	SPECFIC TECHNICAL REQUIREMENT FOR CIVIL, STRUCTURAL & ARCHITECTURAL WORKS FOR FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE FOR NABINAGAR STPP (4X250 MW)	SPECIFICATION NO. PE-TS-463-600-001 VOLUME - IIB SECTION - C REV.NO. 0 DATE 21/12/2019 SHEET 1 OF 17

FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE FOR NABINAGAR TPP (4X250 MW)

VOLUME: IIB

SECTION - C

SPECIFIC TECHNICAL REQUIREMNTS FOR CIVIL, STRUCTURAL & ARCHITECTURAL WORKS

Bharat Heavy Electricals Limited

Project Engineering Management
Power Sector, BHEL

	SPECFIC TECHNICAL REQUIREMENT FOR CIVIL, STRUCTURAL & ARCHITECTURAL WORKS FOR FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE FOR NABINAGAR STPP (4x250 MW)	SPECIFICATION NO. PE-TS-463-600-001 VOLUME - IIB SECTION - C REV.NO. 0 DATE 21/12/2019 SHEET 2 OF 17

CONTENTS

PART-I

GENERAL CIVIL REQUIREMENT

1. GENERAL

Two Volumes-Section C & Section D of this specification cover site survey, soil investigation, site development works, design and construction of Civil, Structural and Architectural works. The scope of works covers complete Civil, Structural and Architectural Works including supply of all materials, labour, tools and plants as required for successful execution of the packages. This Part-I of Section-C Lists Codes and Standards to be adopted and the principal structures of the plant, and briefly describes the basic concept, requirements and features pertinent to each. **If there is any ambiguity and/or contradiction between Section C and Section D, the provisions / requirements laid in Section C shall prevail. In case of ambiguity between BOQ and Part C former shall prevail**.

(Contractor shall read the parts of the specification relevant to the contract and shall ignore the other parts of the specification. Relevant clauses of this section as applicable for respective package to be followed.)

2. CODES AND STANDARDS

Following is a general listing of Codes and Standards to be used in the design of the Plant. Specific applicable codes and standards will be identified in System Design Descriptions/ Technical Specifications as appropriate. The latest editions/ revision of following codes and standards along with addendums/ amendments, if any, shall be followed:

2.1. Earthwork

a) IS-1498: Classification and identification of soils for General Engineering purposes.
b) IS-3764: Safety Code for excavation work.
c) IS-7293: Safety Code for working with construction machinery.
d) IS-4701: Code of practice for earth work on canals.
e) IS-9759: Guide lines for dewatering during construction.
f) IS-10379: Code of practice for field control of moisture and compaction of soils for embankment and sub-grade.

2.2. Concrete

a) IS-269: Ordinary and low heat Portland cement.
b) IS-383: Coarse and fine aggregate from natural sources for concrete.
c) IS-432: Mild Steel and medium tensile steel bars and hard
(Part I & II) drawn steel wire for concrete reinforcement.
d) IS-455: Portland Slag Cement.
e) IS-456: Code of Practice for Plain and reinforced concrete.
f) IS-457: Code of practice for general construction of plain and reinforced concrete for dams and other massive structures.
g) IS-460: Test Sieves (all parts).
h) IS-516: Methods of test for strength of concrete.
i) IS-1199: Methods of sampling and analysis of concrete.
j) IS-1566: Hard drawn steel wire fabric for concrete Reinforcement.
k) IS-1786: High strength deformed steel bars and wires for concrete Reinforcement.
l) IS-1791: General requirement for batch type concrete mixers.
m) IS-1834: Hot applied sealing compounds for joints in concrete.
n) IS-1838: Preformed fillers for expansion joints in concrete pavement and structures.

o) IS-2386: Methods of test for aggregates for concrete (all parts).
(Part I-VIII)
p) IS-2438: Specification for roller pan mixers.
q) IS-2502: Code of practice for bending and fixing of bars for concrete Reinforcement.
r) IS-2505: Concrete vibrators - immersion type.
s) IS-2506: General requirements for screed board concrete vibrators.
t) IS-2722: Specification for Portable Swing weigh batchers for concrete (single and double bucket type).
u) IS-2750: Steel scaffoldings.
v) IS-2751: Recommended practice for welding of mild steel plain and deformed bars for reinforced construction.
w) IS-3150: Hexagonal wire netting for general purposes.
x) IS-3366: Specification for pan vibrators.
y) IS-3370: Code of practice for concrete structures for storage of liquids (all parts).
(Part I-IV)
z) IS-3414: Code of practice for design and installation of joints in buildings.
aa) IS-3558: Code of practice for use of immersion vibrators for consolidating concrete.
bb) IS-4014: Code of practice for steel tubular scaffolding.
(Part I & II)
cc) IS-4656: Form vibrators for concrete.
dd) IS-4925: Concrete batching and mixing plant.
ee) IS-4948: Welded steel wire fabrics for general use.
ff) IS-4990: Plywood for concrete shuttering work.
gg) IS-5256: Code of practice for sealing expansion joints in concrete lining on canals.
hh) IS-6452: High Alumina Cement for Structural use.
ii) IS-6461: Glossary of terms relating to cement concrete.
jj) IS-6494: Code of practice for water proofing of underground reservoir and swimming pools.
kk) IS-6509: Code of practice for installation of joints in concrete pavements.
ll) IS-7320: Concrete slump test apparatus.
mm) IS-7861: Code of practice for extreme weather concreting.
(Part I & II)
nn) IS-8041: Rapid Hardening Portland Cement.
oo) IS-8112: High strength ordinary Portland Cement.
pp) IS-9012: Recommended practice for shotcreting.
qq) IS-9103: Admixtures for concrete.
rr) IS-9417: Recommendations for welding cold worked bars for reinforced concrete construction.
ss) IS-10262: Recommended guidelines for concrete mix design.
tt) IS-458: Specification for precast concrete pipes.
uu) IS-3935: Code of practice for composite construction.
vv) IS-4995: Criteria for design of reinforced concrete bins for storage of granular (all parts) and powdery materials.
ww) IS-5525: Recommendation for detailing of reinforced concrete works.
xx) IS-11384: Code of practice for composite construction in structural steel and concrete.
yy) IS-11682: Criteria for design of RCC staging for overhead water tanks.
zz) IS:12118: Two parts polysulphide based sealants.
aaa) IS:12200: Code of practice for provision of water stops at transverse construction joints in masonry and concrete dams.
bbb) IS:13311: Non-destructive testing of concrete - methods of test.
Part I - Ultrasonic pulse velocity.
Part II - Rebound hammer.
ccc) IS-13920: Code of practice for ductile detailing of reinforced concrete structures subjected to seismic forces.

ddd) SP-16: Design codes for reinforced concrete to IS:456-1978.
eee) SP-23: Hand book of concrete mixes.
fff) SP-24: Explanatory handbook on Indian standards code for plain and reinforced concrete. (IS: 456)
ggg) SP-34: Hand book on concrete reinforcement and detailing.
hhh) ACI-318: American Concrete Institute code for structural concrete.
iii) IS-280: Mild steel wire for general engineering purpose.
jjj) IS-10297: Code of practice for design and construction of floors and roofs using precast reinforced/prestressed concrete ribbed or cored slab units.
kkk) IS-10505: Code of practice for construction of floors and roofs using pre-cast reinforced concrete waffle units.
lll) IS-15658: Pre-cast concrete block for paving.

2.3. Foundations

a) IS-1080: Code of practice for Design and Construction of shallow foundations on soils (other than raft, ring and shell)
b) IS-1904: Code of practice for Design and Construction of foundations in soils: General Requirements
c) IS-2314: Steel sheet piling sections.
d) IS-2911: Code of practice for Design and Construction of Pile foundations (all parts).
e) IS-2950: Code of practice for design and construction of raft foundations.
f) IS-2974: Code of practice for design and construction of machine foundations.
g) IS-4091: Code of practice for Design and Construction of foundations for transmission line towers and poles
h) IS-6403: Code of practice for determination of Bearing capacity of Shallow foundations.
i) IS-8009: Code of practice for calculation of settlement of foundations: (all parts)
j) IS-9556: Code of practice for Design and Construction of diaphragm walls.
k) IS-11089: Code of practice for Design and Construction of ring foundation.
l) IS-12070: Code of practice for design and construction of shallow foundations on rocks.
m) IS-13301: Guidelines for vibration isolation for machine foundation.
n) ISO 10816: Criteria for assessing mechanical vibrations of machines.
o) ISO 1940: Criteria for assessing the st of balance of rotating rigid bodies.
p) DIN: EN13906-1: Helical compression spring made of round wire and rod: calculation and design of compression.
q) DIN: 2096 Helical compression spring out of round wire and rod: Quality requirements for hot formed compression spring.
r) DIN: 4024 Flexible supporting structures for machine with rotating machines.

2.4. Loading

a) IS-875: Code of practice for Structural safety of buildings - loading standards.
b) IS-1911: Schedule of unit weights of building materials.
c) IRC-6: Standard specifications & Code of practice for road bridges.

2.5.Masonry

a) IS-712: Building limes.
b) IS-1077: Common Burnt Clay Building Bricks.
c) IS-1127: Recommendations for dimensions and workmanship of natural building stones for masonry work.

d) IS-1528: Methods of sampling and physical tests for refractory materials.
e) IS-1597: Code of practice for construction of stone masonry (all parts).
f) IS-2212: Code of practice for brickwork.
g) IS-2116: Sand for masonry mortars
h) IS-2185: Concrete masonry units. (all parts - Hollow and Solid concrete blocks).
i) IS-2250: Code of practice for preparation and use of masonry mortars.
j) IS-2572: Code of practice for construction of hollow concrete block masonry.
k) IS-2691: Burnt clay facing bricks.
l) IS-3414: Code of practice for design and installation of joints in buildings.
m) IS-3495: Methods of tests of burnt clay building bricks.
n) IS-4441: Code of practice for use of Silicate type chemical resistant mortars.
o) IS-4860: Acid Resistant Bricks.
p) IS-1905: Code of practice for structural use of unreinforced masonry.
q) IS-10440: Code of practice for construction of reinforced brick and reinforced brick concrete floors and roofs.
r) SP-20: Hand book on masonry design and construction.
s) IS-1489: Portland-pozzolana cement.
t) IS-1542: Sand for Plaster.
u) IS-12269: 53 grade ordinary Portland cement.
v) IS-12894: Specification for fly ash lime bricks.
w) IS-13757: Burnt clay fly ash building bricks.

2.6.Doors, Windows and Ventilators

a) IS-399: Classification of commercial timbers and their zonal distribution.
b) IS-883: Code of practice for design of structural timber in building.
c) IS-1003: Timber panelled and glazed shutters (all parts).
d) IS-1038: Steel doors, windows and ventilators.
e) IS-1081: Code of practice for fixing and glazing of metal (steel and aluminium) doors, windows and ventilators.
f) IS-1361: Steel windows for industrial buildings.
g) IS-2835: Transparent sheet glass for glazing and framing purposes.
h) IS-1948: Aluminium doors windows and ventilators.
i) IS-1949: Aluminium windows for industrial building.
j) IS-2191: Wooden flush door shutters (Cellular and hollow core type).
k) IS-2202: Wooden flush door shutters (solid core type).
l) IS-3103: Code of practice for Industrial ventilation.
m) IS-3548: Code of practice for glazing in buildings.
n) IS-3614: Fire check doors.
o) IS-4021: Timber door, windows and ventilator frames.
p) IS-4351: Steel door frames.
q) IS-6248: Metal rolling shutters and rolling grills.
r) IS-208: Door Handles.
s) IS:281: Mild steel sliding door bolts for use with padlocks.
t) IS-362: Parliament Hinges.
u) IS-419: Putty, for use on window frames.
v) IS-451: Technical supply conditions for wood screws.
w) IS-733: Wrought aluminium and aluminium alloy bars, rods and sections for general engineering purposes.
x) IS-1285: Wrought aluminium and aluminium alloy extruded round tube & hollow section (for general engineering purposes).
y) IS-1341: Steel butt hinges.
z) IS-1823: Floor door stoppers.
aa) IS-1868: Anodic coatings on Aluminium and its alloys.

bb) IS-2209: Mortice locks (vertical type)
cc) IS-2553: Safety glass.
dd) IS-3564: Door closers (Hydraulically regulated).
ee) IS-5187: Flush bolts.
ff) IS-5437: Figured, rolled and wired glass.
gg) IS-6315: Specification for floor springs (Hydraulically regulated) for heavy doors.
hh) IS-7196: Hold fast.
ii) IS-7452: Hot rolled steel sections for doors, windows and ventilators.
jj) IS-10019: Mild steel stays and fasteners.
kk) IS-10451: Steel sliding shutters (top hung type)
ll) IS-12823: Prelaminated particle boards.

2.7.Roof and Flooring

a) IS-2204: Code of practice for construction of reinforced concrete shell roof.
b) IS-3201: Criteria for the design and construction of precast concrete trusses.
c) IS-2210: Criteria for Design of R.C. shell structures and folded plates.
d) IS-809: Rubber flooring materials for general purposes.
e) IS-1195: Bitumen mastic for flooring.
f) IS-1196: Code of practice for laying bitumen mastic flooring.
g) IS-1198: Code of practice for laying, fixing and maintenance of linoleum floors.
h) IS-1237: Cement concrete flooring tiles.
i) IS-1443: Code of practice for laying and finishing of cement concrete flooring tiles.
j) IS-2114: Code of practice for laying in situ terrazzo floor finish.
k) IS-2571: Code of practice for laying in situ cement concrete flooring.
l) IS-5491: Code of practice for laying in situ granolithic concrete floor topping.
m) IS-5766: Code of practice for laying burnt clay brick flooring.
n) IS-1197: Code of practice for laying of rubber floors.
o) IS-2441: Code of practice for fixing ceiling coverings.

2.8.Waterproofing

a) IS-1322: Bitumen felts for waterproofing and damp proofing.
b) IS-1346: Code of practice for waterproofing of roofs with bitumen felts.
c) IS-1609: Code of practice for laying damp proof treatment using bituminous felts.
d) IS-3036: Code of practice for laying lime concrete for a waterproofed roof finish.
e) IS-3037: Bitumen mastic for use in waterproofing of roofs.
f) IS-3067: Code of practice for general design, details and preparatory work for damp proofing and water proofing of buildings.
g) IS-3384: Bitumen primer for use in water proofing and damp proofing.
h) IS-4365: Code of practice for application of bitumen mastic for waterproofing of roofs.
i) IS-5318: Code of practice for laying of flexible PVC sheet and tile flooring.
j) IS-8042: White Portland cement.
k) IS-13755: Dust pressed ceramic tiles with water absorption of 3%, E 6% (Group B11a).
l) IS-13801: Chequered cement concrete tiles.

2.9.Soil Engineering

a) IS-1498: Classification and identification of soils for general engineering purposes.
b) IS-1892: Code of practice for sub-surface investigation for foundations.
c) IS-2131: Method for standard penetration test for soils.
d) IS-2720: Methods of test for soils (all parts).

2.10. Water Supply, Drainage and Sewerage

a) IS-404: Lead pipes
b) IS-458: Concrete pipes
c) IS-651: Salt glazed stoneware pipes and fittings.
d) IS-771: Glazed fire-clay sanitary appliances (all parts).
e) IS-774: Flushing cisterns for water closets and urinals other than plastic cisterns.
f) IS-783: Code of practice for laying of concrete pipes.
g) IS-1172: Code of basic requirements for water supply, drainage and sanitation.
h) IS-1626: Asbestos cement building pipes, gutters and fittings (all parts).
i) IS-1742: Code of practice for building drainage.
j) IS-2064: Code of practice for selection, installation and maintenance of sanitary appliances.
k) IS-2065: Code of practice for water supply in buildings.
l) IS-2470: Code of practice for installation of septic tanks (all parts).
m) IS-3114: Code of practice for laying of Cast Iron pipes.
n) IS-4127: Code of practice for laying of glazed stoneware pipes.
o) IS-12251: Code of practice for Drainage of Building Basement.
p) IS-1200: Method of measurement: Laying of water and [Part- XVI] sewer lines including appurtenant items.
q) IS-1536: Centrifugally cast (spun) iron pressure pipes for water, gas and sewage.
r) IS-1537: Vertically cast iron pressure pipe for water, gas and sewage.
s) IS-3486: Cast iron spigot and socket drain pipes.
t) IS-5329: Code of practice for sanitary pipe work above ground for buildings.
u) IS-3076: Low density polyethylene pipes for potable water supplies.
v) IS-1538: Cast iron fittings for pressure pipes for water, gas and sewage.
w) IS-1230: Cast iron rainwater pipes and fittings.
x) IS-1729: Sand cast iron spigot and socket soil, waste and ventilating pipes, fittings and accessories.
y) IS-784: Prestressed concrete pipes.
z) IS-1726: Cast iron manhole covers and frames.
aa) IS-5961: Cast iron grating for drainage purposes.
bb) IS-5219: (Part-I) "P" and "S" traps.
cc) IS-772: General requirements for enamelled cast iron sanitary appliances.
dd) IS-775: Cast iron brackets and supports for wash basins and sinks.
ee) IS-777: Glazed earthenware wall tiles.
ff) IS-2548: Plastic water closet seats and covers (all parts).
gg) IS-2527: Code of practice for fixing rainwater gutters and downpipes for roof drainage.
hh) IS-554: Pipe threads where pressure tight joints are made on the threads – dimensions, tolerances and designation.
ii) IS-778: Copper alloy gate, globe and check valves for water works purposes.
jj) IS-781: Cast copper alloy screw down bib taps & stop valves for water services.
kk) IS-782: Caulking lead.
ll) IS-1703: Copper alloy float valve for water supply fitting.
mm) IS-2326: Automatic flushing cisterns for urinals.
nn) IS-2556: Vitreous sanitary appliances (vitreous china).
oo) IS-3311: Waste plug and its accessories for sinks and wash basins.
pp) IS-3438: Silvered glass mirrors for general purposes.
qq) IS-3589: Steel pipe for water and sewage (168.3 to 2540mm outside diameter)
rr) IS-3989: Centrifugally cast (Spun) iron spigot and socket soil, waste and ventilating pipes, fittings and accessories.
ss) IS-4111: (Part I to V) Code of practice for ancillary structure in sewerage system.

tt) IS-4733: Methods of sampling and testing sewage effluents.
uu) IS-4764: Tolerance limits for sewage effluents discharged into inland surface waters.
vv) IS-1068: Electroplated coating of nickel plus chromium and copper plus nickel plus chromium.
ww) IS-5382: Rubber sealing rings for gas mains, water mains and sewer
xx) IS-5822: Code of practice for laying of electrically welded steel pipes for water supply.
yy) IS-7740: Code of practice for construction and maintenance of road gullies.
zz) IS-8931: Copper alloy fancy single taps combination tap assembly and stop valves for water services.
aaa) IS-9762: Polyethylene floats for float valves.
bbb) IS-10592: Industrial emergency showers, eye and face fountains and combination units.
ccc) IS-12592: Specification for precast concrete manhole covers and frames.
ddd) IS-12701: Rotational moulded polyethylene water storage tanks.
eee) IS-13983: Stainless steel sinks for domestic purposes.
fff) SP-35: Hand book on water supply and drainage with special emphasis on plumbing.

