination criteria, tests / checks for termination level, fabrication of cage, cage lowering, concrete batching / mixing, transportation, placing, recording of the time of construction operations, method of conducting initial and routine load tests, testing and sampling of concrete during production and placement and acceptance checks on piles for final clearance.

The equipment, deployment of manpower and machinery shall be arranged by the contractor to prevent the collapse of bore hole and to ensure continuous rate of placement of specified grade of concrete.

The piling works shall be executed as per the technical specifications, approved drawings, relevant codes / standards, FQP and BOQ. In addition to the requirements of technical specifications, the following shall also be ensured while execution of piling works:

a) Time gap between completion of pile boring and start of concreting should be kept to the minimum. However the maximum time gap shall not be more than 6 hours.

b) Muck Debris should be removed from the pile bore by air lift technique(by keeping the tremie & air pipe as close as to bottom of pile bore) i.e. after completion of boring, after completion of SPT(wherever applicable), after lowering reinforcement cage, but before start of concreting.

c) Density of bentonite slurry shall be checked from the sample taken from the bottom of pile bore(not at 1.0 m above the bottom of the pile bore)

d) Minimum two welding sets shall be kept ready to join the two cages of reinforcement by engaging 3 or more welders. This will ensure the lowering of R/F cage in minimum time.

e) While lowering the R/F cage into the pile bore, two hooks shall always be used to ensure balanced/symmetrical insertion of cage into the pile bore.

f) Concrete cover blocks at the junction of two R/F cage shall be ensured before lowering the second segment.

g) Surge concreting of about 1.0 cum shall be ensured at the start of concreting (i.e. in the first pour), by suddenly allowing to fall through the tremie pipe from the funnel. This will help in displacing left out muck/debris in the pile bore (by the impact).

h) Continuous feeding of concrete shall be ensured by deploying at least two transit concrete mixers (if required to be deployed) and mixing done through concrete batching plant (if deployed). Cold joints in the pile shall be avoided.

i) In a pile group, SPT shall be carried out at termination level in the pile, taken up first.

j) Bentonite slurry circulation to be ensured from start of boring to start of concreting. Flushing of bentonite slurry will only ensure maintaining of density of bentonite slurry uniformly and will not allow bentonite jelly to settle at the bottom, whereas air lift technique with bentonite circulation will ensure removal of muck debris from the bottom of pile bore.

k) Properties of drilling mud shall be checked prior to commencement of the piling work and thereafter, minimum once per week or as found necessary by the engineer. One sample consisting of 3 specimens shall be tested for the above.

l) Low strain pile integrity test on all job piles and test piles shall be conducted as specified in the Technical Specification. This test shall be suitably used to identify the piles for routine tests. High Strain dynamic test shall be done as per the technical specification. The frequency of the test shall be as per the BOQ

m) For Working Piles: Minimum one sample consisting of 6 test cubes shall be made for first ten piles. Out of these 3 shall be tested for 7 days cube strength and 3 for 28 days cube strength. Minimum one sample of 6 test cubes for every 25 nos. of piles shall be tested, out of these 3 shall be tested for 7 days cube strength and 3 for 28 days cube strength

PILE LOAD TEST

Pile load testing shall conform to the requirements of IS-2911 (Part IV) and the technical specification. Initial load tests as specified in the contract documents shall be conducted to assess the safe load carrying capacity of pile before start of work. To verify the load carrying capacity of the working piles, routine load test shall be conducted.

Pile load-testing procedure and the test setup / scheme shall be submitted for approval of NTPC. The contractor shall use the test setup having arrangement for anchor piles / rock anchors alone or combination of anchor piles / rock anchors and kentledge for both vertical compression and uplift (tension) Load test (initial) on piles. The cost of reaction system / piles shall deem to be included in the cost of test piles

All the gauges and instruments shall be calibrated before the start of the tests on test piles and working piles and the calibration record shall be verified before start of execution of the test.

2.12.0 WATER SUPPLY, DRAINAGE & SANITATION

Material used for sanitary and plumbing fittings and fixtures shall conform to and be tested as per the requirements of relevant IS Codes specified in NTPC technical specification.

The obstructions in sewer lines shall be checked by inserting a smooth ball, of diameter 13 mm less than the pipe bore at the high end of the sewer or drain. If absence of any obstructions, such as yarn or mortar projecting through the joints, ball shall roll down the invert of the pipe and emerge at the lower end. The straightness shall be checked by means of a mirror at one end of the line and lamp at the other. If the pipeline is straight, the full circle of the light may be observed. The mirror will also indicate obstruction in the barrel, if the pipeline is not straight.

The service pipes shall be slowly and carefully charged with water, allowing all air to escape avoiding all shock or water hammer. The service pipe shall then be inspected under test / working condition of pressure and flow, when all draw-off taps

are closed. The service pipes shall be checked for satisfactory support and protection from damage, corrosion and frost.

2.13.0 ARCHITECTURAL & MISC. WORKS

Material used for sanitary and plumbing fittings and fixtures, floor finishes and allied work shall conform and tested as per the requirements of relevant IS Codes specified in NTPC technical specification.

Fabricated item like metal doors, windows, ventilators, louvers, rolling shutters and grills etc. shall be checked for correctness of locations and smoothness of operation and fixtures. All controls and locking devices shall give fault free performance. Door and window shutters shall operate without jamming. The clearance at head and jamb for door shutters shall not exceed 1.5 mm. For double leaf doors, the gap at the meeting stiles shall not be more than 2.5 mm.

Materials used in glass and glazing shall be procured from source approved by NTPC and shall conform to the requirements of the Technical Specification and IS Codes.

False ceiling panels shall be best quality material in thickness and properties called for in the specification / schedule of items. Material Test Certificate to be submitted before bulk supply.

All bought items covered in the scope of contract shall be procured from sources approved by NTPC and shall conform to the requirements of the technical specifications and referred standards /codes.

2.14.0 PRE CAST CONCRETE WORKS

1. All the materials used in Pre cast Concrete work shall be tested and conform to the requirements of IS codes and NTPC Tech. Specification.

2. Concrete mix for Pre cast members shall conform to IS-456-2000.

3. All relevant QA requirements pertaining to cast insitu concrete shall be applicable.

4. Pre Cast Concrete member shall be checked for dimensions (length, cross sectional dimensions, straightness, squareness, and flatness) and tolerances shall be as per NTPC Technical Specification.

2.15.0 FABRIC EXPANSION COMPENSATOR:

Each layer of fabric Compensator shall be checked for thickness, unit weight, tensile strength & elongation, composite layer of the expansion joint shall be tested for temperature withstandability test.

Thermal Insulation shall be checked for thickness, density, thermal conductivity test and all other tests as per IS:8183.

Tests and checks on all other items shall be carried out as per relevant codes.

2.16.0 SLIPFORM SHUTTERING

1. The monitoring of the leveling of the yoke and the platform of the slip form shuttering to be done in each shift to avoid tilt during the casting of the chimney shell.

2. Manning of each shift shall be done by at least two experienced operators and a foreman particularly in night shift.

3. Suitable removal/ reduction of overhung / excess yoke beam length shall be affected with the decrease in the diameter of Chimney shell, as per the approved plan.

4. The laser centering method to be deployed for chimney alignment and Monitoring of chimney centre should be done by laser instruments at least two points. Monitoring/Recording of the same shall be done in each shift of 8 hours

5. Shuttering plates to be used for slip form shall be new and the grade of steel shall conform to the specification requirements.

6. The outage of the alignment of chimney centre shall be prevented by creating a counterbalance for alignment purpose to avoid differential loading, arising out of placement of reinforcement bars at one side or unloading of concrete in a hopper at one side of the platform for slip form shuttering.

एनटीपीसी NTPC	PROJECT:	LIST AND STATUS OF ITEM REQUIRING QP AND SUB-SUPPLIER APPROVAL				NTPC DOC NO	
	PACKAGE: FLUE GAS DESULPHURISATION SYSTEM PACKAGE					REV. NO.	0
	MAIN SUPPLIER:					DATE	
	CONTRACT NO.:						
SR. NO.	**ITEM**	**QAP / INSP. CAT**	**QAP NO.**	**PROPOSED SUB SUPPLIER**	**PLACE OF MANUFACTURING**	**APPROVAL STATUS**	**REMARKS**
1	CEMENT						
2	CONSTRUCTION CHEMICALS - ADMIXTURES, PLASTISIZERS, RETARDERS, WATER PROOFING COMPOUNDS, GROUTS, RESINS, EPOXY ETC.						
3	COLOUR COATED SHEET(FOR COIL)						
4	PROFILERS FOR DECKING/CLADDING SHEETS						
5	ELECTROFORGED GRATING						
6	PAINT AND PAINTING SYSTEM						
7	GI PIPES						
8	INSULATION WOOL						
10	PVC WATER STOP						
11	PLASTIC/ PVC PIPES						
12	FLOOR TILES						
13	FIRE PROOF DOORS						
14	PARTICLE BOARDS, PLYWOOD, MDF						
15	ROOF WATER PROOFING						
16	RCC PIPES						
17	FALSE CEILING - GLASS REINFORCED GYPSUM						
18	BITUMEN ASPHALT						
19	BITUMEN IMPREGNATED FIBER BOARD JOINT						
20	SANITARY ITEMS						
21	CP BRASS TAP AND OTHER SANITARY FITTINGS						
22	POLYTHENE WATER STORAGE TANKS - IS 12701						
23	CHIMNEY ELEVATOR						
24	PTFE BEARING / ELASTOMERIC BEARING						
25	FOUNDATION BOLTS						

LEGENDS:
1. 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 along with the condition of approval, if any.
DR – For these items “Details required” for NTPC review. To be identified with letter “DR” in the list.
'N' 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.’

2. 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
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.

NOTE: For the items placed in CAT-III for Civil Works, the review and final acceptance shall be done by NTPC-EIC/ FQA on the basis of certificate of conformance submitted by the main supplier/ main contractor.