2.11. Paving and Road works

a) IS-73: Paving bitumen
b) IS-702: Industrial Bitumen
c) IS-1201: Method of testing tar and bituminous materials. thru' 1220
d) : Practice followed by Indian Road Congress (all parts).

2.12. Earthquake Resistant Design

a) IS-1893: Criteria for earthquake resistant design of structures.
b) IS-4326: Code of practice for earthquake resistant design and construction of buildings.

2.13. Chimney

a) IS-4998: Criteria for Design of R.C. Chimneys (all parts).
b) IS-6533: Code of practice for design and construction of steel chimneys
c) ACI-307: Specification for the design and construction of reinforced concrete chimneys
d) BS-4076: Specification for steel chimneys
e) CICIND: Model Code for concrete chimneys / Model code for steel chimneys

2.14. Cooling Tower

a) BS-4485: (Part 4) Structural design of cooling towers.

2.15. Structural Steelwork

a) IS-800: Code of practice for general construction in steel.
b) IS-802: Code of practice for use of structural steel in Overhead Transmission Line (All Parts).
c) IS-806: Code of practice for use of steel tubes in general building construction.
d) IS-808: Rolled steel beams, channels and angle sections.
e) IS-813: Scheme of symbols for welding.
f) IS-814: Covered electrodes for manual metal arc welding of carbon and carbon manganese steel.
g) IS-816: Code of practice for use of metal arc welding for general construction in mild steel.

h) IS-817: Code of practice for training and testing of metal arc welders.
i) IS-818: Code of practice for safety and health requirements in electric and gas welding and cutting operation.
j) IS-819: Code of practice for Resistance spot welding for light assemblies in Mild Steel.
k) IS-919: Recommendations for limits and fits for engineering.
l) IS-1024: Code of practice for use of welding in Bridges and Structures subjected to Dynamic loading.
m) IS-1161: Steel tubes for structural purposes.
n) IS-1182: Recommended practice for Radiographic Examination of Fusion Welded Butt joints in steel plates.
o) IS-1200: (Part-VIII) Method of measurement of steelwork and ironwork.
p) IS-1239: Mild steel tubes, tubulars and other wrought steel fittings (all parts).
q) IS-1363: Black hexagonal bolts, nuts and locknuts (Dia. 6 to 39 mm) and black hexagon screws (Dia.6 to 24 mm). [all parts]
r) IS-1364: Precision and semi-precision hexagon bolts, screws, nuts and locknuts (Dia. range 6 to 39 mm). [all parts]
s) IS-1365: Slotted counter sunk head screws (Dia. range 1.6 to 20 mm).
t) IS-1367: Technical supply conditions for threaded steel fasteners. (Part 1 to 18)
u) IS-1443: Code of practice for laying and finishing of cement concrete flooring tiles.
v) IS-1608: Method for tensile testing of steel products.
w) IS-1730: Dimensions for steel plate, sheet and strip for structural and general engineering purpose.
x) IS-1731: Dimensions for steel flats for structural and general engineering purposes.
y) IS-1852: Rolling and cutting tolerances for hot rolled steel products.
z) IS-1977: Structural steel (Ordinary quality)
aa) IS-2016: Plain Washers
bb) IS-2062: Steel for General structural purposes.
cc) IS-2074: Ready mixed paint, air drying, red oxide zinc-chrome, priming.
dd) IS-2633: Methods of testing uniformity of coating of zinc coated articles.
ee) IS-3613: Acceptance tests for wire-flux combinations for submerged-arc welding of structural steels.
ff) IS-3664: Code of practice for Ultrasonic Pulse echo testing by contact and immersions methods.
gg) IS-3757: High strength structural bolts.
hh) IS-4000: High strength bolts in steel structures.
ii) IS-4759: Hot dip zinc coatings on structural steel and other allied products.
jj) IS-5334: Code of practice for Magnetic Particle Flaw detection of welds.
kk) IS-7215: Tolerances for fabrication of steel structures.
ll) IS-7280: Base-wire electrodes for sub-merged arc welding of structural steels.
mm) IS-7318: (Part-I) Approval test for welders when welding procedure approval is not required.
nn) IS-8500: Structural steel - micro alloyed (medium and high strength qualities).
oo) IS-9595: Recommendation for metal arc welding of carbon and carbon manganese steels.
pp) AWS D.1.1 Structural Welding Code.
qq) IS-8640: Recommendations for dimensional parameters for industrial building.
rr) IS-9178: Criteria for design of steel bins for storage of bulk material (all parts).
ss) IS-12843: Tolerances for erection of steel structures.
tt) IS-1181: Qualifying tests for Metal Arc welders (engaged in welding structures other than pipes).
uu) IS-2595: Code of practice for Radiographic testing
vv) IS-2629: Hot dip galvanising of iron and steel
ww) IS-3502: Steel chequered plate.

xx) IS-3658: Code of practice for liquid penetrant flaw detection.
yy) IS-4353: Sub merged arc welding of mild steel and low alloy steel Recommendation.
zz) IS-5369: General requirements for plain washers and lock washer.
aaa) IS-6623: High strength structural nuts.
bbb) IS-6649: Hardened and tampered washers for high strength structural bolts & nuts.
ccc) IS-6911: Stainless steel plate, sheet and strip.
ddd) IS-7205: Safety code for erection of structural steel.
eee) IS-7307: Approved test for welding procedures
(Part I) Fusion welding of Steel
fff) IS-7310: Approval test for welders working to approval welding procedure.
(Part I) Fusion welding of Steel
ggg) SP-6: IS Handbook for structural engineers.

2.16. Painting

a) IS-348: Specification for French Polish.
b) IS-427: Specification for Distemper, dry colour as required.
c) IS-428: Specification for Distemper, oil emulsion, colour as required.
d) IS-1477: Code of practice for painting of ferrous metal in buildings.
(Part I & II)
e) IS-2338: Code of practice for finishing of wood and wood based materials.
(Part I & II)
f) IS-2339: Specification for Aluminium Paints for general purposes in dual containers.
g) IS-2395: Code of practice for painting concrete, masonry and plaster surface.
h) IS-2932: Specification for enamel, synthetic, exterior - a) undercoating, b) finishing.
i) IS-2933: Specification for enamel, exterior - a) undercoating, b) finishing.
j) IS-5410: Specification for cement paint.
k) IS-162: Ready mixed paint, brushing fire resisting, silicate type for use on wood, colour as required.
l) IS-1650: Specification for colours for building and decorative materials.
m) IS-2395: Code of practice for painting concrete, masonry and plaster surfaces.
(Part I) Operations and Workmanship.
(Part II) Schedule.
n) IS-2524: Code of practice for painting of nonferrous metals in buildings.
(Part I) Pre-treatment.
(Part II) Painting.
o) IS-15489: Plastic emulsion paint.
p) IS-6278: Code of practice for white washing and Colour washing.
q) IS-10403: Glossary of term related to building finish.
r) IS-12027: Silicone based water repellent.
s) IS-13238: Epoxy based zinc phosphate primer (2 pack).
t) IS-13239: Epoxy surface (2 pack).
u) IS-13467: Chlorinated rubber for paints
v) IS-14209: Epoxy enamel, two component glossy.
w) BS-5493: Code of practice for protective coating of iron and steel structures against corrosion.

2.17. Sheeting

a) IS-277: Galvanised steel sheets (Plan & corrugated).
b) IS-513: Cold-rolled low carbon steel sheets & strips.
c) IS-730: Hook bolts for corrugated sheet roofing.
d) IS-801: Code of practice for use of cold formed light gauge steel structural members in general building construction.

e) IS-7178: Technical supply condition for tapping screw.
f) IS-8183: Bonded mineral wool.
g) IS-8869: Washers for corrugated sheet roofing.
h) IS-12093: Code of practice for laying and fixing of sloped roof covering using plain and corrugated galvanized steel sheets.
i) IS-12436: Preformed rigid Polyurethane (PUR) and Polyisocyanurate (PIR) foams for thermal insulation.
j) IS-12866: Plastic translucent sheets made from thermosetting polyester resin (glass fiber reinforced).
k) IS-14246: Continuously pre-painted galvanized steel sheets and coils.
l) BS-5950: (Part VI) Code of practice for design of light gauge profiled steel sheeting

2.18. Plastering

a) IS-1661: Code of practice for application of cement and cement lime plaster finishes.
b) IS-2402: Code of practice for external rendered finishes.
c) IS-2547: Gypsum building plaster.

2.19. Acid / Alkali Resistant Tiling

a) IS-158: Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali & heat resisting.
b) IS-412: Expanded metal steel sheets for general purpose.
c) IS-4443: Code of practice for use of resin type chemical resistant mortars.
d) IS-4456: (Part I & II) Method of Test for chemical resistant tiles.
e) IS-4457: Ceramic unglazed vitreous acid resisting tiles.
f) IS-4832: Specification for chemical resistant mortars.
(Part I) Silicon Type
(Part II) Resin Type
(Part III) Sulphur Type
g) IS-9510: Bitumastic acid resisting grade.

2.20. Safety

a) IS-1641: Code of practice for fire safety of buildings - General principles of fire grading and classification.
b) IS-1642: Code of practice for fire safety of buildings - Details of construction.
c) IS-3696: (Part I & II) Safety code for scaffolds and ladders.
d) IS-4081: Safety code for blasting and related drilling operations.
e) IS-4130: Demolition of buildings - code of safety.
f) IS-5121: Safety code for piling and other deep foundations.
g) IS-5916: Safety code for construction involving use of hot bituminous materials.
h) IS-7205: Safety code for erection of structural steel work.
i) IS-7969: Safety code for handling and storage of building materials.

2.21. Architectural Design of Buildings

a) SP-7: National Building Code of India.
b) SP-41: Hand book on functional requirements of buildings (other than industrial buildings).
c) ECBC: Energy Conservation Building Code
d) GRIHA: Green Rating for Integrated Habitat Assessment.

2.22. Other

a) Indian Road Congress (IRC) Bridge Codes
b) Indian Railway Standard Bridge Rules

3. GENERAL

All the quality standards, tolerances, welding standards and other technical requirements shall be strictly adhered to. The Bidder shall fully apprise himself of the prevailing conditions at the proposed site, climatic conditions including monsoon pattern, soil conditions, local conditions and site specific parameters and shall include for all such conditions and contingent measures in the bid, including those which may not have been specifically brought out in the specifications. In case of any conflict between stipulations in various portions of the specification, most stringent stipulation would be applicable for implementation by the Bidder without any extra cost to the Employer.

4. LAYOUT

Before starting the work, the Contractor shall carry out the setting out of foundation and structures and provide levels, with reference to general existing grid and bench mark. **If the Contractor uses the grid, bench mark and reference pillar made by other Contractors, he shall coordinate with the Contractor and shall satisfy himself of the accuracy of the reference marks.** If he is required to set out the foundation afresh, he shall do so independently with reference to the one existing grid and bench
mark which has been followed by other agency at the instruction of the Engineer. In case any discrepancy is found, it shall be immediately brought to the notice of the Engineer for any rectification/modification necessary. No complaint shall be entertained at a later stage. The Contractor shall accurately set out the position for holding down bolts and inserts.

If required, in the opinion of the Engineer, he shall construct and maintain pillars for grid, references and bench marks and maintain them till the completion of the construction. He shall also help the Engineer with instruments, materials and labours for checking the detailed layouts and levels. The Contractor shall be solely responsible for the correctness of the layout and levels, and Engineer's approval shall not be deemed to imply any warranty in carrying out the works correctly. The Tenderer’s shall take into account the cost of these in quoting their price.

5. WORKMANSHIP

Workmanship shall be of the best possible quality and all work shall be carried out by skilled workmen except for those which normally require unskilled persons. Welding shall be done by experienced and certified welders in proper sequence using necessary jigs and fixtures. Fabrication shall be done in shops having proper equipment for accurate edge and shaping and dimensioning of anchor bolt assembly, inserts and other misc. items. In addition to the requirement specified above, if the bye laws of the local Govt., Municipal or other authorities require the employment of licensed or registered workmen for various trades, the Contractor shall arrange to have the work done by such registered or

licensed personnel. In case of manufactured materials, the Contractor shall have, with no additional cost to the Owner, the services of the supervisors of the manufacturers to ensure that the work is being done according to the manufacturer's specifications.

6. TEMPORARY WORK

All scaffoldings, staging, temporary bracing and other necessary temporary work required for proper execution of the Contract shall be provided by the Contractor at his own cost and inclusive of all materials, labour, supervision and other facilities.

The layout and details of such Temporary work shall have the prior approval of the Engineer, but the Contractor shall be responsible for proper strength and safety of the same. All Temporary work shall be so constructed as not to interfere with any permanent work or with the work by other agencies. If it is necessary to remove any of the temporary work at any time to facilitate execution of the work or with the work of other agencies, such removal and re erection, if required, shall be carried out by the Contractor at the direction of the Engineer without any delay and any extra cost on this account shall be borne by the Contractor.

7. INTERFACE WITH STRUCTURES UNDER OTHER'S SCOPE

Modification in layout of foundation/structure during detail engineering stage may be necessary to avoid fouling with those under other's scope. Necessary changes on this account will be made without any extra cost to Owner.

8. SEQUENCE OF WORK AND PROGRESS REPORT

The sequence in which the works are to be carried out shall be as approved by the Engineer in accordance with the construction method accepted by the Engineer and to be followed by the Contractor. A programme of work is to be submitted for the Engineer's review and approval and this has to be periodically updated and modified as per actual progress to enable timely completion.

The Contractor shall regularly submit to the Engineer progress reports for periods of working as specified by the Engineer showing up to date progress on all important items of work.

9. CONSTRUCTION METHODOLOGY

Construction and erection activities shall be fully mechanized from the start of the work. All excavation and backfilling work shall be done using excavators, loaders, dumpers, dozers, porcelains, excavator mounted rock breakers, rollers, sprinklers, water tankers, etc. Manual excavation can be done only on isolated places with specific approval of engineer.

Dewatering shall be done using the combination of electrical and standby diesel pumps.

For concreting, weigh batching plants, transit mixers, concrete pumps, hoists, etc. shall be used.

All handling of materials shall be with cranes.

Heavy trailers shall be used for transportation.

Mechanized modular units of scaffolding and shuttering shall be used.

Grouting shall be carried out using hydraulically controlled grouting equipment.

All finishing items shall be installed using appropriate modern mechanical tools. Manual punching etc. shall not be permitted.

Heavy duty hoists for lifting of construction materials shall be deployed.

Compressors for cleaning of foundations and other surfaces shall be used.

Field laboratory shall be provided with all modern equipment for survey, testing of soil, aggregates, concrete, welding, etc.

All persons working at site shall be provided with necessary safety equipment and all safety aspects shall be duly considered for each construction/ erection activity. Moreover, only the persons who are trained in the respective trade shall be employed for executing that particular work.