Annexure – II

INDICATIVE FIELD QA&QC LABORATORY SET-UP

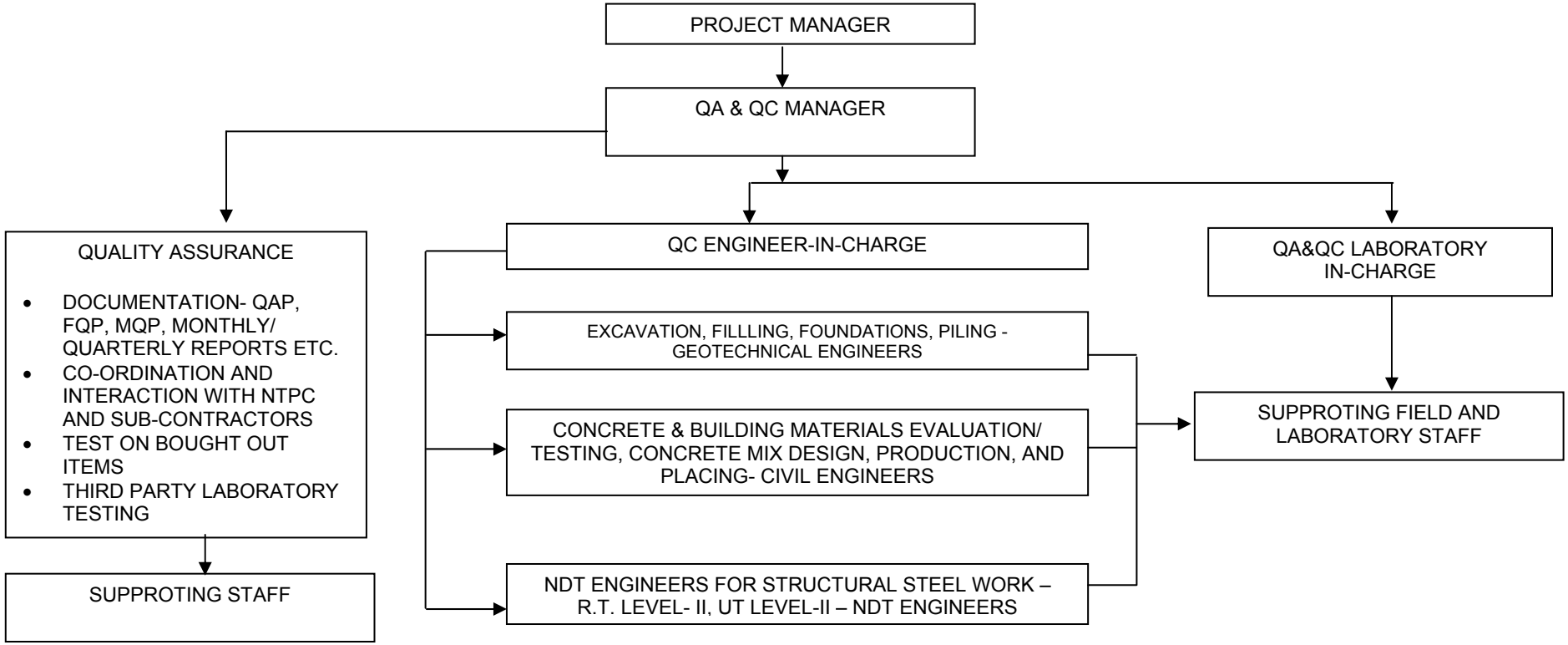
S.No	Equipment	Nos.
1	Vicat Apparatus with deskpot	2
2	Le Chatelier flask	2
3	Le Chatelier Mould	2
4	Cube Moulds for cement testing	12
5	Vibration Machine	1
6	Length comparator	2
7	Shrinkage Bar mould	2
8	Sieve shaker	1
9	Sieves for sand, coarse & fine aggregate	1 set for each
10	Sieves for coarse aggregate for Road	1 set
11	Proctor testing equipment	2 sets + 18 cores
12	Slump testing equipment	6 sets
13	Oven	2
14	Physical balance	1
15	Rapid moisture meter	2
16	Thermometer	4
17	Burret	2
18	Measuring cylinders	9
19	Measuring flasks	3
20	Compression testing machine	2 sets
21	Cube moulds	30
22	Electronic balance	2 (12 kg capacity), 2 (200 mg capacity)
23	pH balance	As per requirement
24	Radiographic facilities	As per requirement, Party should deploy BARC approved agency for carrying out RT
25	Mechanical weighing machine	1 (100 kg capacity)
26	Ultrasonic testing machine	As per requirement
27	D.P. Test kit	10
28	Vernier 300 mm, 600 mm	2
29	Micrometer (0.25 mm) out side (25.00)	2
30	Radiography film viewer	2
31	Inside Micrometer 25-750 dia	2
32	Digital elcometer for paint thickness	2
33	Baking oven for electrode	3
34	Portable ovens	2
35	Rebar detector to locate the reinforcement before core cutting operation	1
36	Concrete coring machine (55mm, 60mm upto 150 mm dia core bit)	1
37	Rebound hammer	1
38	Ultrasonic pulse velocity tester	May be arranged from specialist laboratory.

Note :

1. The equipments listed above are indicative and required to be mobilised as minimum requirement. additional equipment if any ,required for successful completion of work shall be provided /arranged by the contractor.
2. All test reports/ inspection reports have to be computerized and maintained on LAN with an access to the owner
3. Computers - 2 Nos shall be deployed with Windows operating system and connected to the NTPC server
4. Based on the schedule (L2/L3 Network), Quality control & Quality Assurance work plan shall be finalized by the contractor and the same shall be submitted to the engineer-in-charge for acceptance/approval. The Finalized work plan shall be maintained on the computer to be accessed by the owner for database and day to day monitoring.

Annexure – III

INDICATIVE FIELD QA & QC MANPOWER STRUCTURE



NOTE:

1. The above organization setup is minimum, however their deployment shall be as per the agreed deployment schedule. The contractor shall prepare a manpower deployment schedule in line with the finalized work plan and the same shall be submitted to the engineer-in charge for acceptance/ approval.
2. The contractor shall mobilize the QA& QC manpower in line with the finalized manpower deployment schedule and shall ensure their availability well in advance (15 days approx.) of the beginning of the concerned activity/ work.
3. The contractor shall further mobilize required number of skilled & supporting staff and additional resources, if any to meet the work schedule.

LOGO	SUPPLIERS NAME AND ADDRESS:	INDICATIVE FIELD QUALITY PLAN						ANNEXURE- IV			
		ITEM : CIVIL WORK SUB-SYSTEM : Foundations, Excavation & Fill, Concrete, Building, Masonry Etc.		QP NO. : REV. NO .: DATE : PAGE :		1 0	PROJECT: PACKAGE: CONTRACT NO. MAIN CONTRACTOR	FLUE GAS DESULPHURISATION SYSTEM PACKAGE			
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
1.00	**GENERAL REQUIREMENTS**										
A	Setting up of Field QA&QC laboratory		As agreed / required	A	Physical	Once prior to start of work	Tech Specs and Const. Drawings		SR	√	Functioning of laboratory equipment in proper working condition to be verified on monthly basis
B	Avialablility of requisite laboratory set up and equipment in good working condition well before commencement of concerned activity		As agreed / required	A	Physical	Once prior to start of work and thereof monthly	Tech Specs and Const. Drawings		SR	√	
C	Submission of QA & QC manpower deployment schedule based on agreed L-2 network .		-	A	Physical	Once prior to start of work	Tech Specs and Const. Drawings			√	
D	Availability of QA& QC manpower based on deployment schedule .		-	A	Physical	Once prior to start of work and thereof monthly	Tech Specs and Const. Drawings		SR	√	
E	Sampling for testing of buliding materials, concrete mix design etc.		As agreed / required	A	Physical	Once per each source prior to start of concern work	Tech Specs and Const. Drawings		SR	√	Test report along with the recommendations from specialist agency to be submitted to NTPC.
F	Submission of schedule of tests to be done monthly / quaterly and maintenace of the same on a computer connected to LAN of NTPC for monitoring		-	A	Physical	Once prior to start of work and thereof monthly	Tech Specs and Const. Drawings		SR	√	
2.00	**EXCAVATION AND FILLING IN FOUNDATION WORKS**										
	Excavations-										
1		Check for the Nature, type of soil/rock before and during excavations	As agreed / required	B	Visual	Random in eah shift	Tech Specs and Const. Drawings		SR		
2		Check for the Initial ground level before start of excavations	As agreed / required	B	Measurement	100%	Tech Specs and Const. Drawings		SR		
3		Check for the final shape and Dimensions of excavations.	As agreed / required	B	Measurement	100%	Tech Specs and Const. Drawings		SR		
4		Check for the Final excavation lelvels	As agreed / required	B	Measuement	100%	Tech Specs and Const. Drawings		SR		
5		Check for the Side slope of final excavation	As agreed / required	B	Measurement	Random in eah shift	Tech Specs and Const. Drawings		SR		
6		Excavation in Hard Rock.									
i		Receipt, Storage, accountability of Explosive	As agreed / required	B	Physical	Random in each week	Indian Explosive Act 1940/all statutory norms, Tech Specs and Const. Drawings		SR	√	NTPC approved specialist blasting agency such as CMRI, NIRM shall be deployed at site for trial blasts, design blasts, blast vibration monitoring etc. Seismographs shall be deployed at site for monitoring of blast operation vibrations.
ii		Execution of Blasting Operation	As agreed / required	B	Physical	Random in eah shift	IS:4081, Tech Specs and Const. Drawings		SR	√	
iii		Submission of Blasting report to EIC	As agreed / required	C	Physical	Each blast	Tech Specs and Const. Drawings			√	
7		Excavation in Hard Rock (Blasting Prohibited)	As agreed / required	B	Physical	100%	As per approved drawing/ scheme, Tech Specs and Const. Drawings		SR	√	
	Fill/ Backfill -										
8	**Suitability of fill material**										
i		Grain size analysis	As required/ agreed	B	Physical	One in every 2000 cum for each type and source of fill materials subject to a min. of 2 samples	IS:2720 (Pt.IV), Tech Specs and Const. Drawings		SR/TR	√	
ii		Liquid & plastic limit	As required/ agreed	B	Physical	One in every 2000 cum for each type and source of fill materials subject to a min. of 2 samples	IS:2720 (Pt.IV) , Tech Specs and Const. Drawings		SR/TR	√	
iii		Shrinkage limit	As required/ agreed	B	Physical	One in every 5000 cum for each type and source of fill materials subject to a min. of 2 samples	IS:2720 (Pt.IV), Tech Specs and Const. Drawings		SR/TR	√	
iv		Free Swell Index	As required/ agreed	B	Physical	One in every 5000 cum for each type and source of fill materials	IS:2720 (Pt.XI), Tech Specs and Const. Drawings		SR/TR	√	
9	**Standard proctor Test**	Optimum moisture content and max. dry density before fill	As required/ agreed	A	Physical	One in every 2000 cum for each type and source of fill materials	IS 2720 (Pt.VII), Tech Specs and Const. Drawings		SR/TR	√	
10	**Moisture content**	Moisture content of fill before compaction	As required/ agreed	A	Physical	One in every 2000 cum for each type and source of fill materials	IS 2720 (Pt.II), Tech Specs and Const. Drawings		SR/TR	√	
11	**Degree Of Compaction Of Fill / Backfill**										
i		Dry density by core cutter method ---- OR---- Dry density in place by sand displacement method	As required/ agreed	A	Physical	i) For foundation fill/ backfill one for every 10 foundations for each compacted layer.	IS 2720 (Pt. XXIX), Tech Specs and Const. Drawings		SR/TR	√	
						ii) For area filling, one every 1000 SQM area for each compacted layer.	IS 2720 (Pt. XXVIII), Tech Specs and Const. Drawings		SR/TR	√	
ii		Relative density (Density Index)	As required/ agreed	A	Physical	----do----- (i) & (ii) above	IS 2720 (Pt. XIV), Tech Specs and Const. Drawings		SR/TR	√	