PART-II

SPECFIC TECHNICAL REQUIREMNT

NTPC Limited

(A Government of India Enterprise)

NABINAGAR THERMAL POWER PROJECT (4x250MW)

PART - A

TECHNICAL SPECIFICATIONS

SECTION – VI

FOR

FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE

LOT-IA PROJECTS

SECTION - VI

TECHNICAL SPECIFICATION
FOR
FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE

THE TECHNICAL SPECIFICATION, SECTION - VI COMPRISE OF THE FOLLOWING PARTS

PART – A

SUB-SECTION-II-E8	ELECTRIC ACTUATORS WITH INTEGRAL STARTERS
SUB-SECTION-II-E9	HT SWTIGCHGEAR
SUB-SECTION-II-E10	LT SWTIGCHGEAR & LT BUSDUCT
SUB-SECTION-II-E11	DIESEL GENERATORS
SUB-SECTION-II-E12	OUTDOOR TRANSFORMERS
SUB-SECTION-II-E13	ELEVATOR ELECTRICAL
SUB-SECTION-II-E14	FIRE PROOF CABLE PENETRATION SEALING SYSTEM
SUB-SECTION-II-E15	LIGHTING
SUB-SECTION-II-E16	BATTERY
SUB-SECTION-II-E17	BATTERY CHARGER

PART – B (DETAILED TECHNICAL SPECIFICATION)

SUB-SECTION-III-C (CONTROL & INSTRUMENTATION SYSTEM)

SUB-SECTION-III-C1	BASIC DESIGN CRITERIA
SUB-SECTION-III-C2	MEASURING INSTRUMENTS (PRIMARY AND SECONDARY)
SUB-SECTION-III-C3	PROCESS CONNECTION AND PIPING
SUB-SECTION-III-C4	INSTRUMENTATION CABLES
SUB-SECTION-III-C5	PLC BASED CONTROL SYSTEM
SUB-SECTION-III-C6	TYPE TEST REQUIREMENTS
SUB-SECTION-III-C7	CONTROL VALVES, ACTUATORS & ACCESSORIES

PART – B (DETAILED TECHNICAL SPECIFICATION)

SUB-SECTION-IV-D (CIVIL WORKS)

SUB-SECTION-IV-D	CIVIL WORKS

PART – B (DETAILED TECHNICAL SPECIFICATION)

SUB-SECTION- V-Q (QUALITY ASSURANCE)

(MECHANICAL)

SUB-SECTION-V-QM1	FLUE GAS DESULPHURISATION SYSTEM
SUB-SECTION-V-QM2	LIME & GYPSUM HANDLING
SUB-SECTION-V-QM3	EQUIPMENT COOLING WATER SYSTEM
SUB-SECTION-V-QM4	AIR CONDITIONING & VENTILATION
SUB-SECTION-V-QM5	ZERO LIQUID DISCHARGE SYSTEM
SUB-SECTION-V-QM6	COMPRESSOR AIR SYSTEM

(ELECTRICAL)

SUB-SECTION-V-QE1	MOTORS
SUB-SECTION-V-QE2	MEDIUM VOLTAGE BUS DUCTS
SUB-SECTION-V-QE3	LT POWER CABLES
SUB-SECTION-V-QE4	CONTROL CABLES
SUB-SECTION-V-QE5	CABLING EARTHING & LIGHTNING PROTECTION
SUB-SECTION-V-QE6	HT CABLES
SUB-SECTION-V-QE7	ELECTRIC ACTUATORS WITH INTEGRAL STARTERS
SUB-SECTION-V-QE8	HT SWTIGCHGEAR
SUB-SECTION-V-QE9	LT SWTIGCHGEAR
SUB-SECTION-V-QE10	DIESEL GENERATORS
SUB-SECTION-V-QE11	AUXILIARY TRANSFORMERS
SUB-SECTION-V-QE12	ELEVATOR
SUB-SECTION-V-QE13	VFD MODULE
SUB-SECTION-V-QE14	STATION LIGHTING

(CONTROL & INSTRUMENTATION SYSTEM)

SUB-SECTION-V-QC1	MEASURING INSTRUMENTS (PRIMARY & SECONDARY
SUB-SECTION-V-QC2	PROCESS CONNECTION & PIPING
SUB-SECTION-V-QC3	INSTRUMENTATION CABLES
SUB-SECTION-V-QC4	CONTROL DESK PLC PANEL SMOKE DETECTOR FIRE ALARM & CONTROL SYSTEM
SUB-SECTION-V-QC5	POWER SUPPLY SYSTEM
SUB-SECTION-V-QC6	CONTROL VALVE ACTUATORS AND ACCESSORIES
SUB-SECTION-V-QC7	ELECTRICAL ACTUATOR WITH INTEGRAL STARTERS

(CIVIL WORKS)

SUB-SECTION-V-QD1

SUB-SECTION- VI

(PRE-COMMISSIONING ACTIVITIES, COMMISSIONING OF FACILITIES AND INITIAL OPERATIONS)

PART - C

GENERAL CONDITIONS OF CONTRACT

PART - D

ERECTION CONDITIONS OF CONTRACTS

PART - E

LIST OF TENDER DRAWINGS

PART - F

ATTACHMENT-12 TO SECTION-VII (TECHNICAL DATA SHEETS)

PART – A

SUB-SECTION-I

INTENT OF SPECIFICATION

CLAUSE NO.	INTENT OF SPECIFICATION

1.00.00 **INTENT OF SPECIFICATION**

1.01.00 **Scope of the proposal**

The scope of the proposal for Engineering, Supply, Construction, Erection, Testing & Commissioning works for each project of Flue Gas Desulphurisation (FGD) System Package for Lot 1A Projects shall be on the basis of a single point responsibility, completely covering the following activities and services in respect of all the equipment specified and covered under the specifications and read in conjunction with "Scope of Supply & Services", Sub-section-III, Part-A, Section – VI of Technical Specification.

a) Basic Engineering of the plant including preparation of Plant Definition Manuals for the Project;

b) Detailed design of all the equipment and system(s) including civil, structure steel works included in bidder's scope for the Project.

c) Providing engineering drawings, equipment sizing & performance data, instruction manuals, as built drawings and other information;

d) Compliance with statutory requirements and obtaining clearances from statutory authorities, wherever required;

e) Complete manufacturing including shop testing/type testing;

f) Complete Civil, Structural and Architectural works, including survey, providing construction offices, field laboratory and construction equipments;

g) Packing and transportation from the manufacturer's works to the site including customs clearance & port clearance, port charges, if any.

h) Receipt, storage, preservation, handling and conservation of equipment at the site;

i) Fabrication, pre-assembly, if any, erection, testing, commissioning and completion of facilities including putting into satisfactory operation all the equipment including successful completion of initial operation;

j) Reliability tests, performance and guarantee tests after successful completion of facilities;

k) Furnishing of spares on FOR site basis;

l) Reconciliation with customs authorities, as required.

CLAUSE NO.	INTENT OF SPECIFICATION
	m) Satisfactory conclusion of the contract. n) Insurance and other requirements for the complete FGD package in accordance with the provisions of general conditions of contract (Section-IV) of the bidding document.
1.02.00	The requirements, conditions, appendices etc. given in Technical Specifications (Section-VI, Parts A, B, C, D, E & F and shall apply to and shall be considered as a part of this volume as completely as if bound here with. The work to be carried out as per the above scope shall be all in accordance with the requirements, conditions, appendices, etc., stated in Section GCC, which shall be considered as a part of the Technical Specification (Section VI) as completely as if bound herewith. The Contractor shall be responsible for providing all material, equipment and service, which are required to fulfill the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. It is not the intent to specify completely herein, all aspects of design and construction of equipment, nevertheless, the equipment shall conform in all aspects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation, in a manner acceptable to the Employer, who will interpret the meaning of the specification, drawings and shall have a right to reject or accept any work or material which in his assessment is not complete to meet the requirements of this specification and/or applicable international standards mentioned elsewhere in the specification. Bidders are requested to carefully examine and understand the specifications and seek clarifications, if required, to ensure that they have understood the specification. Before, submitting their offer, Bidder is required to visit the Project site for assessing the feasibility & layout for FGD System. The Bidder's offer should not carry any sections like clarifications, interpretations and/or assumptions. In the event of conflict between the Technical Specifications and the Conditions of Contract, the requirements as indicated in the technical specification shall govern, unless confirmed otherwise by the Employer in writing before the award of this contract, based on a written request from the Bidder for such a clarification. However, if the Bidder feels that, in his opinion, certain features brought out in his offer are superior to what has been specified, these may be highlighted separately. The Bidder may also make alternate offers provided, such offers are superior in his opinion, to the requirements of these specifications in which case, adequate technical information, operating feed back, etc., are to be enclosed with the offer, to enable the Employer to assess the superiority and reliability of the alternatives offered. In case of each alternative offer, its implications on the performance, guaranteed efficiency, auxiliary power consumption etc., shall be clearly brought out for the Employer to make an overall assessment. In any case, the base offer shall necessarily be in line with the specifications. Under no circumstances the specified equipment and services shall be brought out as an alternative offer.

CLAUSE NO.	INTENT OF SPECIFICATION
	In case, all the above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.
1.03.00	**The following are the equipment's covered in this specification:**
1.03.01	Wet limestone based Flue gas desulphurization (FGD) for the project, capable of reducing to the specified limits the emissions of Sulphur Dioxide in flue gas produced by specified coal being fired in boiler, complete with all accessories and auxiliary equipment's as per specification requirements including Booster Fans for each unit, Absorber for each unit with Slurry re-circulation pumps & Oxidation blowers, common Limestone Grinding & slurry preparation system, common Gypsum dewatering system, Limestone handling and storage system, Gypsum handling and storage system.
1.03.02	~~One (1) number of elevator for each absorber and One (1) numbers of elevator for Limestone Grinding System building~~.
1.03.03	Buildings for Slurry re-circulation pumps/Oxidation blowers, Limestone Grinding System, Gypsum dewatering system & FGD control Room.
1.03.04	~~All motors, HT & LT Switchgears, DC System, Transformers, Electrical Actuators,~~ HT & LT power & control cables, DG set (if applicable), ~~cabling, lighting etc~~.
1.03.05	~~ZERO LIQUID DISCHARGE (ZLD) SYSTEM for FGD waste water for Barh-I (3X660 MW) & Nabinagar (4x250 MW)~~.
1.03.06	Low Height Wet Chimney(s) for the project.
1.03.07	~~Associated Control & Instrumentation (C&I) equipments~~.
1.03.08	Associated Civil, Structural and Architectural works including foundation as specified in Technical Specification.
1.04.00	Wherever a material or article is specified or described by the name of a particular brand, manufacturer or vendor, the specific items mentioned shall be understood to be descriptive only and not restrictive. Such description indicates the equipment type, function and quality desired. Other manufacturer's products may be considered provided sufficient information so as to enable the Employer to determine that the products proposed are equivalent to those named.
2.00.00	**Additional Requirements**
	(a) Before submitting his bid, the Bidder should inspect and examine the site and its surroundings and should satisfy himself as to the nature of the ground and subsoil, the quantities and nature of work, materials necessary for completion of the work and their availability, means of access to site and in general shall himself obtain all necessary information as to risks, contingencies and other

circumstances which may influence or affect his offer. No consequent extra claims on any misunderstanding or otherwise shall be allowed by the Employer.

(b) Bidder shall take all necessary precautions to protect all the existing equipment, structures, facilities and buildings etc. from damage. In case any damage occurs due to the activities of the contractor on account of negligence, ignorance, accidental or any other reason whatsoever, the damage shall be immediately made good by the contractor at his own cost to the satisfaction of the Employer. The contractor shall also take all necessary safety measures with specific reference to excavation in rock, at his own cost, to avoid any harm or injury to his workers and staff from the equipment and facilities of the power plant.

(c) For his site office and covered store buildings, the contractor shall adopt pre-engineered / pre-fabricated constructions made of steel with single / double skin, insulated or uninsulated roof and wall coverings (fabricated out of permanently color coated metal sheets). Alternatively, contractor can adopt readymade 'Porta cabin' or similar construction. Contractor shall ensure that all such constructions are well engineered, neatly constructed and overall present a pleasing look.

(d) In line with Gazette Notification on Ash Utilization issued by MOEF and its amendment thereafter, contractor shall use ash and ash based products in works as specified in these specifications, drawings and as per instructions of the Engineer. He shall also use ash and ash based products in construction of his offices, stores, staff quarters and labour huts etc. He shall furnish a compliance report along with all details of use of ash and ash based products along with each bill.

(e) Contractor shall establish/set up at site suitable repair facilities for construction plant, equipment and machinery (like piling rigs, cranes batching plant, dewatering pumps etc.) In case of piling rigs, cranes, batching plant etc. he will also make arrangements / tie up with equipment manufacturers / suppliers for periodic overhaul/maintenance and for major breakdown, if any. He shall also keep adequate stock of spares at site for various plant, equipment and machinery to meet day to day requirements as recommended by the equipment manufacturer/suppliers or as instructed by the Engineer. Contractor shall deploy dedicated qualified, full time mechanical/electrical foreman/supervisors for manning the repair facilities as specified above.

3.00.00 APPLICABLE DRAWINGS

The drawings listed below and forming part of the specification (Refer Part-E) shall supplement the requirements specified herein. The scope and terminal points of the equipment to be furnished under this steam generator package shall be as identified in these drawings and read in conjunction with text of the specification:

CLAUSE NO.	INTENT OF SPECIFICATION

(A) SCHEMES

Sl. No	Drawings Title	Drawings No.	Rev. No.	No. of Sheets
1)	Scheme of Absorber system	0011-109-POM-A-001	A	2
2)	Scheme of Limestone Milling system	0011-109-POM-A-002	A	1
3)	Scheme of Gypsum De-watering system	0011-109-POM-A-003	A	1
4)	P&ID Diagram for ECW System of FGD	0011-109-POM-A-004	A	1
5)	Process Flow Diagram for FGD Waste water treatment (FGD WWT) for ZLD	0011-109-POM-A-005	A	3

(B) CONTROL & INSTRUMENTATION

Sl. No.	Drawings Title	Drawings No.	No. of Sheets
1.	Standard configuration diagram for PLC	0000-151-POI-A-013	1
2.	G.A. of Junction Box	0000-999-POI-A-017	1
3.	Instrumentation cabling diagram grounding scheme for cabinets/panels/Power Supply	0000-999-POI-A-019A	2
4.	Scheme of 24V DC Power supply system	0000-999-POI-A-019B	1
5.	Scheme for Uninterruptible Power Supply System	0000-999-POI-A-019C	1
6.	Instrumentation/control/power supply cabling diagram	0000-101/102-POI-A-021	3
7.	Instrument Source Connection details	0000-999-POI-A-035	14
8.	Typical GA of Local Instrument	0000-999-POI-A-036	1

CLAUSE NO.	INTENT OF SPECIFICATION

Sl. No.	Drawings Title	Drawings No.	No. of Sheets
	Enclosure, purging scheme, DP transmitter		
9.	Interfacing of actuators	0000-999-POI-A-063	1
10.	Interfacing of field instruments/Electrical interface/PLC Interface	0000-999-POI-A-065	15

(C) ELECTRICAL

(1) Electrical single line diagram for FGD Package : Drg No. 0011-109-POE-J-001/A-E

Note : All the above drawings are indicative of Employer's requirements to enable the Bidder to make a suitable offer. All variations/alternations shall be clearly brought out in the technical deviation schedule with implications, if any. Such variations may be acceptable, after assessment of its implication and shall be subjected to the Employer's approval. However, the flexibility of operation and maintenance desired by the schemes and layouts shall be binding.

Electrical drawings (except Electrical single line diagram) are attached with respective Electrical Chapters in Part b, Section VI.

4.00.00 QUALIFYING REQUIREMENTS FOR EQUIPMENTS/SYSTEMS

4.01.00 **Provenness criteria for critical equipment, auxiliaries, systems and bought out items:**

The Bidder / Bidder's sub-vendor(s) is required to meet the provenness criteria and/or qualification requirement for critical equipment, auxiliaries, system and bought out items as per criteria stipulated below:

4.01.01 Booster Fans, Slurry Recirculation Pumps, Oxidation Blowers, Wet Limestone Grinding Mills, Slurry Pumps, Agitators & Vacuum Belt Filters for the Wet Limestone based Flue Gas Desulphurisation (FGD) System offered by the Bidder shall be only from such manufacturer(s) who has previously designed (either by itself or under collaboration / licensing agreement), manufactured / got manufactured the respective equipment(s) of the type, application and minimum equipment rating as stipulated below such that the respective equipment(s) should have been in successful operation in at least one (1) plant for a period not less than one(1) year reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder:

CLAUSE NO.	INTENT OF SPECIFICATION

Type and Rating for Qualification

Sl. No.	Name of Equipment	Type of Equipment	Application	Equipment Rating
(a)	Booster Fans	Axial type with variable pitch control	Coal fired power plant	80% of the flow & 100% of the head of the offered Booster Fan with Fan Speed 900 rpm (maximum)
(b)	Slurry Recirculation Pumps	Centrifugal type	Wet Limestone based FGD application in Coal fired power plant	80% of the flow & 100% of the head of the offered Slurry Recirculation Pump
(c)	Oxidation Blowers	Centrifugal/ positive displacement type blower	Wet Limestone based FGD application in Coal fired power plant	80% of the flow & 100% of the head of the offered Oxidation Blower
(d)	Wet limestone Grinding mills	Horizontal Wet Ball mill	Wet Limestone based FGD application in Coal fired power plant	80% of the offered Ball mill capacity with pulverizing fineness not less than 90% thru 325 mesh
(e)	Slurry Pumps	Centrifugal type	Wet Limestone based FGD application or ash slurry application in Coal fired power plant	80% of the flow & 100% of the head of the offered Slurry Pump(s)
(f)	Agitators	Vertical/Horizontal	Wet Limestone based FGD application in Coal fired power plant	Agitator rating not less than that supplied for 500 MW or higher size unit for similar application
(g)	Vacuum Belt filters	Belt type	Wet Limestone based FGD application in Coal fired power plant	80% of the offered Vacuum Belt filter capacity