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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
iii		Dry Density by proctor needle penetration	As required/ agreed	B	Physical	Random checks to be carried out for each compacted layer	Tech Specs and Const. Drawings		SR/TR	√	
3.00	**CAST-IN-SITU CONCRETE**										
	MATERIALS										
1	**Cement**										
i		Initial & Final Setting Time	as per IS:4031	A	Physical	Each Lot	IS:4031	As per relevant IS Codes	SR/LB/ Test Report	√	Each consignment of cement shall be duly correlated with manufactureres TC, If cement is stored more than 90 days in godown of contractor same shall be retested for comp. Strength & setting time.
ii		Compressive strength @ 3, 7 & 28 days	as per IS:4031	A	Physical	Each Lot	IS:4031	As per relevant IS Codes	SR/LB/ Test Report	√	
2	**Coarse Aggregate**										
i		Moisture content	.	B	Physical	Once for each stack of 100 Cum. or part there of Except during monsoon when this has to be done every day before start of concreting	IS:2386 Part-III, IS : 456, IS : 383/Tech Spec, Tech Specs and Const. Drawings		SR/LB		Accordingly water content of the concrete will be adjusted
ii		Specific gravity, bulk density, voids, water absorption,	As required/ agreed	B	Physical	Once for each source & for every change of source	IS:2386 Part-III, IS : 456, IS : 383/Tech Spec, Tech Specs and Const. Drawings		SR/TR		These tests will be carried out white establishing design mix and the results to be intimated to NTPC.
iii		Particle, size & Shape-(Sieve analysis, determination of material finer than 75 micron, flakiness index, elongation index, angularity number)	As required/ agreed	B	Physical	One per 100 cum., or part thereof/change of source whichever is earlier	IS:2386 Part-I, IS : 456, IS : 383/Tech Spec, Tech Specs and Const. Drawings		SR/LB		-do-
iv		Deleterious materials & organic impurities (determination of clay lumps, fine silt, fine dust , light weight pieces , soft particle & estimation of organic impurities.)	As required/ agreed	B	Physical	Once per source/ on every change of source	IS:2386 Part-II, IS : 456, IS : 383/Tech Spec, Tech Specs and Const. Drawings		SR/TR		Experts opinion regarding suitability of the aggregates shall be obtained from the specialist agency such as NCB BallbhGarh etc. finalised during preaward. Results will be reported nearest to 0.1% of clay lumps.
v		Soundness	As required/ agreed	B	Physical	Once per source/ on every change of source	IS: 2386 Part-V, IS:383 , Tech Specs and Const. Drawings		SR/TR		Experts opinion regarding suitability of the aggregates shall be obtained from the specialist agency such as NCB BallbhGarh etc. finalised during preaward.
vi		Alkali aggregate reactivity	As required/ agreed	A	Physical	Once per source/ on every change of source	ASTM C 1260 , Tech Specs and Const. Drawings		SR/TR	√	the quantity of dissolved silica , and reduction in alkalinity to be reported and hence the aggregate type (deleterious /innocuous)result should be supported by petrographic examination
vii		Petrographic examination	As required/ agreed	A	Physical	Once per source/ on every change of source	IS: 2386 Part-VIII, IS:383 , Tech Specs and Const. Drawings		SR/TR	√	Reporting of petrographic examination shall be done as illustrated in IS 2386 (part-VIII)-1963. petrographic report shall be supported by the analysis and recommendation by a specialist instute.
viii		Crushing value abrasion value and impact value	As required/ agreed	A	Physical	Once per source/ on every change of source	IS:383, IS-2386 Part IV/, Tech Specs and Const. Drawings		SR/TR		-do-
3	**Fine Aggregate**										
i		Moisture content	As agreed / required	B	Physical	To be done every day before start of work	IS: 2386 Part-III IS:383 , Tech Specs and Const. Drawings		SR/TR		Weight of sand and weight of water shall be adjusted as per moisture content.
ii		Silt, Clay content and organic impurities	As agreed / required	B	Physical	Once per source& for on every change of source	IS: 2386 Part-II, IS:383 , Tech Specs and Const. Drawings		SR/TR		Acceptance limit as per relevant IS code
iii		All other tests similar to coarse aggregates as mentioned above.	As agreed / required	B	As above	Refer S.No. 2.01.02	IS-2386, IS-383, Tech Specs and Const. Drawings		SR/TR		
4	**Water**										
i		Test for sulphates and chlorides	As required/ agreed	B	Testing	Once per each source thereof yearly.	IS:3025 part 22 and 23 (for test procedure), IS:456(for acceptance criteria) , Tech Specs and		SR/TR		
ii		Tests for ascertaining limit of solids	As required/ agreed	B	Physical	Once per each source thereof yearly.	IS:3025 part 18 (organic),IS:456 , Tech Specs and Const. Drawings		SR/TR		
iii		Tests for pH Value	As required/ agreed	B	Testing	Once per each source thereof yearly.	IS:3025, IS:456, Tech Specs and Const. Drawings		SR/TR		
iv	Check for initial set time for used water and distilled water	vicat appratus		A	Physical	See Remarks	See Remarks, Tech Specs and Const. Drawings		See Remarks	√	Initial set time with used water should not be less than that with distilled water. This check is to be carried out only if the results of the tests mentioned at sl. no. 3.00, .4 i),ii)& iii) mentioned above

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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
v	Check for Concrete compressive strength with used water and distilled water	standard sand and compression testing machine	As agreed / required	A	Physical	See Remarks	See Remarks, Tech Specs and Const. Drawings		See Remarks	√	This check is to be carried out only if the results of the tests mentioned at sl. no. 3.00, .4 i),ii)& iii) mentioned above
5	CONCRETE PRODUCTION										
i		Check for the proportaions of materials for nominal mix concrete as per Table-9 of IS 456	As agreed / required	B	Physical	Random in each shift	IS:456, Tech Specs and Const. Drawings		SR/TR		
ii		Trial mix (Cubes compressive strength) as per Mix Design	As agreed / required	A	Physical	Min. 4 Trial Mixes with admixtures and Without admixtures With fly ash.	IS: 516 & IS:456, IS:10262, Tech Specs and Const. Drawings		SR/TR	√	For trial mix min. of 6 cubes for each mix, 3 specimen shall be tested at 7 days remaining 3 shall be for 28 days comp. Strength. Mix design shall carried out at agency finalised during pre award)
iii		Crushing strength (works Tests cubes)	As agreed / required	A	Physical	One set of 6 cubes per 50 M3 or part thereof for each grade of concrete per shift whichever is earlier.	IS:516, IS:456, Tech Specs and Const. Drawings		SR/TR	√	Min. of 6 cubes for each mix, 3 specimen shall be tested at 7 days remaining 3 shall be for 28 days comp. Strength.
iv		Workability - slump test	As required/ agreed	B	Physical	One sample every 2 hrs. from every mixing plant	IS:456, Tech Specs and Const. Drawings		SR/TR		Slump test for medium and high workability, Compaction factor test for medium and low workability, V.B. test for low to Very low workability
v		Cement content	As agreed / required	B	Physical	At random at the time of batching.	IS:1199 , Tech Specs and Const. Drawings		SR/TR		
vi		Admixtures for Concrete from approved sources	As agreed / required	A	Review of MTC	Random in each shift	IS:456 , Tech Specs and Const. Drawings		SR/TR	√	Admixture of appd. Brand and tested quality shall be used.
vii		Water Tightness Test for Water Retaining Structures	As agreed / required	B	Physical	100%	IS:3370 (Tanks and Revision) , Tech Specs and Const. Drawings		SR	√	
viii		Dimensions and visual exa-mination of finished structure	As agreed / required	B	Physical/ visual	100%	As per Tech. Specification./Appd. Drg./IS-456		SR		
6	CONCRETE CONVEYING, PLACING& COMPACTION										
i	Mixing of concrete	mixing of concrete shall be done in a approved mixer such as to produce a homogenous mix	As required/ agreed			To be calibrated at the time of starting and subsequently once in three months, and shall confirm to IS:4925	Review of calibration chart/ Certificate, IS 457, Tech Specs and Const. Drawings				time of mixing will be as given in IS 457
ii		Calibration of Batching Plant	As required/ agreed	A	Physical	To be calibrated at the time of starting and subsequently once in three months, and shall confirm to IS:4925	Review of calibration chart/ Certificate, Tech Specs and Const. Drawings		SR/TR	√	Cement consumption at batching plant shall also be obtained through comp. Output.Provision of online printer is manadatory
iii		Handling and Transportation of concrete	As required/ agreed	B	Physical	Random in each shift	IS:456, Tech Specs and Const. Drawings		SR		Free fall or drop shall be limited to 150 cm unless permitted concrete should be placed within 30 min of its removal from mixure . Construction methodology to be approved one week prior to start of work.
iv		Placement of concrete	As required/ agreed	B	Physical	Random in each shift	IS:456, Tech Specs and Const. Drawings		SR		No concrete shall be placed until the place of deposit has been throughly inspected and approved, the concrete shall be deposited in such a manner to maintain, until completion of unit, a plastic horizontal surface throughout
v		Check for compaction and Curing	As required/ agreed	B	Physical	Random in each shift	Check for period of curing as per IS 456 , Tech Specs and Const. Drawings		SR		Exposed concrete surface shall be protected against heating and drying for atleast 72 hrs after placement, curing compound may be used
vi		Cleanliness, provision of chute and arrangement for transportation & placement of concrete.	As agreed / required	C	Visual	100%	IS:456, Tech Specs and Const. Drawings		SR		
x		check for segregation	As agreed / required	C	Visual	100%	IS:456, Tech Specs and Const. Drawings				
7	TEST/CHECK ON RCC STRUCTURE IN HARDENDED CONDITIONS										
i		Core Test	As agreed / required	A	Physical	As required by NTPC Engineer.	As per IS:456, IS 516, Tech Specs and Const. Drawings		SR/LB/ Test Report	√	Acceptable if average equivalent cube strength of the cores is equal to at least 85% of the cube strength of the grade of concrete specified for the corresponding age and no indivisual conc has result less than 75%`
ii		Dimensional check on finished structures & Dimensional tolerances	As agreed / required	B	Measurement	Approved Drawing	As per IS:456, Tech Specs and Const. Drawings		SR/LB		
iii		Rebound Hammer test	As agreed / required	A	physical	As required by the NTPC engineer	Tech Specs and Const. Drawings		SR/LB	√	
8	REINFORCEMENT STEEL										
i		Physical and Chemical Properties for each lot as per relevant IS codes	As required/ agreed	A	Review of MTC	Each batch of delivery	IS : 1786, IS:432, IS:1566, Tech Specs and Const. Drawings		MTC	√	Applicable if steel is procured by Contractor
ii		Cutting tolerance	As agreed / required	B	Measurement	Random in each shift	IS : 1852, IS: 432, IS:1786, Tech Specs and Const. Drawings		SR/LB		Tolerance as per specifications

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iii		Freedom form cracks surface flaws, Lamination.	As agreed / required	B	Visual	Random in each shift	IS: 1852, IS:432, IS:1786, Tech Specs and Const. Drawings		SR/LB		To be checked at site. Steel collected from source should be free from excessive rust. To be stored as per Technical Specs.
9	PLACEMENT OF REINFORCEMENT STEEL										
I		Check for bar bending schedule with necessary laps. Spacers & Chairs	As agreed / required	B	Visual & Measurement	Random in each shift	Approved Drawings, Tech Specs and Const. Drawings		SR		
ii		Check for cover, spacing of bars	As agreed / required	B	Visual & Measurement	Random in each shift	Approved Drawings, Tech Specs and Const. Drawings		SR		
iii		Check for bending of bars	As agreed / required	B	Visual & Measurement	Random in each shift	Approved Drawings, Tech Specs and Const. Drawings		SR		
iv		Check for spacers and chairs after the reinforcement cage is put inside the formwork	As agreed / required	B	Visual & Measurement	Random in each shift	Approved Drawings, Tech Specs and Const. Drawings		SR		
v		Acceptance of placement od reinforcement before start of concreting	As agreed / required	B	Visual & Measurement	beofre start of each concreting	IS : 456/ Drawings & approved bar bending, Tech Specs and Const. Drawings schedule		SR		
10	STAGING AND FORMS										
i		Materials and accessories	As agreed / required	B	Visual	Once before start of work	As per relevant IS, Tech Specs and Const. Drawings		SR		Proper care should be taken in order to combat corrosion. Proper care should be taken while cleaning, moving and stacking the scaffolds
ii		Soundness of staging, shuttering and scaffolding	As agreed / required	B	Visual	Once before start of work	As per manufacturer's spec.and as per 3696,4014, 4990, Tech Specs and Const.		SR		
iii		Acceptance of formwork before start concreting		B	Physical / visual	beofre start of each concreting	As per provisions and tolerances, Tech Specs		SR		
11	EMBEDDED PART(INCLUDING LAYING OF RAILS & ANCHOR FASTENERS)										
i		Position and levels of embedded parts	As agreed / required	B	Physical/ measurement	100%	As per drawing, Tech Specs and Const. Drawings		SR		Exposed surfsce of the embeded parts other than holding down bolts are to be painted with primer ,chlorinated , rubber baed zinc phosphate
ii		Position depth and size of bolt hole	As agreed / required	B	Physical/ measurement	Random in each shift	As per drawing, Tech Specs and Const. Drawings		SR		
iii		Location verticality of pipe sleeve/opening of bolt hold	As agreed / required	B	Physical/ measurement	Random in each shift	As per drawing, Tech Specs and Const. Drawings		SR		
iv		Laying of rails under supervision of NTPCs specilised agency.	As agreed / required	B	Physical/ measurement	Random in each shift	As per drawing, Tech Specs and Const. Drawings		SR		
v		Welding / tieing of embeddment to reinforce-ment	As agreed / required	B	Physical/ measurement	Random in each shift	As per drawing, Tech Specs and Const. Drawings		SR		
12	PRE-CAST CONCRETE										
i		Crushing strength	As required/ agreed	A	Physical	one sample of six cubes per 50 cum or part thereof	IS:516&IS; 456, Tech Specs and Const. Drawings		SR/LB	√	a minimum of three specimen shall be tested for 28 days comp. strength
ii		Workmanship free from visual defects	As required/ agreed	B	Physical	100%	Tech Specs and Const. Drawings		SR		The precast units shall be free from defects like honeycombing, reinforcement exposure and should have good finish. All relevant tests like workability, cube test shall be carried out as per IS 456-2000 Same as applicable to cast in situ concrete.
iii		Dimension of finish structure	As required/ agreed	B	Measurement	100%	As per IS:456, Tech Specs and Const. Drawings		SR		If the material already tested of the cast-in-situ concrete and part of the same is used for precast concrete, further testing is not required, otherwise testing is required for every 50 Cum. Of Concrete.
iv		Workability	slump test apparatus	B	Physical	one sample every two hrs from mixing plant	IS:1199 &IS:456, Tech Specs and Const. Drawings		SR/LB		According to the mix design
v		Water cement ratio	As agreed / required	B	Physical	At random at the time of batching	IS:1199 , Tech Specs and Const. Drawings		SR/LB		According to the mix design
vi		Cement content	As agreed / required	B	Physical	At random at the time of batching	IS:1199 /tech spec, Tech Specs and Const. Drawings		SR		According to the mix design
vii		Load Test	As agreed / required	A	Physical	5% or as desired by EIC	IS:456/ As decided by NTPC Site Engr. Incharge., Tech Specs and Const. Drawings		SR	√	These tests shall also be carried out, in case of doubt regarding grade of concrete and poor quality.
13	JOINTS IN CONCRETE										
i		Check for the joint material - bitumen impregnated fibre board, PVC water stops, Sealing compound, Expanded polystyrene board, Hydrophillic strip, Acrylic polymer etc.	As per manufacturer Standards	A	Review of MTC	Each batch of delivery	Tech Specs and Const. Drawings, IS 1838, IS 1834, IS12200		MTC	√	
ii		Acceptance of installation of materials for Joints in concrete	As agreed / required	B	Acceptance	Each installation randomly	As per technical specifications and construction drawings				
14	DAMP PROOF COURSE										
i		Check for the material - Hot bitumen and water proffing materials etc	As agreed / required	A	Review of MTC	Each batch of delivery at site	Tech Specs and Const. Drawings, IS 702		SR	√	
ii		Acceptance of damp proof course	As agreed / required	B	Acceptance	100%	As per technical specifications and construction drawings		SR		