CLAUSE NO.	INTENT OF SPECIFICATION
	Bidder shall offer and supply only the type of the above equipment(s) for which he himself or the manufacturer proposed by the bidder for the above equipment(s) is qualified. The provenness criteria for equipment (Booster Fans) stipulated at Sl. No. 4.01.01 (a) above shall also be considered acceptable provided the rating parameters (i.e., flow, head and rated rpm) is covered within the operating regime of the respective fan performance curve of the reference plant equipment.
4.01.02	In case the Bidder or the proposed sub-vendor is not manufacturer of proven Booster Fans as per clause 4.01.01 (a) above but is a manufacturer of such equipment for units of at least 500 MW rating, the Bidder or the proposed sub vendor can manufacture such equipment for 660 MW units also, provided it has collaboration or valid licensing agreement for design, engineering, manufacturing, supply of such equipment in India with such manufacturer who meet the requirements stipulated at clause 4.01.01 (a) above for the Booster Fans.
4.01.03	A JV / Subsidiary Company formed for manufacturing and supply of equipment(s) as listed at clause no. 4.01.01 above in India, can also manufacture such equipment(s), provided that it has a valid collaboration or licensing agreement for design, engineering, manufacturing of such equipment(s) in India with a qualified equipment manufacturer who meets the requirements stipulated at clause 4.01.01 above (or the technology provider of the qualified equipment manufacturer) for the respective equipment(s). Before taking up the manufacturing of such equipment(s), the bidder/ his sub-vendor(s) must create /have created manufacturing facilities at his works as per collaborator's/licenser's design, manufacturing and quality control system for such equipment(s). Further, in such a case, such qualified equipment manufacturers should have, directly or indirectly through its holding company/ subsidiary company, at least 26% equity participation in the Indian Joint Venture Company/ Subsidiary Company, which shall be maintained for a lock-in period of seven (7) years from the date of incorporation of such Joint Venture/ Subsidiary or upto the end of defect liability period of the contract, whichever is later.
4.01.04	In case the Bidder or the proposed sub-vendor is not manufacturer of proven Oxidation Blowers as per clause 4.01.01 (c) above but is a manufacturer of Blowers/compressors for minimum 50 NM^3/min capacity, the Bidder or the proposed sub-vendor can also manufacture Oxidation Blowers, provided it has collaboration or valid licensing agreement for design, engineering, manufacturing, supply of such Oxidation Blowers in India with such manufacturer who meet the requirements stipulated at clause 4.01.01 (c) above for the Oxidation Blowers. Before taking up the manufacturing of such equipment, the bidder/ his sub-vendor must create /have created manufacturing facilities at his works as per collaborator's /licenser's design, manufacturing and quality control system for such equipments.
4.01.05	**(i)** In case the Bidder or the proposed sub-vendor is not manufacturer of proven Wet limestone Grinding mills as per clause 4.01.01 (d) above but is a manufacturer

CLAUSE NO.	INTENT OF SPECIFICATION
	of dry Grinding mills for power or cement industry of minimum 20 T/h capacity, the Bidder or the proposed sub-vendor can also manufacture Wet limestone Grinding mills, provided it has collaboration or valid licensing agreement for design, engineering, manufacturing, supply of such Wet limestone Grinding mills in India with such manufacturer who meet the requirements stipulated at clause 4.01.01 (d) above for the Wet limestone Grinding mills. Before taking up the manufacturing of such equipment, the bidder/ his sub-vendor must create /have created manufacturing facilities at his works as per collaborator's /licenser's design, manufacturing and quality control system for such equipments. In addition, the Bidder along with the qualified equipment manufacturer shall furnish DJU in which executant of the DJU shall be jointly and severally liable for the successful performance of the equipment as per the format enclosed in the bidding document. The DJU shall be submitted prior to the placement of order on the approved sub-vendor for Wet limestone Grinding mills. In case of award, each executant of the DJU except the Bidder shall be required to furnish an on demand bank guarantee for INR 10 Million (Indian Rupees Ten Million only) for each project. **OR** **(ii)** In case, the bidder or proposed sub vendor is not a manufacturer of proven Wet Limestone Grinding Mills as per clause 4.01.01 (d) above, but have designed, manufactured & supplied dry Grinding Ball Tube mills for at least 500 MW pulverized coal fired power plant, the Bidder or the proposed sub-vendor can also manufacture Wet limestone Grinding Mills provided it has a licensing agreement with a Wet limestone Grinding mills manufacturer who meet the requirements stipulated at clause 4.01.01 (d) above for the Wet limestone Grinding mills and provides extended warranty of three (3) years for the Wet Limestone Grinding Mills. In such a case Bidder shall provide an additional on demand bank guarantee for INR 10 Million (Indian Rupees Ten Million only) for each project.
4.01.06	In case the Bidder or the proposed sub-vendor is not manufacturer of proven Agitators as per clause 4.01.01 (f) above but is a manufacturer of Agitators for similar process/duty application in petrochemical or metals and mining industry, the Bidder or the proposed sub-vendor can also manufacture Agitators, provided it has collaboration or valid licensing agreement for design, engineering, manufacturing, supply of such Agitators in India with such manufacturer who meet the requirements stipulated at clause 4.01.01 (f) above for the Agitators. Before taking up the manufacturing of such equipment, the bidder/ his sub-vendor must create /have created manufacturing facilities at his works as per collaborator's /licenser's design, manufacturing and quality control system for such equipments.
4.01.07	In case the Bidder or the proposed sub-vendor is a manufacturer of Slurry Pumps who meets the requirements stipulated at clause 4.01.01 (e) above, the Bidder or the proposed sub-vendor can also manufacture Slurry Recirculation Pumps,

CLAUSE NO.	INTENT OF SPECIFICATION
	provided it has collaboration or valid licensing agreement for design, engineering, manufacturing, supply of such equipment in India with such manufacturer who meet the requirements stipulated at clause 4.01.01 (e) above for the Slurry Recirculation Pumps. **Before** taking up the manufacturing of such equipment, the bidder/ his sub-vendor must create /have created manufacturing facilities at his works as per collaborator's /licenser's design, manufacturing and quality control system for such equipment.
4.01.08	Before taking up the manufacturing of such equipment(s) as per clause 4.01.02, 4.01.03, 4.01.04, 4.01.05(i), 4.01.06 & 4.01.07 above, the Bidder / its sub vendor(s) must create (or should have created) manufacturing and testing facilities at its works as per Collaborator / licenser's design, manufacturing and quality control system for such equipments duly certified by the Collaborator / licensor. Further, the Collaborator / Licenser shall provide (or should have provided) all design, design calculation, manufacturing drawings and must provide (or should have provided) technical and quality surveillance assistance and supervision during manufacturing, erection, testing, commissioning of equipments.
4.01.09	Bidder shall offer and supply only the type of the above equipment(s) for which it, itself or the manufacturer / Collaborator(s) / Licenser(s) proposed by the Bidder for the above equipment(s) is qualified.
4.01.10	The Employer reserves the right to fully satisfy himself regarding capability and capacity of Bidder / its sub-vendor(s) and the proposed arrangement and may prescribe additional requirement before allowing manufacture of the equipment listed above for this contract.
	Note to clause 4.01.01 (1) Whenever the term 'coal fired' is appearing above, "Coal" shall be deemed to also include bituminous coal/brown coal/Anthracite Coal/lignite.
4.02.00	**Sub QR for Civil Works:**
4.02.01	Bidder or its agency should have in past executed civil and structural works for 500 MW or higher capacity coal based/Lignite based power plant including earthwork in filling involving mechanical compaction and cutting in hard rock, foundations, Bulk material handling plant involving underground storage hopper and underground tunnels.
4.02.02	Bidder can engage more than one agency, in case the Bidder itself is not able to meet the requirement at 4.02.01. The agency being engaged for a particular work should have in the past executed such works of 500 MW or higher capacity plant.

CLAUSE NO.	INTENT OF SPECIFICATION
4.02.03	For Chimney, Bidder or its agency should have in the past built at least one (1) reinforced concrete chimney of minimum 100m height.
4.02.04	In case Bidder or its agency do not meet the requirements at 4.02.01and the Bidder proposes to engage agency (ies) for civil & structural works on work volume basis (except for Chimney), Bidder or its agency (ies) should have executed such works in the past and the annual rate of execution in the reference works should not be less than eighty percent (80%) of the asking rate of such works, (structural steel fabrication & erection, RCC, earthwork in filling involving mechanical compaction and cutting in hard rock, RCC in underground storage hopper and underground tunnels) for which it is being engaged. Successful Bidder shall finalize the agency (ies) for each work in consultation with Engineer-in-charge at site before engaging them. **Design agency for Civil & Steel Structural Works:**
4.02.05	Bidder or its agency (ies) should have carried out the design and detailed engineering of following works: (i) Civil & Structural works associated with at least one bulk material handling plant for 500 MW or higher capacity coal based/Lignite based power plant. (ii) For Chimney, Bidder or its design agency (ies) should have carried out design & detailed engineering of at least one reinforced concrete chimney with steel flues, of minimum 100m height. (iii) Machine foundations such as Mill foundations/ Block foundations.
4.02.06	Bidder can engage more than one agency (of repute), in case the Bidder itself is not able to meet the requirement at 4.02.05. The design agency (ies) proposed by the Bidder shall be subject to Employer's approval.
4.03.00	**PROVENNESS CRITERIA FOR ELECTRICAL EQUIPMENTS**
4.03.01	**HT MOTORS**
4.03.01.01	**BOOSTER FAN MOTOR** The offered Squirrel cage Induction motor shall be from such a Manufacturer who has manufactured and supplied motor of 4MW or above rating, which should have been in successful operation for at least one (1) plant for a period not less than one (1) year reckoned as on the date of consideration for approval but not later than six months after award date of contract to the Main bidder.

CLAUSE NO.	INTENT OF SPECIFICATION
4.03.02	**LT SWITCHGEAR**
4.03.02.01	**ROUTE 1**
4.03.02.01	(i) Bidder/ Sub Vendor should have manufactured and supplied at least a total of four hundred & fifty (450) nos. draw out type Air Circuit Breaker Panels and / or draw out type Motor Control Centre Panels with fault rating of at least 45kA for 1 second and 105kA peak under a single order and these panels should have been in successful operation for a period of not less than two (2) years reckoned as on the date of consideration for approval but not later than six months after award date of contract to the Main bidder.
4.03.02.01	(ii) Bidder/ Sub Vendor should have manufactured and supplied at least one hundred & fifty (150) nos. of Air Circuit Breakers having fault rating of at least 105kA MAKING and 45kA BREAKING, and their associated draw out type Air circuit breaker panels having fault rating of at least 45kA for 1 Second and 105kA peak, which should have been in successful operation for a period of not less than two (2) years reckoned as on the date of consideration for approval but not later than six months after award date of contract to the Main bidder.
4.03.02.02	**ROUTE 2**
4.03.02.02	(i) Bidder/Sub-vendor should have manufactured and supplied at least a total of two hundred & twenty five (225) nos. draw out type Air Circuit Breaker Panels and / or draw out type Motor Control Centre Panels with fault rating of at least 45kA for 1 second and 105kA peak under a single order and these panels should have been in successful operation for a period of not less than two (2) years reckoned as on the date of consideration for approval but not later than six months after award date of contract to the Main bidder.
4.03.02.02	(ii) Bidder/Sub-vendor should have manufactured and supplied at least seventy five (75) nos. of draw out type Air Circuit Breaker panels having fault rating of at least 45kA for 1 second and 105kA peak, which should have been in successful operation for a period of not less than two (2) years reckoned as on the date of consideration for approval but not later than six months after award date of contract to the Main bidder.
4.03.02.02	(iii) Bidder/Sub-vendor shall Associate/Collaborate with a manufacturer who meets the requirements stipulated in Route 1. In such a case, Bidder/Sub-vendor should furnish a Deed of Joint Undertaking executed by Bidder/Sub-vendor and its Associate/Collaborator as per the format enclosed in the bidding document in which the Bidder/Sub-vendor and its Associate/Collaborator are jointly and severally liable to the Employer for successful performance of the LT Switchgears under this package. This Deed of Joint Undertaking should be submitted prior to the placement of order on approved Sub Vendor. In case of award, the Associate or Collaborator of the Bidder / Sub Vendor (as applicable) will be required to

CLAUSE NO.	INTENT OF SPECIFICATION
	furnish an on-demand Bank Guarantee for INR 1 Million (Indian Rupees One Million only) **per project.** **Note:** Each Single Front Panel shall be counted as one (1) Panel, Double Front Panel as one (1) Panel and Air Circuit Breaker Panel as one (1) Panel.
4.03.03	**11 KV / 3.3 KV SWITCHGEARS** **Route 1**
4.03.03.01	The Bidder/ Sub Vendor should have manufactured and supplied on an average one hundred (100) numbers of 11kV and /or 6.6kV Switchgear panels per annum during the last three years reckoned as on the date of consideration for approval but not later than six months after award date of contract to the Main bidder.
4.03.03.02	The Bidder/ Sub Vendor should have designed, manufactured and supplied at least one hundred (100) numbers of 11kV and /or 6.6kV Switchgear panels complete in all respects with fault rating of at least 40kA for one (1) second and 100kA (peak), which should have been in successful operation for a period of at least two (2) years reckoned as on the date of consideration for approval but not later than six months after award date of contract to the Main bidder.
4.03.03.03	The Bidder/ Sub Vendor should have manufactured and supplied at least one hundred (100) numbers of Vacuum Circuit Breakers for 11kV and /or 6.6kV panels with a rating of 40kA rms BREAKING, 100kA peak MAKING and 40kA withstand for one (1) second, which should have been in successful operation in 6.6kV or higher voltage application for a period of at least two (2) years reckoned as on the date of consideration for approval but not later than six months after award date of contract to the Main bidder. **Route 2** Bidder/ Sub Vendor based on technological support of its Associate or Collaborator, can also participate provided
4.03.03.04	The Bidder/ Sub Vendor should have manufactured and supplied on an average one hundred (100) numbers of 11kV and /or 6.6kV Switchgear panels per annum during the last three years reckoned as on the date of consideration for approval but not later than six months after award date of contract to the Main bidder.
4.03.03.05	The Bidder/ Sub Vendor should have manufactured and supplied at least one hundred (100) numbers of 11kV and /or 6.6kV Switchgear panels complete in all respects with fault rating of at least 40kA for one (1) second and 100kA (peak). The Bidder/ Sub Vendor should have type tested the offered type of panels as specified.

CLAUSE NO.	INTENT OF SPECIFICATION
4.03.03.06	The Bidder/ Sub Vendor should have manufactured and supplied at least one hundred (100) numbers of Vacuum Circuit Breakers for 11kV and /or 6.6kV panels with a rating of 40kA rms BREAKING, 100kA peak MAKING and 40kA withstand for one (1) second, reckoned as on the date of consideration for approval but not later than six months after award date of contract to the Main bidder.
4.03.03.07	Bidder's/ Sub Vendor's Associate or Collaborator meets the qualifying requirement stipulated at 4.03.03.02 & 4.03.03.03 stipulated under Route 1.
4.03.03.08	Bidder/ Sub Vendor furnishes a Deed of Joint Undertaking jointly executed by it and its Associate/ Collaborator as per format enclosed in the bidding document in which the Bidder/ Sub Vendor and its Associate/ Collaborator are jointly and severally liable to the Employer for successful performance of the MV Switchgears. This Deed of Joint Undertaking should be submitted prior to the placement of order on approved Sub Vendor. In case of award, the Associate or Collaborator of the Bidder / Sub Vendor (as applicable) will be required to furnish an on-demand Bank Guarantee for INR 1 Million (Indian Rupees One Million only) **per project.** **Note:** Equipment designed by the Bidder itself or through its Collaborator/Associate for reference plant, shall also be considered meeting the requirement of design.
4.03.04	**NUMERICAL RELAYS & NETWORKING**
4.03.04.01	Numerical Relays shall be offered from a Manufacturer who has manufactured and supplied and successfully configured at least 100 No's of Numerical Relays with IEC 61850 used for application in Feeder Protections/Transformer Protections/Motor Protections. These relays should have been in successful operation for at least one (1) year reckoned as on the date of consideration for approval but not later than six months after award date of contract to the Main bidder.
4.03.04.02	The Numerical Relay Network system shall be offered from an Integrator /Manufacturer who has designed and successfully done FAT for a network on IEC 61850 with at least 100 no's of Communicable Numerical Relays reckoned as on the date of consideration for approval but not later than six months after award date of contract to the Main bidder.
4.03.05	**AUXILIARY OIL FILLED TRANSFORMERS**
4.03.05.01	The Bidder/ Sub-Vendor should have manufactured & supplied at least two numbers (one each at two different installations) of 16 MVA, 11KV or higher rating oil filled transformers which should have been in successful operation for a period of at least two (2) years reckoned as on the date of consideration for approval but not later than six months after award date of contract to the Main bidder.