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15	**GROUTING**										
i		Check for the material	As agreed / required	A	Review of MTC	Each batch of delivery	As per technical specifications and construction drawings		SR	√	Check for chemical, epoxy, resin grouts etc
ii		Check for the type of mix - fluid mix, plastic mix, stiff mix etc.	As agreed / required	B	Physical	Prior to start of work	As per technical specifications and construction drawings				
iii		Check for the mixing, placement, application and grout pressure	As agreed / required	B	Physical	Random in each shift	As per technical specifications and construction drawings		SR		
iv		Check for the compressive strength	As agreed / required	A	Physical	Each batch of delivery	As per technical specifications and construction drawings		SR	√	
v		Acceptance of the grouts	As agreed / required	B	Physical	Each grout section	As per technical specifications and construction drawings		SR		
16	**SLIPFORM SHUTTERING**										
i		Submission of Slipform Work system to be used	-	B	Submission	Before Comencement of work	As per specifications		SR		
ii		Check for the Slipform shutters	As required	B	Physical	Before Comencement of work	As per specifications		SR		Check for water level system, Controls, Walkways etc.
iii		Details Positions and arrangement of Jack rods	-	B	Approval	Before Comencement of work	As per specifications		SR		Submitted to Engineer for approval
iv		Details of Proposed arrangement for continuous readings	-	B	Approval	Before Comencement of work	As per specifications		SR		Submitted to Engineer for approval
v		Check for All type of openings, Chases, Fixing of Blocks and similar built-up features	As required	B	Physical	100% during execution	Construction Drawings and specifications		SR		No any type of openings ,chases , blocks other than shown in the construction drawings or approved by Engineer shall be executed in the concrete.
vi		Details of proposed method for concrete curing and protection	-	B	Approval	Before Comencement of work	Construction Drawings and specifications		SR		Submitted to Engineer for approval
vii		Check of Concrete Curing and Protection	As required	B	Physical	At Random	Construction Drawings and specifications		SR		Concrete shall not remain uncured for period longer than 12 hours
viii		Check for Sliding Operation	As required	B	Physical	Each Sliding	As per specifications		SR		Rate of Sliding, Delays in sliding, Discontunity or stop strat sliding to be checked
		Monitoring of Sliding Portion									
ix		Progress Height	As required	B	Physical	Six hourly intervals	As per specifications		SR		To be recorded in tabular form and on graphs immediately after each monitoring
x		Centre line in relation to the centers at the base	As required	A	Physical	Six hourly intervals	As per specifications		SR	√	To be recorded in tabular form and on graphs immediately after each monitoring
xi		Internal wall faces in relation to the concrete at the base	As required	B	Physical	Six hourly intervals	As per specifications		SR		To be recorded in tabular form and on graphs immediately after each monitoring
xii		Wall thickness	As required	B	Physical	Six hourly intervals	As per specifications		SR	√	To be recorded in tabular form and on graphs immediately after each monitoring
xiii		Twist	As required	B	Physical	Six hourly intervals	As per specifications		SR	√	To be recorded in tabular form and on graphs immediately after each monitoring
xiv		Verticality of the structure	Optical Theodolight	B	Physical	Every day in morning	As per specifications		SR		To be recorded in tabular form and on graphs immediately after each monitoring
xv		Check for Tolerances for chimney construction	As required	B	Physical	For every day monitoring	As per specifications		SR		
4.00	**BRICK MASONARY**										
1	**Test on Bricks**										
i		Check for Dimensions , shape	As required/ agreed	A	Measurement/ Physical Test	As per relevant IS Code/ One Sample for 30,000 Nos. or part thereof	IS: 1077, Tech Specs and Const. Drawings		Inspection Report	√	Efflorescence shall be checked at each source.
ii		compressive strength, water absorption, warpage efflorescence.	As required/ agreed	B	Measurement/ Physical Test	As per relevant IS Code/ One Sample for 30,000 Nos. or part thereof	IS: 1077, IS:3495 part I (Compressive Strength) Part II (Water Absorbtion) Part III(Efflorescence) Part IV (War page), Tech Specs and Const.			√	Preconditioning of brick shall be done as per IS. For comperssive strength, warpage and water absorbtion
2	**Test on Mortar**	Compressive strength, consistency and water retentivity for each portion of walls, plasters and ceilings.	As required/ agreed	B	Test	At random	IS 2250-1981, Tech Specs and Const. Drawings		LB		Cement used in mortar shall confirm to either IS 269: 1976 or IS 455- 1976 sand shall confirm to IS 2116 -1980
3	**Masonry construction**	Acceptance of Workmanship, verticality and alignment	As agreed / required	B	Visual/ Physical	100%	IS 2212, IS 1905 , Tech Specs and Const. Drawings		SR/LB		
5.00	**FINISHING AND ALLIED WORKS**								.		
1	**MATERIALS- FINE SAND, SAND FOR PLASTERING**										
i		Deleterious Material	As agreed / required	B	Physical	Once per source	IS : 2386 (Part-I &II) & IS :2116, Tech Specs and Const. Drawings		SR		
ii		Grading	As agreed / required	B	Physical	50 Cum./or part thereof	IS:3150,1542& Apprd. drgs, Tech Specs and Const. Drawings		SR		Table –I of IS:2116

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iii		Galvanized hexagonal wire netting for lath plastering	As agreed / required	B	Review of MTC	Each batch of delivery	, Tech Specs and Const. Drawings		SR		
iv		Check for the thickness and finishing of plaster	As agreed / required	B	Visual/ Measurement	Random in each shift	As per IS 1661 , Tech Specs and Const. Drawings		SR/LB		
2	PLASTERING										
i		Check for defects and the remedial measure for bond filler , blistering , cracking and crazing , efflorescence and irregularity of surface texture	As agreed / required	B	Visual/ Physical	Random in each shift	Tech Specs and Const. Drawings, IS: 1661		SR		
ii		Truness of plastering system	As agreed / required	B	Visual/ Physical	Random in each shift	Tech Specs and Const. Drawings		SR		finished plaster surface shall not show any deviation more than 4 mm when checked with straight edge of 2 m length
iii		Acceptance of Grooves and finishing	As agreed / required	B	Acceptance	100%	Tech Specs and Const. Drawings		SR		
3	STONE GRIT PLASTER/ GRANULAR TEXTURED COAT FINISH										
i		Check for Preparation of surface	As agreed / required	B	Physical	Random in each shift	Tech Specs and Const. Drawings		SR		
ii		Check for material - Size of chips	As agreed / required	B	Physical	Random in each shift	Tech Specs and Const. Drawings		SR		
iii		Acceptance of Grooves and finishing	As agreed / required	B	Acceptance	100%	Tech Specs and Const. Drawings		SR		
4	WATER PROOFING SYSTEM										
i		Check for the material	As agreed / required	A	Physical and Review of MTC	Each lot of delivery	Tech Specs and Const. Drawings,		SR/ MTC	√	
ii		Acceptance of water proofing system - Application, fixing, laying	As agreed / required	B	Physical	100%	Tech Specs and Const. Drawings		SR		Water pounding test shall be done
5	FALSE CEILING										
i)		Check for the Materials - Glass Reinforced Gypsum (GRG), Pre-painted coil coated steel false ceiling system etc.	As agreed / required	A	Physical and MTC Review	Each batch of delivery	As per relevant IS and Tech. Specs / Manufacturer's TC		-do-	√	
ii)		Acceptance of installation	As agreed / required	B	Physical / measurements	Each installation	-do-		-do-		All supports , hangers , accessories shall be as per Tech. Specifications/ approved manufacturer's recommendations
6.00	PAINTING SYSTEM - All surfaces										
1	Check for the Materials and accessories	White wash, Distemper and all types of Primer and Paints - Check for Shade, type from brand and manufacturer as approved by NTPC EIC	As agreed / required	A	Review of MTC	Each batch of delivery	Tech Specs and Const. Drawings		SR/MTC	√	Mfr.'s T.C. shall be correlated with the consignment received.
2	Check for Surface prepration		As agreed / required	B	Physical /visual	Random in each shift	Tech Specs and Const. Drawings		SR		
3	Check for DFT of painted surfaces		As agreed / required	B	Physical	Each surface at random	Tech Specs and Const. Drawings		SR		
4	Acceptance of painted surfaces		As agreed / required	B	Physical	Each surface at random	Tech Specs and Const. Drawings		SR		
6.10	CHIMNEY PAINTING										
i		Requirements for Steel Surfaces	As Required	B	Physical	Randomly	Tech Specs and Const. Drawings		SR		No of Coats applied and DFT/WFT to be checked as per specified
ii		Requirements for Cast Iron Surfaces	As Required	B	Physical	Randomly	Tech Specs and Const. Drawings		SR		No of Coats applied and DFT/WFT to be checked as per specified
iii		Requirements for Concrete Surfaces	As Required	B	Physical	Randomly	Tech Specs and Const. Drawings		SR		No of Coats applied and DFT/WFT to be checked as per specified
iv		Material Requirements	As Required	B	Physical	Randomly	Tech Specs and Const. Drawings		SR		Requirement of DFT to be checked as per Specifications. Procurement to be done from approved/acceptable manufacturer/source
v		Preparation of Surfaces	As Required	B	Physical	Randomly	Tech Specs and Const.		SR		
vi		Application of Paint	As Required	B	Physical	Randomly	Tech Specs and Const. Drawings		SR		AS per recommendations by Manufacturer along with Relevant IS Codes and Specification requirements
7.00	DOORS , WINDOWS VENTILATORS & GRILL										

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1	**Check for the material/ items for all type of timber, flush doors, Particle doors, wire guage, Aluminium doors, Fire proof doors, windows fittings, Anodized aluminium works, Mortice locks, Automatic operating system etc received at site**	Review of MTC / make or/and Physical checks, tests report (if MTC is not available)	As agreed / required	A	Review of MTC/ Physical	for each batch of delivery	Tech Specs and Const. Drawings		SR	√	
2	**Wood work in frames**	Wood work in frames - Check for dimensions, surface finish and rebating etc.	As agreed / required	B	Physical	Random for each installation	Tech Specs and Const. Drawings		SR		
3	**Wardrobe shutter and show cases**										
i		Check for material as per IS 3087 and 3097 - from NTPC approved source	As agreed / required	B	Physical	one sample for each section for each lot of delivery	Tech Specs and Const. Drawings, IS 3087 and 3097		SR		
ii		Acceptance of fixing after completion	As agreed / required	B	Acceptance	100%	Tech Specs and Const. Drawings, IS 3087 and 3098		SR		
4	**Pelmets**										
i		Check for material as per IS 3087/ 3097 - from NTPC approved source	As agreed / required	B	Physical	one sample for each section for each lot of delivery	Tech Specs and Const. Drawings, IS 3087/ 3097		SR		
ii		Acceptance of fixing after completion	As agreed / required	B	Acceptance	100%	Tech Specs and Const. Drawings, IS 3087/ 3098		SR		
5	**MS Grills**										
i		Check for the material for section and weight from NTPC approved source	As agreed / required	A	Physical	one sample for each section for each lot of delivery	Tech Specs and Const. Drawings		SR	√	
ii		Check for fabrication done at approved workshop	As agreed / required	B	Physical	Random	Tech Specs and Const. Drawings		SR		
		Acceptance of fixing of MS Grills	As agreed / required	B	Acceptance	Random	Tech Specs and Const. Drawings		SR		
6	**Fitting and fixtures - MS sliding door bolts, tower bolts, pull bolt lock, MS handles, Safety Chains, brass locks, brass latch, hydraulic floor springs & door closers, etc**	Check for fitting items as per relavent IS codes, tech specifications and BOQ- from NTPC approved source	As agreed / required	B	Physical and acceptance	Five samples for each item for each lot of delivery	Tech Specs and Const. Drawings		SR		
7	**Fitting and fixtures - Aluminium sliding door bolts, tower bolts, pull bolt locks, handles, door stoppers etc.**	Check for fitting items as per relavent IS codes, tech specifications and BOQ- from NTPC approved source	As agreed / required	B	Physical and acceptance	Five samples for each item for each lot of delivery	Tech Specs and Const. Drawings		SR		
8	**Fire proof doors**										
i		a) Check for the Fire Proof Doors	As required/ agreed	A	Review of MTC	Each lot	As per Technical Specifications and approved drawings, IS 3614 Part (I &II), TAC		MTC	√	
ii		b) Check for DFT and Fire Retardency of Paint	As required/ agreed	B	Physical	Each Door	As per Technical Specifications and approved drawings, IS 3614 Part (I &II)		SR/LB		
9	**Acceptance of all type fittings after fixing**	Acceptance of fittings after completion	As agreed / required	B	Physical and acceptance	Random for each type of fitting	Tech Specs and Const. Drawings		SR		
8.00	**GENERAL STEEL WORK**										
1	**Check for Material**	Review of MTC/ make / Physical checks, tests (if MTC is not available)	As agreed / required	A	Review of MTC for each delivery	For each batch of delivery	Tech Specs and Const. Drawings		SR	√	
2	**Rolling shutters**										
i		Check for surface finish and thickness of plate of rolling shutters of approved make and DFT	As agreed / required	B	Physical	Random for each batch of delivery	Tech Specs and Const. Drawings		SR		
ii		Acceptance of rolling shutters after fixing	As agreed / required	B	Physical and acceptance	Random	Tech Specs and Const. Drawings		SR		
3	**Steel Glazed doors and T-iron frames sections**										
i		Check for shape, tolerances, thickness, welding and finishing of sections (Check MTC whereever applicable)	As agreed / required	A	Review of MTC for each delivery	Random for each delivery	Tech Specs and Const. Drawings		SR	√	
ii		Acceptance of Steel Glazed doors and T-iron frames sections after fixing	As agreed / required	B	Physical and acceptance	Random for each installation	Tech Specs and Const. Drawings		SR		
4	**Pressed steel pressed frames/ doors**										
i		Check for shape, tolerances, thickness, welding and finishing (Check MTC whereever applicable)	As agreed / required	A	Review of MTC for each delivery	Random for each delivery	Tech Specs and Const. Drawings, IS4351, IS2202		SR	√	
ii		Acceptance of Pressed steel pressed doors after fixing	As agreed / required	B	Physical and acceptance	Random for each installation	Tech Specs and Const. Drawings		SR		
5	**Fencing and Gates**										