CLAUSE NO.	INTENT OF SPECIFICATION
	And
4.03.05.02	Bidder/ Sub-Vendor should have his own facilities for conducting all routine and type tests as per IS: 2026 (except short circuit test).
	And
4.03.05.03	16 MVA, 11 KV Class or higher rated oil filled transformer manufactured by Bidder/ Sub-Vendor should have been successfully short circuit tested. **Note**: i) Two different installations mean two different project sites or two different contracts. ii) Equipment designed by the Bidder/Sub-vendor by itself or through its Collaborator/Associate for reference plant, shall also be considered meeting the requirement of design.
4.04.00	**FGD WASTE WATER TREATMENT SYSTEM FOR ZERO LIQUID DISCHARGE (ZLD)**
4.04.01	**Route-1**
4.04.01.01	Bidder/Bidder's Sub vendor should have designed, supplied, erected/supervised erection and commissioned/supervised commissioning at least one (1) number of FGD Waste Water Treatment System (essentially comprising of Evaporator (Brine Concentrator) and/or Crystalliser, Vapour Compressor) operating in Coal fired unit(s) of power plant, having inlet feed as FGD waste water of TDS not less than 30,000 ppm and treatment capacity of not less than 10 m^3/hr. The above FGD Waste Water Treatment System should have been in successful operation for a period not less than one (1) year reckoned as on the date of consideration for approval but not later than six months after award date of contract to the Main bidder.
4.04.02	**Route-2**
4.04.02.01	The Bidder/its Sub-vendor who do not meet the qualification requirements stipulated at 4.04.01.01 above, may also participate provided the Bidder/its Sub vendor is a contractor who have designed, supplied, erected/supervised erection and commissioned/supervised commissioning at least one (1) number of Waste Water Treatment System (essentially comprising of Evaporator (Brine Concentrator) and/or Crystalliser) operating in an Industrial unit which should have been in successful operation for a period not less than one (1) year reckoned as on the date of consideration for approval but not later than six months after award date of contract to the Main bidder and associates/collaborates with an Associate/Collaborator who in turn fully meets the requirements stipulated at 4.04.01.01 above.
4.04.02.02	Bidder/its sub vendor should also have a valid ongoing collaboration and technology transfer agreement with an Associate/Collaborator meeting requirements of clause 4.04.01.01 above, valid minimum up to the end of the defect liability period of the

CLAUSE NO.	INTENT OF SPECIFICATION

contract. In such a case Bidder/Sub vendor can either source the FGD Waste Water Treatment System from such system provider or can itself manufacture/get manufactured, supply and install the FGD Waste Water Treatment System as per the design, manufacturing and installation drawings released by such Associate/Collaborator.

4.04.02.03 The Bidder shall furnish a Deed of Joint Undertaking (DJU) executed by it, its Sub vendor (if applicable) and the Collaborator/Associate and each executant of DJU shall be jointly and severally liable to the Employer for successful performance of FGD waste water treatment system.

The Deed of Joint Undertaking(s) (DJU) should be submitted at the time of placement of order on approved Sub vendor. In case of award, the Associate or Collaborator of the Bidder/Sub-vendor (as applicable) shall be required to furnish an on demand bank guarantee for INR 20 Million (Rupees Twenty Million) for each project.

4.05.00 Provenness criteria for critical equipment, auxiliaries, systems and bought out items for FGD waste water system:

4.05.01 The Bidder/Bidder's sub-vendor(s) is required to meet the provenness criteria and/or qualification requirement for critical equipment, auxiliaries, system and bought out items as per criteria stipulated below:

Evaporator/Brine Concentrator, Crystallizer, Mechanical Vapour Compressor, Evaporator feed Heat exchanger, Crystalliser Heat exchanger for FGD Waste Water System for ZLD offered by the Bidder shall be only from such manufacturer(s) who has previously designed (either by itself or under collaboration/licensing agreement), manufactured/got manufactured the respective equipment(s) of the type, application and minimum equipment rating not less than that supplied in FGD waste water application and such equipment(s) should have been in successful operation in at least one (1) coal fired power station for a period not less than one (1) year reckoned as on the date of consideration for approval but not later than six months after award date of contract to the Main bidder.

Sl. No.	Name of Equipment	Type of Equipment	Application	Equipment Rating
a)	Evaporator/ Brine concentrator	Falling Film	FGD application in Coal fired power plant	Evaporator/Brine concentrator of a FGD Waste water treatment system of capacity not less than 10 m^3/hr.
b)	Crystallizer	Forced circulation	FGD application in Coal fired power plant	Crystallizer of a FGD Waste water treatment system of capacity not less than 10 m^3/hr.
c)	Mechanical Vapour Compressor	Centrifugal	FGD application in Coal fired power plant	Mechanical Vapour Compressor of a FGD Waste water treatment system of capacity not less than 10 m^3/hr.

CLAUSE NO.	INTENT OF SPECIFICATION

Sl. No.	Name of Equipment	Type of Equipment	Application	Equipment Rating
d)	Evaporator feed Heat Exchanger	Plate type /Tube & Shell type	FGD application in Coal fired power plant	Evaporator feed Heat Exchanger of a FGD Waste water treatment system of capacity not less than 10 m^3/hr.
e)	Crystallizer Heat Exchanger	Plate type/Tube & Shell type	FGD application in Coal fired power plant	Crystallizer Heat Exchanger of a FGD Waste water treatment system of capacity not less than 10 m^3/hr.

Bidder shall offer and supply only the type of the above equipment(s) for which he himself or the manufacturer proposed by the Bidder for the above equipment(s) is qualified.

4.05.02 A JV / Subsidiary Company formed for manufacturing and supply of equipment(s) as listed at clause no. 4.05.01 above in India can also manufacture such equipment(s), provided that it has a valid collaboration or licensing agreement for design, engineering, manufacturing of such equipment(s) in India with a qualified equipment manufacturer who meets the requirements stipulated at clause 4.05.01 above (or the technology provider of the qualified equipment manufacturer) for the respective equipment(s). Before taking up the manufacturing of such equipment(s), the bidder/his sub-vendor(s) must create/have created manufacturing facilities at his works as per collaborator's/licenser's design, manufacturing and quality control system for such equipment(s).

Further, in such a case, such qualified equipment manufacturers should have, directly or indirectly through its Holding company/Subsidiary company, at least 26% equity participation in the Indian Joint Venture Company/Subsidiary Company, which shall be maintained for a lock-in period of seven (7) years from the date of incorporation of such Joint Venture/Subsidiary or upto the end of defect liability period of the contract, whichever is later.

4.05.03 In case the Bidder or the proposed sub-vendor is not manufacturer of proven Evaporator/Brine concentrator as per clause 4.05.01 (a) above but is a manufacturer of Evaporator/Brine concentrator for any Industrial unit, the Bidder or the proposed sub-vendor can also manufacture Evaporator/Brine concentrator, provided it has collaboration or valid licensing agreement for design, engineering, manufacturing, supply of such Evaporator/Brine concentrator in India with such manufacturer who meet the requirements stipulated at clause 4.05.01 (a) above for the Evaporator/Brine concentrator. Before taking up the manufacturing of such equipment, the bidder/ his sub-vendor must create /have created manufacturing facilities at his works as per collaborator's /licenser's design, manufacturing and quality control system for such equipment.

4.05.04 In case the Bidder or the proposed sub-vendor is not manufacturer of proven Crystallizer as per clause 4.05.01 (b) above but is a manufacturer of Crystallizer for any Industrial unit, the Bidder or the proposed sub-vendor can also manufacture Crystallizer, provided it has collaboration or valid licensing agreement for design, engineering, manufacturing, supply of such Crystallizer in India with such

CLAUSE NO.	INTENT OF SPECIFICATION
	manufacturer who meet the requirements stipulated at clause 4.05.01 (a) above for the Crystallizer. Before taking up the manufacturing of such equipment, the bidder/ his sub-vendor must create /have created manufacturing facilities at his works as per collaborator's /licenser's design, manufacturing and quality control system for such equipment.
4.05.05	In case the Bidder or the proposed sub-vendor is not manufacturer of proven Mechanical Vapour Compressor as per clause 4.05.01 (c) above but is a manufacturer of Compressor, the Bidder or the proposed sub-vendor can also manufacture Mechanical Vapour Compressor, provided it has collaboration or valid licensing agreement for design, engineering, manufacturing, supply of such Mechanical Vapour Compressor in India with such manufacturer who meet the requirements stipulated at clause 4.05.01 (c) above for the Mechanical Vapour Compressor. Before taking up the manufacturing of such equipment, the bidder/ his sub-vendor must create /have created manufacturing facilities at his works as per collaborator's /licenser's design, manufacturing and quality control system for such equipment.
4.05.06	In case the Bidder or the proposed sub-vendor is not manufacturer of proven Evaporator feed Heat Exchanger as per clause 4.05.01 (d) above but is a manufacturer of Heat exchanger, the Bidder or the proposed sub-vendor can also manufacture Evaporator feed Heat Exchanger, provided it has collaboration or valid licensing agreement for design, engineering, manufacturing, supply of such Evaporator feed Heat Exchanger in India with such manufacturer who meet the requirements stipulated at clause 4.05.01 (d) above for the Evaporator feed Heat Exchanger. Before taking up the manufacturing of such equipment, the bidder/ his sub-vendor must create /have created manufacturing facilities at his works as per collaborator's /licenser's design, manufacturing and quality control system for such equipment.
4.05.07	In case the Bidder or the proposed sub-vendor is not manufacturer of proven Crystallizer Heat Exchanger as per clause 4.05.01 (e) above but is a manufacturer of Heat exchanger, the Bidder or the proposed sub-vendor can also manufacture Crystallizer Heat Exchanger, provided it has collaboration or valid licensing agreement for design, engineering, manufacturing, supply of such Crystallizer Heat Exchanger in India with such manufacturer who meet the requirements stipulated at clause 4.05.01 (e) above for the Crystallizer Heat Exchanger. Before taking up the manufacturing of such equipment, the bidder/ his sub-vendor must create /have created manufacturing facilities at his works as per collaborator's /licenser's design, manufacturing and quality control system for such equipment.
4.05.08	Before taking up the manufacturing of such equipment(s) as per clause 4.05.03, 4.05.04, 4.05.05, 4.05.06, 4.05.07 above, the Bidder/its sub vendor(s) must create (or should have created) manufacturing and testing facilities at its works as per Collaborator/licenser's design, manufacturing and quality control system for such equipments duly certified by the Collaborator/licensor. Further, the Collaborator / Licenser shall provide (or should have provided) all design, design calculation, manufacturing drawings and must provide (or should have provided) technical and quality surveillance assistance and supervision during manufacturing, erection, testing, commissioning of equipments.

CLAUSE NO.	INTENT OF SPECIFICATION

4.05.09 Bidder shall offer and supply only the type of the above equipment(s) for which it, itself or the manufacturer / Collaborator(s) / Licenser(s) proposed by the Bidder for the above equipment(s) is qualified.

4.05.10 The Employer reserves the right to fully satisfy himself regarding capability and capacity of Bidder / its sub-vendor(s) and the proposed arrangement and may prescribe additional requirement before allowing manufacture of the equipment listed above for this contract.

Note to clause 4.04.00 & 4.05.00

Whenever the term 'coal fired' is appearing above, "Coal" shall be deemed to also include bituminous coal/brown coal/Anthracite Coal/lignite.

4.06.00 Agency for Wet Stack Flow Model Study

Wet Stack Flow Model Study shall be carried out by an agency which has successfully performed at least two (2) flow model studies, in separate coal fired power plants, of wet stack installed after wet limestone based FGD Absorber (without reheating of cleaned flue gas), and based on the studies developed at least two (2) wet stack liquid collection systems which are in successful operation for a period of at least two (2) years reckoned as on the date of consideration for approval but not later than six months after award date of contract to the Main bidder.

4.07.00 Balance equipments/ systems

The Bidder at his option can source the balance of plant equipment/systems not covered in clause 4.01.00, 4.02.00**,** 4.03.00, 4.04.00, 4.05.00 & 4.06.00 above. However for such balance of plant equipment/systems, the Employer reserves the rights to satisfy himself on the provenness of the equipment and capability and capacity of the manufacturers.

4.08.00 Notwithstanding anything stated above, the Employer reserves the right to assess the capabilities and capacity of the Bidder/his collaborators/ licenser/ his sub-contractors to perform the contract, should the circumstances warrant such assessment in the overall interest of the Employer.

4.09.00 To enable the approval of sub-vendors, the Bidder shall provide all necessary data such as type, design, make, capacity, duty conditions, date of commissioning/ operation etc.

SUB-SECTION-II-A11

PROJECT INFORMATION- NABINAGAR 4X250 MW

CLAUSE NO.	PROJECT INFORMATION

1.00.00 BACKGROUND

Details of proposed Stage / Units

Project name	:	Nabinagar TPP
No. of Units x capacity	:	4 x 250 MW
Project setting up by	:	NTPC(FOR BHARTIYA RAIL BIJLEE COMPANY LTD.)

The SG with ESP package and TG package of the subject project is being executed by M/s. BHEL.

1.01.00 LOCATION AND APPROACH

Project Location	:	(i) Place : Nabinagar
	:	(ii) District : Aurangabad
	:	(iii) State : Bihar
Latitude and Longitude of project location	:	North : 24 deg. 42' 30" (N) East : 84 deg. 05' 36" (E)
Nearest Railway station	:	Dehri-On-Sone
Distance of project location from the Railway station	:	30 KM (Approx.)
Nearest MajorTown	:	Aurangabad
Distance of the town from the Project site	:	50 KM
Nearest CommercialAirport	:	Gaya
Distance of airport from the project site	:	100 KM
Nearest Highway	:	National Highway-2
Distance from nearest highway point to the site	:	25 KM
Vicinity plan	:	Vicinity plan of the project enclosed at Annexure-I.
Any other information	:	Further to the information given in this sub-section, Bidders are advised to visit the project site and collect data on local site conditions.

CLAUSE NO.	PROJECT INFORMATION	
1.02.00	**LAND REQUIREMENT**	
	Total area of land acquired for the project	: 1700 Acres
	Any other information	: Approximately 1700 acres of land has been identified near Dhundhua village for the Plant, Township and Ash Disposal Area. In principle commitment for the availability of land for Plant, Township and Ash Disposal Area has been obtained from Revenue Department, Govt. of Bihar vide letter dated 29.3.2003. Further, Central Coalfields Ltd., (CCL) vide their letter dated 29.05.03 have indicated that Central Mine Planning & Design Institute Ltd (CMPDI) have confirmed that plant location along with its other allied infrastructure are not coming on coal bearing area.
1.03.00	**WATER**	
	Nearest Water Source	: The project site is located near the river Sone which is the only source of water for the project. Therefore, the make up water requirement for the project is proposed to be drawn from the pondage created by Indrapuri Barrage, which is about 3 kms from the proposed site.
	Proposed water requirement for the Stage	: 60 Cusec
	Proposed source / arrangement to the meet the water requirement	: The project site is located near the river Sone which is the only source of water for the project. Therefore, the make up water requirement for the project is proposed to be drawn from the pondage created by Indrapuri Barrage, which is about 3 kms. from the proposed site. The make up water requirement for the project operating on cooling towers is about 4300 cubic m/hr with ash water recirculation system and about 5900 cubic m/hr. with once through ash water system. Water Resource Department, Govt. of Bihar, accorded in-principle clearance of 60 cusecs of consumptive water from upstream of Indrapuri Barrage vide their letter dated 06.03.03.

CLAUSE NO.	PROJECT INFORMATION

1.04.00 **COAL and WATER, Utility details:**

(i) Coal Quality Parameters and Fuel Oil Characteristics

Source:Pachra and Pachra south blocks in North Karanpura coalfields

Requirement: 5 MTPA

The Coal quality parameters and Fuel Oil Characteristics are enclosed at Table-1, & Table-2A & 2B of this Sub-Section.

Water data

(ii) Process water:
Process water quality based on COC in Table-3.

(iii) Clarified water:
Clarified water quality is indicated in Table-3.

(iv) DM water for Equipment cooling water system.
DM water quality is indicated in Table-4.

1.05.00 **Steam Generator and ESP data:** refer Table-5

1.06.00 Drawings are enclosed as per Table-6 for initial overview to the Bidder.

2.00.00 NOT USED

3.00.00 **RAILWAY SIDING**

For bringing the equipment and material to the power house through rail, railway siding is proposed to be constructed from nearest railway station.

4.00.00 **METEOROLOGICAL DATA**

Meteorological data of the nearest observatory Dehri station is enclosed as Annexure-II to this subsection.

5.00.00 **CRITERIA FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT**

All structures and equipment shall be designed for seismic forces adopting the site specific seismic information provided in this document and using the other provisions in accordance with IS:1893 (Part 1 to Part 4). Pending finalization of Part 5 of IS:1893, provisions of part 1 shall be read along with the relevant clauses of IS:1893:1984, for embankments.

A site specific seismic study has been conducted for the project site. The peak ground horizontal acceleration for the project site, the site specific acceleration spectral coefficients (in units of gravity acceleration ‘g’) in the horizontal direction for

the various damping values and the multiplying factor (to be used over the spectral coefficients) for evaluating the design acceleration spectra are as given at Appendix-I.

Vertical acceleration spectral values shall be taken as 2/3rd of the corresponding horizontal values.

The site specific design acceleration spectra shall be used in place of the response acceleration spectra, given at figure-2 in IS:1893 (Part 1) and Annex B of IS:1893 (Part 4). The site specific acceleration spectra along with multiplying factors specified in Appendix-I includes the effect of the seismic environment of the site, the importance factor related to the structures and the response reduction factor. Hence, the design spectra do not require any further consideration of the zone factor (Z), the importance factor (I) and response reduction factor (R) as used in the IS:1893 (Part 1 to Part 4).

Damping in Structures

The damping factor (as a percentage of critical damping) to be adopted shall not be more than as indicated below for:

Steel structures	2%
Reinforced Concrete structures	5%
Reinforced Concrete Stacks	3%
Steel stacks	2%

Method of Analysis

Since most structures in a power plant are irregular in shape and have irregular distribution of mass and stiffness, dynamic analysis for obtaining the design seismic forces shall be carried out using the response spectrum method. The number of vibration modes used in the analysis should be such that the sum total of modal masses of all modes considered is at least 90 percent of the total seismic mass and shall also meet requirements of IS:1893 (Part 1). Modal combination of the peak response quantities shall be performed as per Complete Quadratic Combination (CQC) method or by an acceptable alternative as per IS:1893 (Part 1).