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i)	Check for Materials for fencing and gates	PVC coated chain link fencing (IS 2720), Welded wire mesh (IS 1566), Reinforced barbed tape galvanised (IS 2629) etc.	As agreed / required	A	Review of MTC	Each batch of delivery	Tech Specs and Const. Drawings		SR/MTC	√	Mfr.'s T.C. shall be correlated with the consignment received.
ii)	Check for alignments, erection painting, DFT etc.		As agreed / required	B	Physical / measurements	Each installation	Tech Specs and Const. Drawings		SR		Erection shall be as per NTPC Tech. Specs.
ii)	Acceptance of the installation and working		As agreed / required	B	Physical / measurements	Each installation	Tech Specs and Const. Drawings		SR		Erection shall be as per NTPC Tech. Specs.
6	**Galvanised Chicken Wire Mesh**	Check for Guage and Dimensions from NTPC approved Source	As agreed / required	B	Acceptance	Random for each delivery	Tech Specs and Const. Drawings		SR		
9.00	**FLOOR FINISHES AND ALIED WORKS**										
1	**Cement Concrete Flooring**										
i		Check for execution of concreting	As agreed / required	B	Physical	Random in each shift	Tech Specs and Const. Drawings		SR		
ii		Check for providing and fixing glass/ PVC strips in joints	As agreed / required	B	Physical	Random in each shift	Tech Specs and Const. Drawings		SR		
iii		Check for laying, polishing, curing, finishing for terrazzo, marble chip flooring	As agreed / required	B	Physical	Random in each shift	Tech Specs and Const. Drawings		SR		
iv		Acceptance of lines, levels and finishing	As agreed / required	B	Acceptance	100%	Tech Specs and Const. Drawings		SR		
10.00	**SANITORY INSTALLATIONS**										
1		Check for size and surface finish of all sanitory items and fixtures from NTPC approved sources, (Check MTC whereever applicable)	As agreed / required	A	Physical / review of MTC	Each lot of delivery as per Specifications	Tech Specs and Const. Drawings		SR	√	To be procured from NTPC approved source
2		Acceptance of installations of all sanitory items and fixtures	As agreed / required	B	Acceptance	100%	Tech Specs and Const. Drawings		SR		
3	**SCI, CI, S&S Pipes & Fittings etc**										
i		Check for Work man ship and finish	As agreed / required	B	Visual	Random	Tech Specs and Const. Drawings		SR		
ii		Check for Unit weight and Dimensions	As agreed / required	B	Physical	Random	Tech Specs and Const. Drawings		SR		
iii		Hydrostatic test	As agreed / required	A	Review of MTC for each delivery	Each lot of delivery as per Specifications	Tech Specs and Const. Drawings		SR	√	
11.00	**WATER SUPPLY AND ALL TYPES OF FITTINGS**										
1		Check for size and surface finish of all water supply, GI/ MS pipes and fittings, Photo Voltaic Control System etc from NTPC approved sources (Check MTC whereever applicable)	As agreed / required	A	Physical / review of MTC	each delivery as per Specifications	Tech Specs and Const. Drawings		SR	√	To be procured from NTPC approved source
2		Acceptance of installations of all water supply, GI pipes and fittings	As agreed / required	B	Acceptance	100%	Tech Specs and Const. Drawings		SR		
3	**CI, S&S Pipes & Fittings**										
i		Check for Work man ship and finish	As agreed / required	B	Visual	Random as per Specifications	Tech Specs and Const. Drawings		SR		
ii		Check for Unit weight and Dimensions	As agreed / required	B	Physical	Random	Tech Specs and Const. Drawings		SR		
iii		Hydrostatic test	As agreed / required	A	Physical / review of MTC	Each lot of delivery as per Specifications	Tech Specs and Const. Drawings		SR	√	
4	**Polyethylene Water Storage Tanks**										
i		Check for material of tanks from NTPC approved sources	As agreed / required	A	Physical / review of MTC	Each lot of delivery as per Specifications	Tech Specs and Const. Drawings		SR	√	
ii		Aceptance for instllation and fitting (IS 12701)	As agreed / required	B	Acceptance	100%	Tech Specs and Const. Drawings		SR		
12.00	**DRAINAGE AND SANITATION**										
1	**Sanitary appliances**										
i		Check for Viterous China, Glazed, ceramic sanitary appliances (Water closets, Wash basins, urinals) etc.	As agreed / required	A	Physical / review of MTC	each delivery as per Specifications	Tech Specs and Const. Drawings		SR	√	To be procured from NTPC approved source
ii		Acceptance of installation of Viterous China, Glazed, ceramic sanitary appliances (Water closets, Wash basins, urinals) etc.	As agreed / required	B	Acceptance	100%	Tech Specs and Const. Drawings		SR		
2	**SW Pipes and RCC Pipes**										
i		Check for size and surface finish of Pipes from NTPC approved sources	As agreed / required	A	Physical	100% after delivery	Tech Specs and Const. Drawings, IS458, IS 1536		SR	√	
ii		Testing of Joints	As agreed / required	B	Physical	100%	Tech Specs and Const. Drawings		SR		

LOGO	SUPPLIERS NAME AND ADDRESS:	INDICATIVE FIELD QUALITY PLAN						ANNEXURE- IV			
		ITEM : CIVIL WORK SUB-SYSTEM : Foundations, Excavation & Fill, Concrete, Building, Masonry Etc.		QP NO. : REV. NO .: DATE : PAGE :		1 0	PROJECT: PACKAGE: CONTRACT NO. MAIN CONTRACTOR	FLUE GAS DESULPHURISATION SYSTEM PACKAGE			
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
i		Acceptance of installations of Pipes	As agreed / required	B	Acceptance	100%	Tech Specs and Const. Drawings		SR		Acceptance tests shall be done as per specifications
3	**CI Pipes, Covers and Frames**										
i		Check for CI and SFRC covers and frames as per IS 1726 and IS 12592 from NTPC approved sources (Check MTC whereever applicable)	As agreed / required	A	Physical / review of MTC	Each lot of delivery	Tech Specs and Const. Drawings, IS 1536, IS 12592		SR	√	
ii		Acceptance of installations of CI Pipes, Covers and Frames	As agreed / required	B	Acceptance	1	Tech Specs and Const. Drawings		SR		
4	**RCC manholes**	Acceptance of RCC manholes after completion	As agreed / required	B	Acceptance	1	Tech Specs and Const. Drawings , IS 4111		SR		
13.00	**FOUNDATION SYSTEM**										
1	**SHALLOW FOUNDATIONS**										
i		Check for the foundation excavation - Location, Layout, size, depth etc	As required / agreed	B	Physical	Each location	As per technical specifications and construction drawings		SR	√	lines and levels to be checked
ii		Check for the foundation casting - Layout, Shape, dimensitions, Reinforcement, concreting, curing etc	As required / agreed	B	Physical	Each foundation	As per technical specifications and construction drawings		SR		lines and levels to be checked. Concrete Grade to be checked as per Mix Design
14.00	**SHEETING AND OTHER WORKS**										
1		Check for Material like modular areated panel, permanently colour coated sheets , metal decking , pre-engineered buildings, AC sheeting, Fire proof doors and insulations (all tests as per tehcnical Specifications)	As per manufacturer Standards	A	Review of MTC	Each batch of delivery	Tech Specs and Const. Drawings		MTC	√	1)FQP for structural steel shall also be applicable.2) For aluminium door/windows, check for anodisation as per Tech. Spec. 3) Fire proof doors shall be procured from TAC Approved parties as per relevant IS/Tech. 4) For aluminium cladding grade of alminium to be checked.
2		Check for Storage at Site	As agreed / required	B	Visual	Random in each shift	Tech Specs and Const. Drawings		SR		
3		Installation, lap alignment & workmanship.	As agreed / required	B	Visual/ Physical	Random in each shift	Tech Specs and Const. Drawings		SR		No gas cutting of sheets acceptable . Profile sheets will be kept covered in weather proof storage
4		Installation of lining &insulation &check thermal insulationfor wall clading for thickness , density , thermal conductivityn at 50 deg c and all other tests as per IS:8183	As agreed / required	B	Testing	100%	Tech Specs and Const. Drawings		SR	√	&stored at accurate height to avoid any exposure of actual water. Principle of first in and first out shall be apply for erecting the sheets.
5		Check for the installation, alignments, finishing etc	As agreed / required	B	Visual/ Physical	Random in each shift	Tech Specs and Const. Drawings		SR/LB		
6		Fasteners for sheeting work	As agreed / required	B	Review of TC including 1000 hrs salt spray test	100%	Tech Specs and Const. Drawings		SR/LB		
7		Acceptance of each type of installation	As agreed / required	B	Visual/ Physical	Each installation	Tech Specs and Const. Drawings		SR/LB		
15.0	**PILING WORK (IF APPLICABLE)**										
15.1	**Execution**										
i		100 mm Dia Borehole	As required	A	Physical	100%	NTPC Tech. Specs		SR/LB	√	If carried out by the contractor
ii		Pile layout	Total station	B	Measurement	100%	As per appd. Drawings and technical specification		SR/LB	√	
iii		Recording ground level	As required	B	Measurement	Random	IS:2911, as per appd. Drawings and technical		SR/LB	√	
iv		Cleaning/Flushing of pile bore	As required	B	Visual	Random	As per appd. Drawings and technical specification		SR/LB	√	
v		Size of bore and During boring of pile record commencement of SPT/ core recovery to ensure socketing length equivalent in terms of the Diameter of the pile below the socketing horizon.	As required	B	Measurement	100%	As per appd. Drawings and technical specification		SR/LB	√	
vi		Trial mix to ascertain the workability and cube strength	After receiving the recommended mix design from specialist agency,	B	Physical	One for each mix proportion	NTPC tech specification		SR/LB	√	Necessary correction for moisture content and water absorption according to mix design recommendation may be carried out during the trial mix
vii		Cement content	As required	B	Physical	Once per shift	As per approved design mix.		SR/LB	√	At batching plant
viii		Pouring of concrete to project above cutoff level.	As required	B	Measurement	100%	As per appd. Drawings and technical specification		SR/LB	√	
ix		Pile termination level	SPT & core recovery	A	Soil data	As per NTPC specifications	As per appd. Drawings and technical specification		SR	√	
15.2	**Testing**										
i		Bentonite	IS:2720	A	Physical / testing	Once per source	As per IS:2720 / tech. Specs.		SR/LB	√	Review of test report
ii		Density check on sample of mud collected from pile bore bottom	Sample collection	A	Physical	As per Tech. Spec.	As per NTPC Tech Spec.		SR/LB	√	Tests to be done before placing concrete. Samples to be collected from pile bore bottom.