In general, seismic analysis shall be performed for the three orthogonal (two principal horizontal and one vertical) components of earthquake motion. The seismic response from the three components shall be combined as specified in IS:1893 (Part 1).

CLAUSE NO.	PROJECT INFORMATION

The spectral acceleration coefficient shall get restricted to the peak spectral value if the fundamental natural period of the structure falls to the left of the peak in the spectral acceleration curve.

For buildings, if the design base shear (V_B) obtained from modal combination is less than the base shear ($\bar{V}_B$) computed using the approximate fundamental period (T_a) given in IS:1893:Part 1 and using site specific acceleration spectra with appropriate multiplying factor, the response quantities (e.g. member forces, displacements, storey forces, storey shears and base reactions) shall be enhanced in the ratio of $\bar{V}_B / V_B$. However, no reduction is permitted if $\bar{V}_B$ is less than V_B.

For regular buildings less than 12m in height, design seismic base shear and its distribution to different floor levels along the height of the building may be carried out as specified under clause 7.5, 7.6 & 7.7 of IS:1893 (Part 1) and using site specific design acceleration spectra. The design horizontal acceleration spectrum value (Ah) shall be computed for the fundamental natural period as per clause 7.6 of IS:1893 (Part 1) using site specific spectral acceleration coefficients with appropriate multiplying factor given in Appendix-I.

Design/Detailing for Ductility for Structures

The site specific design acceleration spectra is a reduced spectra and has an in-built allowance for ductility. Structures shall be engineered and detailed in accordance with relevant Indian/International standards to achieve ductility.

CLAUSE NO.	PROJECT INFORMATION	एनटीपीसी NTPC

APPENDIX – I

SITE SPECIFIC SEISMIC PARAMETERS FOR DESIGN OF STRUCTURES AND EQUIPMENT

The various site specific seismic parameters for the project site shall be as follows:

1) Peak ground horizontal acceleration : 0.16g

2) Multiplying factor to be applied to the site specific horizontal acceleration spectral coefficients (in units of gravity acceleration 'g') to obtain the design acceleration spectra

   a) for ordinary moment resisting steel frames designed and detailed as per IS:800 : 0.04

   b) for braced steel frames designed and detailed as per IS:800 : 0.03

   c) For special moment resisting RC frames designed and detailed as per IS:456 and IS:13920 : 0.024

   d) for RCC chimney : 0.08
   e) for Liquid retaining tanks : 0.048
   f) for Steel chimney, Absorber tower : 0.06

   g) for design of structures not covered under 2 (a) to 2 (f) above and under 3 below : 0.04

3) Multiplying factor to be applied to the site specific horizontal acceleration spectral coefficients (in units of gravity acceleration 'g') for design of equipment and structures where inelastic action is not relevant or not permitted : 0.08

Note: g = Acceleration due to gravity

The horizontal seismic acceleration spectral coefficients are furnished in subsequent pages.

APPENDIX – I

HORIZONTAL SEISMIC ACCELERATION SPECTRAL COEFFICIENTS
In units of 'g' for New Nabinagar project

Time Period	Damping Factor (as a percentage of critical damping)		
(Sec)	2%	3%	5%
0.000	1.000	1.000	1.000
0.030	1.000	1.000	1.000
0.050	1.750	1.607	1.443
0.100	3.737	3.060	2.374
0.104	3.904	3.174	2.443
0.123	3.904	3.401	2.753
0.150	3.904	3.401	2.753
0.200	3.904	3.401	2.753
0.250	3.904	3.401	2.753
0.300	3.904	3.401	2.753
0.350	3.904	3.401	2.753
0.400	3.904	3.401	2.753
0.450	3.904	3.401	2.753
0.500	3.904	3.401	2.753
0.516	3.904	3.401	2.753
0.550	3.662	3.401	2.753
0.600	3.357	3.142	2.753
0.607	3.320	3.105	2.753
0.670	3.006	2.813	2.493
0.700	2.877	2.693	2.386
0.750	2.685	2.513	2.227
0.800	2.518	2.356	2.088
0.850	2.369	2.218	1.965
0.900	2.238	2.094	1.856
0.950	2.120	1.984	1.758
1.000	2.014	1.885	1.670
1.050	1.918	1.795	1.590
1.100	1.831	1.714	1.518
1.150	1.751	1.639	1.452
1.200	1.678	1.571	1.392
1.250	1.611	1.508	1.336

APPENDIX – I

HORIZONTAL SEISMIC ACCELERATION SPECTRAL COEFFICIENTS
In units of 'g' for New Nabinagar project

Time Period	Damping Factor (as a percentage of critical damping)		
(Sec)	2%	3%	5%
1.300	1.549	1.450	1.285
1.350	1.492	1.396	1.237
1.400	1.439	1.346	1.193
1.450	1.389	1.300	1.152
1.500	1.343	1.257	1.113
1.550	1.299	1.216	1.077
1.600	1.259	1.178	1.044
1.650	1.221	1.142	1.012
1.700	1.185	1.109	0.982
1.750	1.151	1.077	0.954
1.800	1.119	1.047	0.928
1.850	1.089	1.019	0.903
1.900	1.060	0.992	0.879
1.950	1.033	0.967	0.856
2.000	1.007	0.943	0.835
2.050	0.982	0.920	0.815
2.100	0.959	0.898	0.795
2.150	0.937	0.877	0.777
2.200	0.915	0.857	0.759
2.250	0.895	0.838	0.742
2.300	0.876	0.820	0.726
2.350	0.857	0.802	0.711
2.400	0.839	0.785	0.696
2.450	0.822	0.769	0.682
2.500	0.806	0.754	0.668
2.550	0.790	0.739	0.655
2.600	0.775	0.725	0.642
2.650	0.760	0.711	0.630
2.700	0.746	0.698	0.619
2.750	0.732	0.685	0.607
2.800	0.719	0.673	0.596

APPENDIX – I

HORIZONTAL SEISMIC ACCELERATION SPECTRAL COEFFICIENTS
In units of 'g' for New Nabinagar project

Time Period	Damping Factor (as a percentage of critical damping)		
(Sec)	2%	3%	5%
2.850	0.707	0.661	0.586
2.900	0.694	0.650	0.576
2.950	0.683	0.639	0.566
3.000	0.671	0.628	0.557
3.050	0.660	0.618	0.548
3.100	0.650	0.608	0.539
3.150	0.639	0.598	0.530
3.200	0.629	0.589	0.522
3.250	0.620	0.580	0.514
3.300	0.610	0.571	0.506
3.350	0.601	0.563	0.499
3.400	0.592	0.554	0.491
3.450	0.584	0.546	0.484
3.500	0.575	0.539	0.477
3.550	0.567	0.531	0.470
3.600	0.559	0.524	0.464
3.650	0.552	0.516	0.458
3.700	0.544	0.509	0.451
3.750	0.537	0.503	0.445
3.800	0.530	0.496	0.439
3.825	0.527	0.493	0.437
3.850	0.523	0.490	0.434
3.900	0.516	0.483	0.428
3.950	0.510	0.477	0.423
4.000	0.504	0.471	0.418

CLAUSE NO.	PROJECT INFORMATION

6.00.00 **CRITERIA FOR WIND RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT**

All structures shall be designed for wind forces in accordance with IS:875 (Part-3) and as specified in this document. See Annexure – B for site specific information.

Along wind forces shall generally be computed by the Peak (i.e. 3 second gust) Wind Speed method as defined in the standard.

Along wind forces on slender and wind sensitive structures and structural elements shall also be computed, for dynamic effects, using the Gust Factor or Gust Effectiveness Factor Method as defined in the standard. The structures shall be designed for the higher of the forces obtained from Gust Factor method and the Peak Wind Speed method.

Analysis for dynamic effects of wind must be undertaken for any structure which has a height to minimum lateral dimension ratio greater than “5” and/or if the fundamental frequency of the structure is less than 1 Hz.

Susceptibility of structures to across-wind forces, galloping, flutter, ovalling etc. should be examined and designed/detailed accordingly following the recommendations of IS:875(Part-3) and other relevant Indian standards.

It should be estimated if size and relative position of other structures are likely to enhance the wind loading on the structure under consideration. Enhancement factor, if necessary, shall suitably be estimated and applied to the wind loading to account for the interference effects.

Damping in Structures

The damping factor (as a percentage of critical damping) to be adopted shall not be more than as indicated below for:

a) Welded steel structures : 1.0%

b) Bolted steel structures : 2.0%

c) Reinforced concrete structures : 1.6%

d) Steel stacks : As per IS:6533 & CICIND Model Code whichever is more critical.

ANNEXURE-B

SITE SPECIFIC DESIGN PARAMETERS

The various design parameters, as defined in IS: 875 (Part-3), to be adopted for the project site shall be as follows:

a) The basic wind speed "V_b" at ten metres above the mean ground level : 47 metres/second

b) The risk coefficient "K_1" : 1.07

c) Category of terrain : Category-2

7.00.0 FOUNDATION SYSTEM AND GEOTECHNICAL DATA

7.00.01 Geotechnical data and foundation system for the respective project are enclosed at annexure-III. The corresponding bore logs are enclosed at annexure-IV.

7.00.02 The available soil data is of vicinity of proposed structures, therefore, bidder shall carryout his own detailed soil investigation for facilities under this package and shall be as per the scheme approved by owner**.**The scheme for geotechnical investigation shall be as given at Clause 7.07.00 and shall be approved by owner before execution.Geotechnical investigation work shall got executed by the Contractor through the agencies as mentioned in Clause No. 7.07.03. However, no time extension shall be given on account of soil investigation carried out by the Bidder. The geotechnical investigation report shall be prepared with detailed recommendations regarding type of foundation and allowable bearing pressure for various structures/ facilities and other soil parameters. The report shall be submitted for Owner's approval prior to commencement of design of foundation.

7.00.03 The Bidder should note that nothing extra whatsoever on account of variation between soil data collected by Owner and that found by the Bidder during geotechnical investigation by him or during execution of works, shall be payable.

7.00.04 Tank Foundations

a) The tanks shall rest on flexible tank pad foundation, resting on sand with concrete ring wall to retain sand. Base of the concrete ring wall shall not rest on the expansive soil, if any.

b) Entire loose/ soft soil inside the concrete ring wall shall be removed and shall be filled with sand. Sand for filling shall be clean and well graded conforming to IS 383 with grading Zone I to III.

c) Sand shall be spread in layers not exceeding 30cm compacted thickness over the area. Each layer shall be uniformly compacted by mechanical means like plate vibrators, small vibratory rollers,etc to achieve a relative density of not less than 80%.

d) Other requirements of tank foundations shall be as per IS 803 and as specified elsewhere in the specifications.

CLAUSE NO.	PROJECT INFORMATION

7.02.00 **Foundation System**

The requirements for the foundation system to be adopted are as given in subsequent clauses. Depending upon the depth of competent strata/stratum, type of structures, functional requirement of facility, extent of cutting / filling, suitable foundation, open or pile shall be adopted with approval of owner.

7.02.01 General Requirements

a) All structures/equipment shall be supported either on suitable open foundations (isolated, combined, raft) or pile foundations depending on type of structures/facilities, sub-strata, topography etc.

b) The roads, ground floor slabs, trenches, pipe pedestals, channels/drains and staircase foundation with foundation loading intensity less than 4 T / M2 may be supported on open / shallow foundations resting on virgin / controlled compacted filled up soil.

c) No other foundation (other than as mentioned in (b) above) shall rest on the filled up ground / soil.

d) No foundation shall rest on the black cotton soil.

e) Before execution of work the bidder shall ensure that there is no obstruction to underground/overground facilities like sewer lines, pipe lines etc. Any such damage and remedial/ rectification measures shall be at the contractors cost.

f) Bidder shall also ensure that there is no damage to existing nearby foundations and the foundations pertaining to this package are not placed at shallower depth than the nearby foundations. If required depth of foundation is deeper than the existing foundations, proper protection shall be provided to existing foundations.

g) All foundations shall be designed in accordance with relevant parts of the latest revisions of Indian Standards.

h) The water table for design purpose shall be considered at Finished Ground Level.

i) A combination of open and pile foundations shall not be permitted under the same equipment / structure / building.

j) Foundation for equipments on ground floor

For equipments of static weight upto 1.5 T, the equipment may be supported on the ground floor slab by locally thickening the slab. Thickening of the ground floor slab shall be done upto an extent of about 0.6 m beyond the plan area of the equipment on all the sides. Further, the load intensity below the equipment shall be limited to 4T/m2. Other requirements of floor slab and compaction below the floor slab shall be adhered, as specified elsewhere in the specifications.

For equipment of static weight more than 1.5 T, the equipment foundation shall be taken to the founding level or shall be built up with PCC from the level as mentioned in the Table 1. The pedestal of equipment foundation or the foundation Block shall be isolated from the adjoining floor slab by providing bitumen impregnated fiber board of minimum 50 mm thick, conforming to IS: 1838 all around the equipment pedestal for the full depth of the floor slab.

CLAUSE NO.	PROJECT INFORMATION

7.02.02 **Open Foundations**

In case open foundations are adopted, following shall be adhered to.

a) The minimum width of foundation shall be 1.0 m.

b) Minimum depth of foundation shall be 1.0m below Ground Level.

c) It shall be ensured that all foundations of a particular structure/ buildings/ facility shall rest on one bearing stratum.

d) Wherever the intended bearing sub-strata is virgin soil stratum but the actual stratum encountered during foundation excavation consists of filled up soil at founding level, under such cases either the foundation shall be lowered completely into the virgin stratum or the filled up soil upto the virgin layers shall be removed and built up through PCC (1:4:8) up to designed foundation level.

7.02.03 Pile Foundations –

(a.) In case piles are adopted, following shall be adhered to :

i) The pile foundation shall be of RCC, Cast-in-situ bored piles as per IS:2911. Pile boring shall be done using Rotary Hydraulic Rigs/conventional tripod rig. Two stage flushing of pile bore shall be ensured by airlift technique duly approved by the Employer.

If required, temporary or permanent MS liner may be provided for piling.

ii) The minimum diameter of pile shall be 600 mm. The allowable load capacity of the pile in different modes (vertical compression, lateral and pullout) shall be as per approved geotechnical report & as enclosed in relevant annexure:

iii) Only straight shaft piles shall be used. Minimum cast length of pile above cutoff level shall be 1.0 m.

iv) The contractor shall furnish design of piles (in terms of rated capacity, length, diameter, termination criteria to locate the founding level for construction of pile in terms of measurable parameter, reinforcement for job as well as test piles, pile load test arrangement, locations of initial test piles etc.) for Engineer's approval.

v) The piling work shall be carried out in accordance with IS:2911 (Relevant part) and accepted construction methodology. The construction methodology shall be submitted by the Contractor for Engineer's approval.

vi) Number of initial load tests to be performed for each diameter and rated capacity of pile shall be subject to minimum as under.

Vertical

Lateral Minimum of 2 Nos. in each mode.

Uplift

vii) The initial pile load test shall be conducted with test load upto three times the estimated pile capacity. In case of vertical compression test (initial test) the method of loading shall be cyclic as per IS:2911 (relevant part).

CLAUSE NO.	PROJECT INFORMATION

viii) Load test shall be conducted at pile Cut-off Level (COL). If the water table is above the COL the test pit shall be kept dry throughout the test period by suitable de-watering methods. Alternatively the vertical load test may be conducted at a level higher than COL. In such a case, an annular space shall be created to remove the effect of skin friction above COL by providing an outer casing of suitable diameter larger than the pile diameter.

ix) Number of routine pile load tests to be performed for each diameter/allowable capacity of pile shall be as under :

i) Vertical : 0.5% of the total number of piles provided.

ii) Lateral : 0.5% of the total number of piles provided.

x) The routine tests on piles shall be conducted upto test load of one and half times the allowable pile capacity. Piles for routine load tests shall be approved by the Employer.

xi) In case, routine pile load test shows that the pile has not achieved the desired capacity or pile(s) have been rejected due to any other reason, then the Contractor shall install additional pile(s) as required and the pile cap design shall accordingly be reviewed and modified, if required.

xii) Testing of piles and interpretation of pile load test results shall be carried out as per IS:2911 (Part-4). Contractor shall ensure that all the measuring equipment and instruments are properly calibrated at a reputed laboratory / institute prior to their use. Settlement / movement of the pile top shall be made by Linear Variable Differential Transducers (LVDT) having a least count of 0.01mm.

xiii) The test load on initial test piles shall be applied by means of reaction from anchor piles / rock anchors alone or combination of anchor piles / rock anchors and kentledge with concrete blocks.

CLAUSE NO.	PROJECT INFORMATION

xiv) Low Strain Pile Integrity test shall be conducted on all test piles and job piles. This test shall be used to identify the routine load test and not intended to replace the use of static load test. This test is limited to assess the imperfection of the pile shaft and shall be undertaken by an independent specialist agency to be approved by Engineering department of Owner. The test equipment shall be of TNO or PDI make or equivalent. The process shall confirm to ASTM.

xv) High Strain Dynamic Load Test may be carried out for routine load testing of working piles. However, at least two numbers of static routine vertical load tests shall be carried out on pile on which high strain dynamic load test has already been carried out for establishing the correlation between the two tests. In case of discrepancy if any between dynamic and static vertical load tests, then additional static routine vertical load tests shall be conducted as decided by the Engineer and the results of static routine vertical load shall prevail. Number of routine vertical pile load tests as per clause 7.02.03 (ix) shall be total of static routine vertical load test and high strain dynamic load tests.