LOGO	SUPPLIERS NAME AND ADDRESS:	INDICATIVE FIELD QUALITY PLAN						ANNEXURE- IV			
		ITEM : CIVIL WORK SUB-SYSTEM : Foundations, Excavation & Fill, Concrete, Building, Masonry Etc.		QP NO. : REV. NO .: DATE : PAGE :		1 0	PROJECT: PACKAGE: CONTRACT NO. MAIN CONTRACTOR	FLUE GAS DESULPHURISATION SYSTEM PACKAGE			
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
iii		Slump test of concrete	IS:1199	B	Physical	Every 2 hrs at pouring point of concrete	IS:2911, As per appd. Drawings and technical specification		SR/LB	√	
iv		Cube sampling for works cube test	IS:456	B	Physical	One set of 6 cubes per 50 CuM or part thereof for each grade of concrete per shift whichever is earlier.	IS:2911, As per appd. Drawings and technical specification		SR/LB	√	
v		Initial pile load test, Vertical (Compression), Lateral (horizontal) and pullout (tension).	IS:2911 / as required	A	Testing	100% for 3 nos. for each type or as specified in BOQ / Tech. Spec.	IS:2911, As per appd. Drawings and technical specification		SR/LB	√	In case of compression test method the loading shall be cyclic.
vi		Routine pile tests, compression and horizontal	Calibrated dial gauges etc. as required.	A	Testing	100% for 0.5% of the total number of piles provided for each type of test/Tech. Spec.	IS:2911, As per appd. Drawings and technical specification		SR/LB	√	Routine Test shall be conducted by direct loading method.
vii		Integrity Tests	PEM	A	Testing	100%	IS:2911, As per appd. Drawings and technical specification and suppliers manual		Test Report	√	CHP
16.0	SPECIAL ITEMS										
16.1	Earthing Mat (Grounding System)										
i	Material	Earthing mat	As agreed / required	A	EIC Approved source and review of MTC/ test reports	Each lot of delivery as per Specifications	As per relevant IS and Tech. Specs / Manufacturer's, IS 3043		SR/MTC	√	
ii		Weld sizes & length	Visual/Tape	B	Visual/ Measurement	1	Tech Specs and Const. Drawings				NTPC approved electrodes shall be used
iii		D P test	DP test Kit	A	Physical	10% at random of the offered lot	Tech Specs and Const. Drawings		TR	√	
iv		Earth test	Earthing test kit	A	Physical	1	Tech Specs and Const. Drawings,		SR	√	
16.2	Bitumen layer for tank foundation										
i	Material	Grade of bitumen	As agreed / required	A	EIC Approved source and review of MTC/ test reports	Each lot of delivery as per Specifications	As per relevant IS and Tech. Specs /MTC		SR/MTC	√	
ii	Acceptance and workmanship	Application / workmanship	As agreed / required	B	Physical	Random	Tech Specs and Const. Drawings		SR		
16.3	Composite Aluminium Panels and structural glazing										
i	Material	Type of aluminium panels / structural glazing / fasteners and fixtures / silicon sealant	As agreed / required	A	EIC Approved source and review of MTC/ test reports	Each lot of delivery as per Specifications	Technical specifications / drawings		SR/MTC	√	MTC shall cover all the properties / parameters as per technical specifications
ii	Acceptance and workmanship	Installation / workmanship	As agreed / required	B	Physical	Random	Technical specifications / drawings		SR		
		LEGEND: D * Records, indentified with "Tick" (√) shall be essentially included by supplier in QA documentation.						**DOC. NO.:** CS-4140-109-2	**REV:**		
		Legend to be used: Class # : A = Critical, B=Major, C=Minor; SR, TR, MTC, LB									
Manufacturer/ Sub-supplier	Main-supplier	**Categorization Witnessing & Accepting (As per NTPC QA&I System)** **Category 'A' FQA Engineer in association with Executing Engineer, Category 'B' Executing Engineer, Category 'C' Executing Engineer** ;**SR** = Site Register , **TR**= Test Report, **MTC =** Manufacturer's Test Certificate					**For NTPC USE**				
Signature		This document shall be read in conjunction with NTPC Tech. Specifications, BOQ, Drawings						**REVIEWED BY**	**APPROVED BY**		**APPROVAL SEAL**

LOGO	SUPPLIERS NAME AND ADDRESS:	INDICATIVE FIELD QUALITY PLAN									ANNEXURE- V
		ITEM : STRUCTURAL STEEL WORK		QP NO. :		2	PROJECT:	FLUE GAS DESULPHURISATION SYSTEM PACKAGE			
				REV. NO .:		0	PACKAGE:				
		SUB-SYSTEM : FABRICATION & ERECTION		DATE :			CONTRACT NO.				
				PAGE :			MAIN CONTRACTOR				
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
1.00	MATERIALS										
i		Structural steel procured from NTPC approved sources-Mechanical (YS, UTS, Elg, UT if specified),,and Chemical properties (CE as per IS)		A	Review	For each batch of each section delivered at site	Technical Specification and Construction Drawings, IS 2062		SR	√	Correlated MTC shall be verified. In the event of non submission of MTC , sample shall be selected by FQA for testing
2.00	FIT-UP										
2.01		Marking and Cutting	As agreed / required	B	Visual & Measurement	Each plate/ Section	Tech Specs and Const. Drawings/ Approved cutting plan		SR		
2.02		Match markings for trial assembled components	As agreed / required	B	Physical	Each fit-up	Tech Specs and Const. Drawings		SR		
2.03		Weld Fit Up	As agreed / required	B	Physical	Each fit-up	Tech Specs and Const. Drawings		SR	√	Edge Preparation/ Gap/ Alignment
3.00	PRE HEATING (wherever applicable)										
3.01		Pre-Heating Temperature	As agreed / required	B	Measurement	Each pre-heating	Tech Specs and Const. Drawings, Approved WPS		SR	√	
3.02		Post Weld Heat Treatment (PWHT), if required	As agreed / required	A	Time & Temperature	Each PWHT	Tech Specs and Const. Drawings, Approved WPS		SR	√	
4.00	WELDING REQUIREMENTS										
4.01		PQR and Welder's Qualification	As agreed / required	A	Physical	Each welder	Approved WPS/ PQR, AWS-D1.1/ASME-IX, Tech Specs and Const. Drawings		Test Report	√	
4.02		Welding consumables	As agreed / required	B	Physical	Random in each shift	Approved WPS/ Owner Rationalized list of Electrodes.		SR	√	
4.03		Sequence of welding	As agreed / required	B	Physical	Random in each shift	Tech Specs and Const. Drawings, Agreed scheme		SR		
4.04		Removal/ grinding of temporary attachments	As agreed / required	B	Measurement	All cleats/ attachments	Tech Specs and Const. Drawings, IS-7215/Approved Drg.		SR		
4.05		Completeness after welding-Dimensions/ distortion	As agreed / required	B	Visual	Each structure component	Tech Specs and Const. Drawings		SR		
5.00	NON DESTRUCTIVE AND DESTRUCTIVE TESTING										
5.01	Fillet Welds										
5.01.01		Visual	As required/ agreed	B	Visual/ Measurement	Each welded joint	As per technical specifications and construction drawings		SR		As per requirement of Owner Engineer
5.01.02		Macro-Etch Examination	As required/ agreed	B	Physical	Main fillet weld with min one joint per built up beam, columns and crane girders	As per technical specifications and construction drawings		SR	√	

LOGO	SUPPLIERS NAME AND ADDRESS:	INDICATIVE FIELD QUALITY PLAN						ANNEXURE- V			
		ITEM : STRUCTURAL STEEL WORK		QP NO. :		2	PROJECT:	FLUE GAS DESULPHURISATION SYSTEM PACKAGE			
				REV. NO .:		0	PACKAGE:				
		SUB-SYSTEM : FABRICATION & ERECTION		DATE :			CONTRACT NO.				
				PAGE :			MAIN CONTRACTOR				
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
5.01.03		Dye Penetration Test (DPT)	As required/ agreed	B	Physical	25% weld length of tension member of crane girder- For crane girder 5% of Weld length with min. 300mm at each location - Except Crane Girder, for all other Fillet Welds	As per technical specifications and construction drawings		SR	√	
5.02	**Butt Welds**										
5.02.01		Visual	As required/ agreed	B	Visual	Random in each shift	As per technical specifications and construction drawings		SR		
5.02.02		Dye Penetration Test	As required/ agreed	B	Physical	100% DPT after back gouging on all butt welds except for coal bunker bins 10% DPT after back gouging-For coal bunker bins	As per technical specifications and construction drawings		SR		All butt welds to be back gouged before DPT
5.02.03		Mechanical testing on production test coupons	As required/ agreed	A	Physical	Min. one joint per built up beams, coloums and crane girder.	As per technical specifications and construction drawings		SR	√	Test on production test coupons
5.02.04		Radiography Test (RT)	As required/ agreed	A	Physical	100% RT on butt welds of tension flange (bottom flange) of crane girders 5% spot RT on butt welds / at inaccessible locations UT on butt welds- For coal bunker bins 10% RT weld length of each welder on butt welds, except for crane girders and coal bunk	As per technical specifications and construction drawings		SR	√	In case of failure of any welds in SPOT/RT or UT the % of retesting shall be doubled at that particular location. Acceptance criteria of NDT on welds shall be as per AWS D1.1. Wherever RT is not feasible UT to be carried out with the approval of the Engineer
5.03	**Full Penetration Welds (Other than butt welds)**										
5.03.01		Ultrasonic Testing (UT)	As required/ agreed	A	Physical	100% UT on the web to flange joint of crane girder 10% UT on other full penetration joints	As per technical specifications and construction drawings		IR	√	In case of failure of any welds in SPOT/RT or UT the % of retesting shall be doubled at that particular loaction. Acceptance criteria of NDT on welds shall be as per AWS D1.1.

LOGO	SUPPLIERS NAME AND ADDRESS:	INDICATIVE FIELD QUALITY PLAN						ANNEXURE- V			
		ITEM : STRUCTURAL STEEL WORK		QP NO. :		2	PROJECT:	FLUE GAS DESULPHURISATION SYSTEM PACKAGE			
				REV. NO .:		0	PACKAGE:				
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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
5.04	NON DESTRUCTIVE AND DESTRUCTIVE TESTING FOR CHIMNEY STEEL LINER										
i		Visual examination	As required/ agreed	B	Visual	100%	As per technical specifications and construction drawings, IS 822, AWS D 1.1		SR	√	As per requirement of NTPC Engineer
ii		DPT	As required/ agreed	B	Physical	100%	As per technical specifications and construction drawings, IS 822, AWS D 1.1		IR	√	
iii		RT	As required/ agreed	A	Physical	10% FOR SHOP BUTT WELD AND 15% FOR SITE BUTT WELDS	As per technical specifications and construction drawings, IS 822, AWS D 1.1				
6.00	FOUNDATION CHECKS										
6.01		Dimensions and levels	As agreed / required	B	Physical/ Measurement	Each Foundation	Tech Specs and Const. Drawings		SR	√	Shape, lines (including diagonal checks)
6.02		Foundation Bolts and Embedments	As agreed / required	B	Physical/ Measurement	Each Foundation	Tech Specs and Const. Drawings		SR	√	Measurement of Verticality, Levels, pitch distance
7.00	PRE-ASSEMBLY CHECKS										
7.01		Punch Erection marks and match marks on members	As agreed / required	B	Visual/ Physical	Each structural member	Tech Specs and Const. Drawings				Markings for - Assembly designation, Part number, Weight, Any other important identifications.
7.02		Pre-assembly as per match mark	As agreed / required	B	Visual/ Physical	Each structural member	Tech Specs and Const. Drawings				
7.03		Camber, sweep and total length after trial assembly of structure.	As agreed / required	B	Visual/ Physical	Each structural member	Tech Specs and Const. Drawings		SR	√	
7.04		Control assembly check at shop	As agreed / required	B	Visual/ Physical	Every first and tenth set of identical structure	Tech Specs and Const. Drawings				
8.00	ERECTION CHECKS										
8.01		Alignment, slopes, level, tolerances of erected member	As agreed / required	B	Measurement	Each structural member	Tech Specs and Const. Drawings		SR	√	
8.02		Tightening of bolts including foundation bolts with lock nuts	As agreed / required	B	Visual/ Physical	Each structural member	Tech Specs and Const. Drawings		SR	√	
8.03		Acceptance of erected structure	As agreed / required	B	Visual/ Physical	Each erected structure	Tech Specs and Const. Drawings, IS 7215 and IS 12843		SR	√	
9.00	INSTALLATION AND ALIGNMENT OF STEEL LINER										
i		Submission of Installation/ Erection Scheme/ methodology for all structures	-	B	Approval	Once prior to erection of each structure	Approved drawings and Technical Specifications		SR	√	
ii		Check for Erection Marks	-	B	Visual	100%	Approved drawings and Technical		SR		
iii		Check for Installation of Steel Liners	As required	B	Visual/ Acceptance	100%	Approved drawings and Technical Specifications		SR		
iv		Check for Site Joints	As required	B	Visual/ Acceptance	100%	Approved drawings and Technical Specifications		SR		
v		Check for Installation of Inlet Transition Ducts	As required	B	Visual/ Acceptance	100%	Approved drawings and Technical Specifications		SR		

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		ITEM : STRUCTURAL STEEL WORK		QP NO. :		2	PROJECT:	FLUE GAS DESULPHURISATION SYSTEM PACKAGE			
				REV. NO .:		0	PACKAGE:				
		SUB-SYSTEM : FABRICATION & ERECTION		DATE :			CONTRACT NO.				
				PAGE :			MAIN CONTRACTOR				
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
vi		Check for Installation of Insulations and Expansion Compensators	As required	B	Visual, Physical, Acceptance	100%	Approved drawings and Technical Specifications		SR		Each layer of expansion Compensator tobe checked at shop for thickness, unit weight, tensile strength & elongation along with temp. withstandability for composite joints
vii		Ensure the Erection of all steel structures along with permissible tolerances and their acceptance	As required	B	Visual/ Acceptance	100%	Approved drawings and Technical Specifications		SR		
viii		Check and approval for Dismantling, Modification and Re-erection, if required for any reason	As required	B	Visual/ Acceptance	100%	Approved drawings and Technical Specifications		SR		
10.00	PAINTING SYSTEM										
10.01		Paining Materials and accessories	As agreed / required	A	Review of MTC	Each batch of delivery	Tech Specs and Const. Drawings		SR/MTC	√	Mfr.'s T.C. shall be correlated with the consignment received.
10.02		Surface prepration	As agreed / required	B	Physical /visual	Random in each shift	Tech Specs and Const. Drawings, Relevant code/ standards		SR	√	
10.03		DFT of paint - Over steel surface	As agreed / required	B	Physical	Each surface at random	Tech Specs and Const. Drawings		SR	√	
10.04		Acceptance of painted surfaces	As agreed / required	B	Physical	Each surface at random	Tech Specs and Const. Drawings		SR		
11.00	PERMANENT BOLTS AND NUTS AND WASHERS										
11.01		Material	As agreed / required	A	Physical and MTC Review	Once for each lot of delivery	Tech Specs and Const. Drawings		SR/MTC	√	Permanent mild steel Bolts, mild steel Nuts, Mild steel Washers, High strength structural Bolts, Washers-Dimensions, properties, storage along with MTC
11.02		Contact surfaces before bolting	As agreed / required	B	Physical	Random before asembly for bolting	Tech Specs and Const. Drawings, IS 4000		SR		
11.03		Inspection of the assembled bolts	As agreed / required	B	Physical	Randomly in each shift for assembeled bolts	Tech Specs and Const. Drawings, IS 4000		SR		
11.04		Tensioning	As agreed / required	B	Physical	Randomly during snug tight test and after full tensinoning	Tech Specs and Const. Drawings, IS 4000		SR	√	
11.05		Acceptance of installed bolts	As agreed / required	B	Physical	Each bolt	Tech Specs and Const. Drawings		SR		
12.00	STAINLESS STEEL HAND RAILS										
12.01		Material	As agreed / required	A	Physical/MTC Review(In case procured by contractor)	Once for each lot of delivery	Tech Specs and Const. Drawings		SR/MTC	√	Also check grade of steel
12.02		DPT for welding	As agreed / required	A	Physical	Random for each fabrication	AWS D1.1 / 'Tech Specs and Const. Drawings		SR/LB	√	WPS shall be submited for Owner approval , electrodes used shall be as specified in WPS

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1	2	3		4	5	6	7	8	9	D*	10
12.03		Acceptance of stainless steel hand rails	As agreed / required	B	Physical	Each installation	Tech Specs and Const. Drawings		SR		
13.00	**PTFE SLIDING BEARINGS AND ELASTOMERIC BEARINGS**										
13.01		Material from approved source	As agreed / required	A	Physical and MTC Review	Once for each lot of delivery	Tech Specs and Const. Drawings		SR/MTC	√	
13.02		Acceptance of installation of bearings	As agreed / required	B	Physical	Each installation	Tech Specs and Const. Drawings		SR		
		LEGEND: D * Records, indentified with "Tick" (√) shall be essentially included by supplier in QA						**DOC. NO.:**	**REV:** 0		
		Legend to be used: Class # : A = Critical, B=Major, C=Minor; SR, TR, MTC, LB									
Manufacturer/ Sub-supplier	**Main-supplier**	**Categorization Witnessing & Accepting (As per Owner QA&I System)** **Category 'A' FQA Engineer in association with Executing Engineer, Category 'B' Executing Engineer, Category 'C' Executing Engineer ;SR = Site Register , TR= Test Report,MfrTC = Manufacturer's Test Certificate**					**For Owner USE**				
Signature		This document shall be read in conjunction with Owner Tech. Specifications, BOQ, Drawings						**REVIEWED BY**	**APPROVED BY**		**APPROVAL SEAL**