The procedure to carryout the test shall be submitted to the Engineer.The test and equipment shall conform to ASTM D4945-00. The test shall be conducted by an experienced independent test agency approved by the owner.Field data shall be submitted to the site engineer and shall include force velocity curves, pile capacity, simulated static load test curve, net and total pile displacement, pile integrity. A (Case pile wave analysis) CAPWAP or equivalent software analysis shall be conducted on the field data for correct capacity estimation and to evaluate end bearing and skin friction components of the pile.

xvi) From load considerations, single pile may be used under a column/tower. In that case, pile shall be connected with tie beams at pile cut off level in both directions.

xvii) Contribution of frictional resistance of filled up soil if any, shall not be considered for computation of frictional resistance of piles.

xviii) Reinforcement for job piles shall be designed as following:

(a) Compression + bending piles: For these piles, the allowable safe pile capacities in compression and bending shall be considered.

(b) Tension + bending piles: For these piles, the actual pile forces to be considered. However, maximum 3 types of combinations for varying percentage of tension capacity + bending case may be designed & adopted by contractor for the entire scope of work under this package.

7.03.00 Special Requirements

7.03.01 Details of treatment for foundations / underground structures required to counteract soil / water chemical environment shall be as per detailed geotechnical investigation to be carried

	out by contractor.Contractor shall carry out chemical analysis during detailed geotechnical investigation and required treatment shall be provided accordingly.
7.04.00	**Excavation, Filling and Dewatering**
7.04.01	For excavation works, comprehensive dewatering with well point or deep wells arrangement, if required, shall be adopted. Scheme for dewatering and design with all computations and back up data for dewatering shall be submitted for the owner's information. The water table shall be maintained at 0.5m below the founding depth.
7.04.02	Excavation for shallow foundations shall be covered with PCC immediately after reaching the founding level. In case of any local loosening of soil or any loose pockets are encountered at founding level during excavation the same shall be removed and compensated by PCC M7.5. The final layer of about 300 mm thickness above the founding level shall be excavated by suitable means, so as to avoid disturbance to founding stratum.
7.04.03	Backfilling around foundations, pipes, trenches, sumps, pits, plinths, etc. shall be carried out with approved material in layers not exceeding 300 mm compacted thickness (higher thickness of layers upto 500mm with heavy mechanical compacting equipment) and each layer shall be compacted to 90% of standard proctor density for cohesive soils and to 80% of relative density for non-cohesive soils Rock pieces having size less than 150 mm and interstices filled with soil may be used for backfilling around foundation, plinths etc. and shall be compacted to minimum of 85% of original stack of material after filling the interstices.
7.04.04	Founding level for trenches/channels shall be decided as per functional requirement. The bottom of excavation shall be properly compacted prior to casting of bottom slab of trenches / channels.
7.04.05	CBR tests for pavement/road design shall be carried out by the Contractor after earth filling (if applicable) has been completed upto the formation level.
7.04.06	The contractor shall take all necessary measures during excavation to prevent the hazards of falling or sliding of material or article from any bank or side of such excavation which is more than one and a half meter above the footing by providing adequate piling, shoring, bracing etc. against such bank or sides. Adequate and suitable warning signs shall be put up at conspicuous places at the excavation work to prevent any persons or vehicles falling into the excavation trench. No worker should be allowed to work where he may be stuck or endangered by excavation machinery or collapse of excavations or trenches.
7.05.00	**EXCAVATION IN ROCK** Excavation in rock shall be carried out by mechanical means and if blasting is required for founding of some of the structures under this package, control blasting only shall be carried out.
7.05.01	Controlled blasting shall be done by a specialised agency duly approved by Engineer. All controlled blasting shall be done by using time delay detonators (i.e. excel type).
7.05.02	a) Contractor shall engage an agency expert in blasting such as, NIRM (National Institute of Rock Mechanics), CMPDIL, Central Institute of Mining and Fuel Research Dhanbad, Dept. of Mining of Govt. Institutions etc. to design detailed blasting scheme and get the same approved from Engineer before carrying out the blasting

CLAUSE NO.	PROJECT INFORMATION

operation. All blasting shall be done as per the approved blasting scheme & initial blasting operations shall be done under the supervision & guidance of the representative of the blasting expert.

b) All the statutory laws, (Explosives Act etc.) rules, regulations, Indian Standards, etc. pertaining to the acquisition, transport, storage, handling and use of explosives, etc. shall be strictly followed.

c) The Contractor shall obtain Licenses from Competent Authorities for undertaking blasting work as well as for procuring, transporting to site and storing the explosives as per explosives act. The Contractor shall be responsible for the safe transport, use, custody and proper accounting of the explosive Materials.

d) The Contractor shall be responsible and liable for any accident and injury / damage which may occur to any person or property of the project or public on account of any operations connected with the storage, transportation, handling or use of explosive and blasting operations.

7.06.00 Sheeting & Shoring

The contractor shall ascertain for himself the nature of materials to be excavated and difficulties, if any, likely to be encountered in excavation while executing the work. Sheet piling, sheeting and shoring, bracing and maintaining suitable slopes, drainage, etc. shall be provided and installed by the Contractor, to the satisfaction of the Engineer.

7.07.00 Geotechnical Investigation

The Contractor shall carry out detailed geotechnical investigation in the areas under his scope for establishing the sub-surface conditions and to decide type of foundations for the structures envisaged, construction methods, any special requirements/treatment called for remedial measures for sub-soil/ foundations etc. in view of soft sub-soils, aggressive sub-soils and water, expansive/swelling soils etc. prior to commencement of detailed design/drawings. The Contractor shall obtain the approval for the field testing scheme proposed by him from the Owner before undertaking the geotechnical investigation work.

7.07.01.00 **Scheme of geotechnical Investigation**

7.07.02.01 Field test shall include but not be limited to the following:

Boreholes, Standard Penetration Test (SPT), Dynamic Cone Penetration Test (DCPT), collection of disturbed samples (DS) and undisturbed soil samples (UDS), Trial Pits (TP), Plate Load Tests (PLT), Electrical Resistivity Test (ERT), In situ field permeability tests, collection of water samples, etc.

7.07.02.02 The diameter of borehole shall be minimum 150 mm in soil and 76 mm in rock. The diameter of UDS sampler shall be 100 mm minimum. Core drilling in rock shall be done by using hydraulically feed rotary drill & double tube core barrel with diamond bit.

7.07.02.03 The minimum tests are indicated in Clause No. 7.08.00. Adequate number of tests shall be conducted up to sufficient depth for complete determination of subsoil conditions. The depth of boreholes shall be as specified in Appendix A. SPT shall be carried out in all types of soil deposits and in all rock formations with core recovery up to 20%, met within a borehole. This test shall be conducted at every 3.0 m interval or at change of strata, up to the final depth. SPT 'N' of 100 and above shall be referred as refusal. UDS shall be collected at every 3.0 m interval or at change of strata up to depth of borehole. UDS may be replaced by additional SPT, if SPT'N' value in the strata is above 50.

7.07.02.04 Laboratory tests shall be done as per relevant IS codes. The laboratory tests, not be limited to the following shall be conducted on disturbed and undisturbed soil samples, rock samples & water samples collected during field investigations in sufficient numbers.

CLAUSE NO.	PROJECT INFORMATION

Laboratory Tests on Soil Samples

Laboratory tests shall be carried out on disturbed and undisturbed soil samples for Grain Size Analysis, Hydrometer Analysis, Atterberg Limits, Triaxial Shear Tests (UU), Natural Moisture Content, Specific Gravity and Bulk Unit Weight, Consolidation Tests, Unconfined Compression Test, Free swell Index, Shrinkage Limit, Swell Pressure Test, Chemical Analysis test on soil and water samples to determine the carbonates, sulphates, chlorides, nitrates, pH, organic matter and any other chemicals harmful to concrete and reinforcement/ steel.

Laboratory Tests on Rock Samples

Moisture content, porosity & density, Specific Gravity, Hardness, Soundness, Slake durability index, Unconfined compression test (Both at saturated and in-situ water content), Point load strength index and deformability test (Both at saturated and in-situ water content) shall be carried out on rock samples.

7.07.02.05 Geotechnical investigation (field & laboratory) shall be carried out in accordance with the provisions of relevant Indian Standards.

On completion of all field & laboratory work, geotechnical investigation report shall be submitted for Owner's review/approval. The Geotechnical investigation report shall contain geological information of the region, procedure adopted for investigation, field & laboratory observations/ data/ records, analysis of results & recommendations on type of foundation for different type of structures envisaged for all areas of work with supporting calculations. Recommendations on treatment for soil, foundation, based on subsoil characteristics, soft soils, aggressive chemicals, expansive soils, etc.

Recommendations on foundation system and the net allowable bearing pressures and pile capacity shall be based on the conservative values of geotechnical investigation data.

7.07.03.00 Geotechnical investigation work shall be got executed by the Contractor through the following agencies.

1. C.E.TESTING COMPANY Pvt. Ltd, Kolkata
2. CengrsGeotechnica Pvt. Ltd, New Delhi
3. M.K. Soil Testing Laboratory, Ahemdabad
4. SECON Pvt Ltd, Bangalore
5. Soil Engineering Consultants, New Delhi
6. Orbital Infrastructure Consultancy & Research Pvt. Ltd. Cuttack
7. KCT Consultancy Services, Ahemdabad
8. ARKITECHNO Consultants (India) Pvt. Ltd. Bhubaneswar

7.08.00 Geotechnical Investigation Scheme

a) **Boreholes (Minimum)**

S.N	Structure	Spacing/Number of borehole	Depth of borehole	Remarks
1	FGD	Minimum 14 Nos.	Depth of boreholes shall be 25m to 35m.	Depth of

CLAUSE NO.	PROJECT INFORMATION

2	Crusher House	Minimum 2 Nos.	Depth of boreholes shall be 25m to 35m.	boreholes shall be as mentioned in column "Depth of Borehole" or 5m continuous in rock with RQD > 25% whichever is earlier.
3	Gypsum and Lime storage area	Minimum 10 Nos.	Depth of boreholes shall be 15m to 25m	
4	Other Structure/Facility	Minimum 2 Nos. boreholes under each area / facility	15 to 20 m	
5	Chimney	Minimum 2 Nos.	30 to 35m	

b) Other Field Tests (Minimum)

1	Cyclic Plate Load Test (CPLT)	3nos	Test Depth from 2 to 4 m	
2	Trial Pit (TP)	5 Nos.	Depth - 3 m	
3	In Situ Permeability Test In Boreholes	In minimum 3 Nos. of boreholes	Tests shall be conducted at depths of 1.0m, 3.0m, 5.0m, 8.0m and 12.0m.	
4	ERT	Minimum 10 Nos.		

- Depth and location of Boreholes and other field tests (PLT, ERT, field permeability tests etc.) shall be approved by Owner before execution of geotechnical investigation work.
- Investigation in any other building / structure / facilities / trestleswhich are not mentioned above shall also be carried out, if required, by the bidder for the facilities under his scope.

CLAUSE NO.	PROJECT INFORMATION

Annexure-III

SOIL DATA AND FOUNDATION SYSTEM

Employer has carried out geotechnical investigation in the areas near to this package. Logs of representative boreholes to be used for bidder's information in the vicinity of proposed area are enclosed with this Annexure-II. The bidder is required to carry out geotechnical investigation as per the clause no. 7.07.00 and ascertain the pile capacity and bearing capacity. The onus of correct assessment / interpretation and understanding of the existing subsoil condition / data is on the Bidder. Ground water table is encountered at a depth of about 11.0 to 13.0m below natural ground level (NGL) at the time of investigation. Fluctuation may occur in ground water table due to seasonal variation. The natural ground level is varying as per enclosed contour/spot level drawing.

a) The foundation system to be adopted for different structures shall be as given in Table – i below

Table – i: Net Allowable Bearing Pressure

STRUCTURE	TYPE OF FOUNDATION TO BE ADOPTED
FGD and related structures	Open/Piles

b) During design the Allowable Bearing Pressure shall be as furnished in Table-ii. Bidder is required to carry out geotechnical investigation in this area. The allowable bearing pressure shall be adopted after approval of geotechnical investigation report by owner. However, the maximum allowable bearing pressure shall be as per the approved geotechnical report and shall be limited to the values as furnished in Table-ii.

Table – ii: Net Allowable Bearing Pressure

Structure	Founding Level in RL	Net Allowable Bearing Pressure T/m^2		
		Isolated / Strip		Rafts (width > 6m) for 75mm settlement
		width upto 6 m for 25mm settlement	Width upto 6m for 40mm settlement	
FGD and related structures	2.5 m below NGL	8.0	9.0	10.0
	3.5 m	10.0	12.0	14.0

	below NGL			
	4.5 m below NGL	12.0	15.0	17.0

The net allowable bearing pressure higher than above mentioned values shall not be permitted. At intermediate levels the bearing capacity shall be same as the net allowable bearing pressure corresponding to the immediate shallower level mentioned above.

c) Permissible Settlement of Foundations:

For open foundations, the total permissible settlement and differential settlement shall be governed by IS: 1904 and from functional requirements whichever is more stringent. However, total settlement shall be restricted to the following:

Isolated, Strip & Raft (Mill foundations/machine foundation)	25 mm
Isolated & Strip (Other than Mill foundations/machine foundation)	40 mm
Raft (widths greater than 6 m) (Other than Mill foundations/machine foundation)	75 mm

In case the total permissible settlement is to be restricted to less than as above specified from functional requirements, then the net allowable bearing pressure shall be reduced after review in consultation with Engineer.

d) The diameter of pile, minimum length and maximum allowable capacity of piles shall be as given below:

Area/ Location	Pile Diameter (mm)	Minimum Length of Bored Pile Below Cut-off Level (m)	Safe Load Capacity in		
			Vertical Comp. (MT)	Pullout (MT)	Lateral (MT)
FGD and related structures	600	18.0	140.0	45.0	7.0
	760	19.0	250	75.0	12.5

- Cut off Level (COL) is assumed at 3.0 m below FGL (RL(+) 127.0m). If the COL is shallower than the assumed COL, then the length of the pile shall be increased accordingly.

CLAUSE NO.	PROJECT INFORMATION

e) The criteria for Pile Termination (founding level) shall be as given below:

The termination level of the pile shall be decided based on the following criterion

i) Minimum length of the pile below COL (cut off level) shall be as specified above

ii) The minimum pile length for each group of piles shall be determined based on the nearest borelog. Pile shall be socketed into yellowish weathered sand stone. A socketing length of four (4) times the diameter of the pile into rock with rock core recovery ≥ 20% shall be ensured for 600 mm & 760 mm dia piles. For pile termination, SPT 'N' values shall be used from the nearby borelog data. The boreholes are in the bidder's scope and shall be conducted as per the enclosed scheme.

iii) However, in no case the length of pile shall be less than the minimum length determined as in (i) or (ii) above whichever is longer, for that pile group.

g) Special Requirements:

i) Chemicals in ground water and subsoil, as observed during investigation are:

Chemical	SO_3	Chlorides	pH
Ground Water	18 to 30 ppm	50-82 ppm	7.26 – 7.44
Sub-soil	0.011 to 0.023 %	0.02 to 0.064 %	7.3 – 7.62

ii) In view of the above, the following shall be adopted.

Cement Type	As specified elsewhere in the specifications
Concrete Grade	As specified elsewhere in the specifications
Type of Reinforcement	As specified elsewhere in the specifications
Cover to Reinforcement	As specified elsewhere in the specifications

CLAUSE NO.	PROJECT INFORMATION

TABLE-1

COAL CHARACTERISTICS

Sl. No.	Description	Symbol	Design Coal	Worst Coal	Best Coal	Range of Adequacy Coal
1	2	3	4	5	6	7
A.	**PROXIMATE ANALYSIS** (As received basis)					
1.	Total Moisture	%	15.00	17.00	12.00	12.00-17.00
2.	Ash	%	43.00	47.00	38.00	36.00-49.00
3.	Volatile matter	%	20.00	18.00	22.00	25.00-15.00
4.	Fixed carbon	%	22.00	18.00	28.00	37.00-17.00
B.	**ULTIMATE ANALYSIS** (As received basis)					
1.	Carbon	C%	30.77	25.97	39.08	41.11-24.35
2.	Hydrogen	H2%	3.4	2.85	3.5	3.60-2.87
3.	Nitrogen	N2%	0.7	0.45	0.55	0.55-0.40
4.	Oxygen (By difference)	O2%	6.2	5.6	6.07	6.1-5.5
5.	Sulphur	S%	0.4	0.50	0.36	0.30-0.50
6.	Carbonates	CO3%	0.50	0.60	0.40	0.30-0.35
7.	Phosphorous	P2%	0.03	0.03	0.04	0.04-0.03
8.	Total Moisture	H2O%	15.00	17.00	12.00	12.00-17.00
9.	Ash	%	43.00	47.00	38.00	36.00-49.00
10.	Gross Calorific Value	KCal/Kg	3300	2800	4000	4200–2700
11.	Hard grove index		55	50	60	45-65
C.	**ASH ANALYSIS**					
1.	Silica	(SiO2)%	59.79	61.30	56.70	62-56
2.	Alumina	(Al2O3)%	25.36	28.00	23.50	28-23
3.	Iron Oxide	(Fe2O3)%	7.20	6.00	10.00	6-10

CLAUSE NO.	PROJECT INFORMATION

Sl. No.	Description	Symbol	Design Coal	Worst Coal	Best Coal	Range of Adequacy Coal
1	2	3	4	5	6	7
4.	Titania	(TiO2)%	1.2	1.00	1.50	1-1.7
5.	Phosphoric Anhydride	(P2O5)%	2.6	1.5	3	1-3
6.	Lime	(CaO)%	0.88	0.5	1.50	0.5-1.7
7.	Magnesia	(MgO)%	0.55	0.4	1	0.4-1.1
8.	Sulphuric Anhydride	(SO3)%	1.2	0.5	1.4	0.5-1.7
9.	Alkalies (By Difference)	(Na2O+K2O)%	1.22	0.8	1.4	0.6-0.8
	Note: Na2O content in the above shall not be more than 0.1%					
D.	**ASHFUSIONRANGE** (Under reducing atmosphere)					
a)	Initial Deformation Temperature (IDT)	°C	1150	1200	1100	1100-1200
b)	Hemispherical temperature	°C	1350	1450	1300	1300-1400
c)	Flow temperature	°C	1400	1400	1400	1400-1450

CLAUSE NO.	PROJECT INFORMATION

TABLE –2A

FUEL OIL CHARACTERISTICS

Sl. No.	Characteristics	Heavy Furnace Oil grade HV (HFO) IS-1593-1982	Low Sulphur Heavy Stock (LSHS) IS-11489-1985	Heavy Petroleum stock (HPS) IS-11489-1985
1.	Total sulphur content	4.5% Max.	1.0% Max.	4.5% Max.
2.	Gross calorific value (KCal/kg)	of the order of 10,000	of the order of 10,000	of the order of 10,000
3.	Flash Point (Min)	66 deg C	76 deg C	66 deg C
4.	Water content by volume (Max)	1.0%	1.0%	1.0%
5.	Sediment by weight (Max)	0.25%	0.25%	0.25%
6.	Asphaltene content by weight (Max.)	2.5%	2.5%	2.5%
7.	Kinematic viscosity in Centistokes	370 at 50deg C	100 at 100deg C	100 at 100deg C
8.	Ash Content by weight (Max.)	0.1%	0.1%	0.1%
9.	Acidity (inorganic)	Nil	Nil	Nil
10.	Pour Point (Max.)	57 deg C	66 deg C	72 deg C
11.	Sodium content	—	—	100 ppm
12.	Vanadium content	25 ppm	25ppm	25 ppm
13.	Specific heat below pour point (KCal/Kg °C)		0.65	

CLAUSE NO.	PROJECT INFORMATION

TABLE –2B

LIGHT DIESEL OIL CHARACTERISTICS

AS PER IS 1460-2000

	Characteristics	LDO
1.	Pour Point (max)	21 deg.C& 12°C for Summer and Winter respectively
2.	Kinematic viscosity in centistokes at 40 deg.C	2.5 to 15.7
3.	Sediment percent by mass (max)	0.10
4.	Total sulphur percent by mass (max)	1.8
5.	Ash percentage by mass (max)	0.02
6.	Carbon residue (Rans bottom) percent by pass (max.)	1.50
7.	Acidity in organic	Nil
8.	Flash point(Min.) - Pensky Martens	66 deg.C
9.	Copper strip corrosion for 3 hours at 100°C	Not worse than No. 2
10.	Water content, % by volume(max)	0.25
11.	GCV (Kcal/kg)	10,000

CLAUSE NO.	PROJECT INFORMATION

Table-3

DESIGN CLARIFIED WATER ANALYSIS

S.No	Constituent	As	mg/l (except pH & turbidity)
1.	Calcium	$CaCO_3$	131
2.	Magnesium	$CaCO_3$	52
3.	Sodium + Potassium	$CaCO_3$	65
4.	Total Cations	$CaCO_3$	248
5.	Chloride	$CaCO_3$	20
6.	Sulphate	$CaCO_3$	93
7.	Nitrate	$CaCO_3$	10
8.	Alkalinity	$CaCO_3$	125
9.	Total Anions	$CaCO_3$	248
10.	Iron(total)	Fe	0.3
11.	Total Silica	SiO_2	22
12.	pH value	---	7.0-8.2
13.	Turbidity	NTU	10

Note: Clarified water is used for CW system as make up & the CW system is expected to operate at about 5.0 – 5.5 Cycles of Concentration (COC) with suitable chemical treatment program using acid, scale & corrosion inhibitor dozing. As CW blow down water is tapped from CW system, the water quality of CW blow down shall accordingly be arrived by the bidder.

Table-4

ANALYSIS OF DM WATER

Sl.No.	Characteristics	Value
1.	Silica (Max.)	0.02 ppm as SiO2
2.	Iron as Fe	Nil
3.	Total hardness	Nil
4.	pH value	6.8 to 7.2
5.	Conductivity	Not more than 0.1 μs/cm

CLAUSE NO.	PROJECT INFORMATION

Table-5

STEAM GENERATOR DATA

1.	Location	Outdoor
2.	Operation	Base load
3.	Type	Pulverised coal fired
4.	Maximum Continuous Rating	810 Tons/hr.
5.	Steam pressure at SH outlet	155 Kg/cm²(a)
6.	Steam temperature at SH outlet	540°C
7.	Oil for start up and flame stabilization	Heavy Oil/LSHS/HPS/LDO
8.	Fuel oil system sizing	30% of Boiler MCR for Heavy oil/ LSHS/HPS (7.5% for LDO)
9.	Pulverised coal size and 99% thru 50 mesh	Minimum 70% through 200 Mesh
10.	Type of pulveriser	Vertical spindle mills
11.	Type of oil burners	Steam atomised, (Air atomised for LDO)
12.	No. of air heaters	Two (2) nos. of Tri-sector type
13.	No. of ID Fans	Two (Radial type, both working)

2.00.00 ESP DATA

1.	Location:	Downstream side of Air preheaters
2.	Operation:	Base load
3.	Type:	Rigid Discharge frame
4.	Rapping:	Intermittent

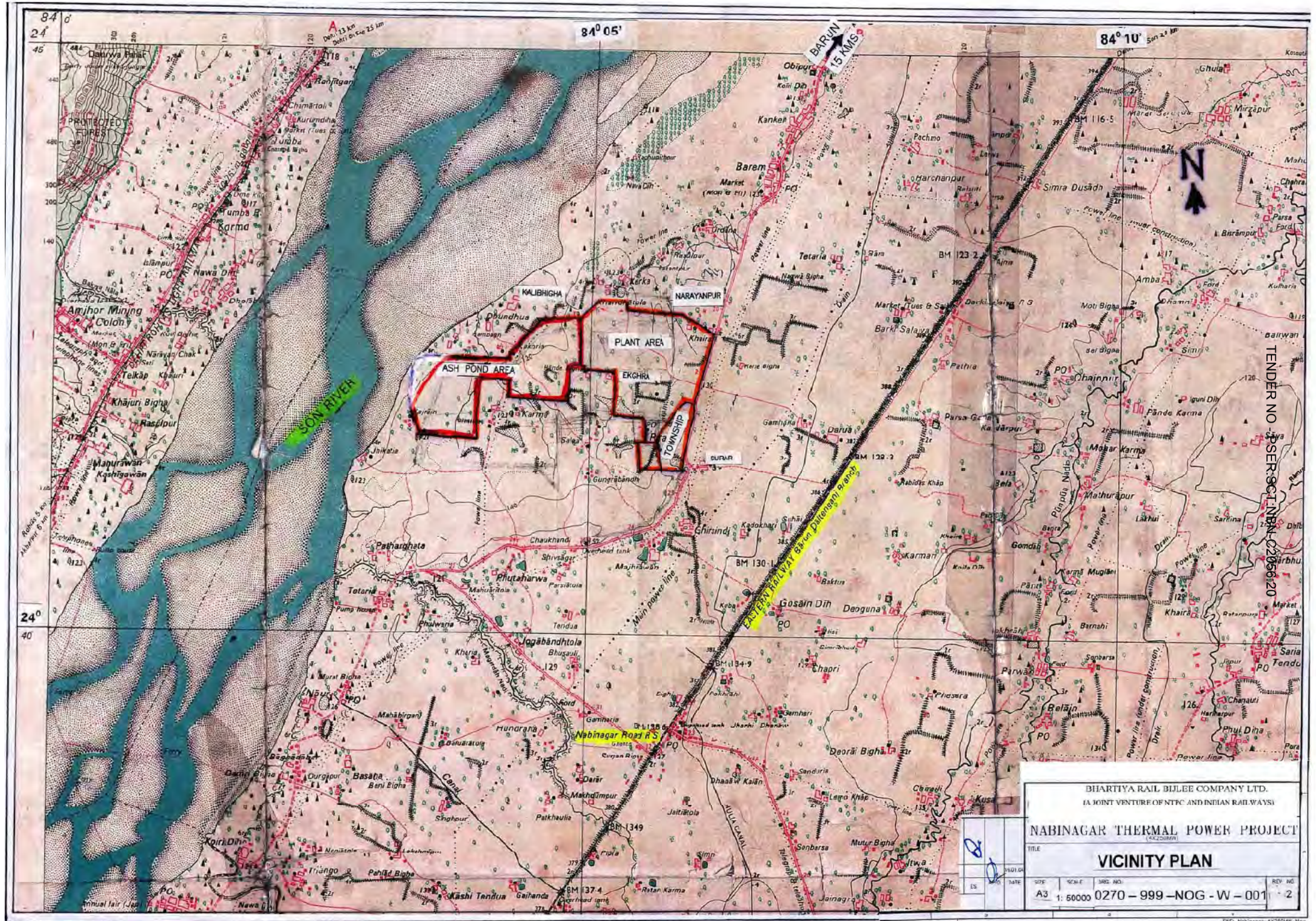
CLAUSE NO.	PROJECT INFORMATION

TABLE-6

List of Drawings enclosed in this sub-section:

Sl.No.	Drawing Description	Drawing No.
1.	General Layout Plan	Enclosed
2.	Topographical Survey	Enclosed
3.	Equipment Layout Plan	Enclosed
4.	ID system-Elevation & Plan	Enclosed
5.	Pipe Cable Trestle Layout	Not located near FGD area
6.	Pipe Cable Trestle Foundation	Not located near FGD area
7.	Chimney foundation details	

	Chimney shell outer diameter at ground level (m)	Chimney foundation outer diameter (m)	Type of foundation	Level of Top of foundation (m)	Level of Bottom of foundation (m)
Unit #1&2	28	42.1	Raft supported on piles	RL(+) 126.00	RL(+) 122.25
Unit #3&4	28	42.1	Raft supported on piles	RL(+) 126.00	RL(+) 122.25



TENDER NO - CSER-SCT-NBN-C2056/20

BHARTIYA RAIL BIJLEE COMPANY LTD.
(A JOINT VENTURE OF NTPC AND INDIAN RAILWAYS)

NABINAGAR THERMAL POWER PROJECT (4X250MW)

TITLE

VICINITY PLAN

SIZE	SCALE	DRG. NO.	REV. NO.
A3	1: 50000	0270 – 999 –NOG - W – 001	2

FILE: Nabinagar-4X250MW-New

Annexure 2

जलवायवी सारणी
CLIMATOLOGICAL TABLE

स्टेशन : देहरी
STATION : Dehrl

अक्षांश LAT 24°55′ N देशांतर LONG 84°11′ E समुद्री तल मध्य से ऊँचाई HEIGHT ABOVE M. S. L. 107 METRES

1951 से 1980 तक के प्रेक्षणों पर आधारित
BASED ON OBSERVATIONS FROM 1951 TO 1980

माह		स्टेशन का सतह दाब	वायु तापमान — मध्य: शुष्क बल्ब	नम बल्ब	दैनिक अधिकतम	दैनिक न्यूनतम	माह में उच्चतम	माह में निम्नतम	चरम: उच्चतम	दिनांक और वर्ष	निम्नतम	दिनांक और वर्ष	आर्द्रता: सापेक्ष आर्द्रता	वाष्प दाब	मेघ की मात्रा: समस्त मेघ	निम्न मेघ	वर्षा: मासिक योग	वर्षा के दिनों की संख्या	संलग्न सबसे नम महीने का योग	संलग्न शुष्कतम महीने का योग	24 घंटों की सबसे भारी वर्षा	दिनांक और वर्ष	मध्य पवन गति
			AIR TEMPERATURE — MEAN: DRY BULB	WET BULB	DAILY MAX	DAILY MIN	HIGHEST IN THE MONTH	LOWEST IN THE MONTH	EXTREMES: HIGHEST	DATE AND YEAR	LOWEST	DATE AND YEAR	HUMIDITY: RELATIVE HUMIDITY	VAPOUR PRESSURE	CLOUD AMOUNT: ALL CLOUDS	LOW CLOUDS	RAINFALL: MONTHLY TOTAL	NO. OF RAINY DAYS	TOTAL IN WETTEST MONTH WITH YEAR	TOTAL IN DRIEST MONTH WITH YEAR	HEAVIEST FALL IN 24 HOURS	DATE AND YEAR	MEAN WIND SPEED
MONTH		STATION LEVEL PRESSURE	hPa	°C	°C	°C	°C	°C	°C		°C		%	hPa	Oktas of sky		mm		mm	mm	mm		Kmph
जनवरी JAN	I	1004.9	15.1	12.6	23.6	10.1	27.9	6.1	30.6	28 1958	-1.0	18 1977	74	12.7	1.7	0.9	17.5	1.7	94.0 1930	0.0	65.0	27 1950	3.9
	II	1001.4	21.5	15.3									49	12.5	1.6	1.1							
फरवरी FEB	I	1002.5	18.5	14.3	27.1	12.9	32.2	8.3	35.3	23 1964	3.0	15 1974	62	12.9	1.5	0.7	11.2	1.3	103.9 1907	0.0	52.6	05 1915	4.9
	II	998.9	25.3	16.8									40	12.5	1.3	0.7							
मार्च MAR	I	999.3	24.5	17.2	33.2	17.7	38.5	12.7	41.5	31 1973	6.8	03 1976	46	13.7	1.6	0.5	11.7	1.2	88.9 1944	0.0	43.7	16 1944	5.8
	II	995.1	31.5	19.0									27	12.0	1.3	0.8							
अप्रैल APR	I	995.2	30.9	20.2	38.9	23.1	42.7	17.8	44.4	23 @ 1973	10.3	04 1976	35	15.2	1.3	0.3	7.2	0.7	48.3 1914	0.0	43.2	08 1914	6.8
	II	990.8	36.9	21.5									22	13.3	1.3	0.4							
मई MAY	I	990.7	33.3	23.2	41.1	26.2	44.7	21.3	46.7	21 1951	12.8	16 1976	41	20.2	1.2	0.4	16.8	1.2	103.4 1914	0.0	96.0	31 1914	6.6
	II	986.5	38.8	23.9									27	17.7	1.1	0.3							
जून JUN	I	987.0	32.2	25.8	38.5	26.7	44.0	22.7	47.2	09 1966	14.8	15 1976	61	28.2	3.9	2.0	109.5	6.0	505.4 1961	0.0	220.0	13 1961	6.4
	II	983.5	35.5	26.1									49	26.3	4.3	2.7							
जुलाई JUL	I	987.2	29.2	26.5	33.4	25.2	37.8	22.4	42.2	01 1962	15.3	15 1976	81	32.5	6.4	4.8	315.2	14.5	655.8 1922	55.1 1903	202.4	01 1925	5.8
	II	984.3	31.1	27.0									73	32.5	6.3	4.9							
अगस्त AUG	I	988.6	28.6	26.6	32.3	25.0	35.0	22.7	39.4	03 1972	15.8	25 1976	85	33.0	6.2	4.9	277.8	15.0	748.3 1948	78.6 1979	254.5	14 1910	4.9
	II	985.4	30.2	27.1									79	33.4	6.2	5.1							
सितम्बर SEP	I	992.7	28.5	25.9	32.2	24.4	34.9	22.0	37.1	12 1979	14.0	19 1976	81	31.4	4.8	3.5	193.7	9.4	771.7 1976	25.1 1928	218.4	12 1936	4.6
	II	989.0	29.9	26.5									77	32.0	4.9	3.8							
अक्तूबर OCT	I	998.8	26.6	23.1	31.9	20.9	34.4	16.7	37.1	14 1974	9.3	31 1976	73	25.5	1.9	1.2	48.0	3.1	240.3 1928	0.0	153.7	06 1928	3.2
	II	995.2	29.3	24.2									65	26.1	1.9	1.3							
नवम्बर NOV	I	1003.2	21.3	17.6	29.2	14.6	31.9	10.7	35.1	07 1977	2.8	30 1975	68	17.3	1.3	0.5	7.7	0.4	105.2 1915	0.0	100.8	19 1915	2.8
	II	999.7	26.0	19.6									53	18.0	1.0	0.5							
दिसम्बर DEC	I	1005.3	16.2	13.6	25.1	10.9	28.2	7.1	31.7	01 1952	0.3	22 1976	74	13.7	1.3	0.4	4.9	0.6	47.7 1913	0.0	21.6	21 1940	3.1
	II	1001.7	22.3	16.1									49	13.1	1.2	0.4							
वार्षिक योग या मध्य ANNUAL TOTAL OR MEAN	I	996.3	25.4	20.6	32.2	19.8	45.1	5.4	47.2		-1.0		65	21.4	2.8	1.7	1038.9	55.1	1789.8 1961	530.1 1966	254.5		4.9
	II	992.6	29.9	21.9									51	20.8	2.7	1.8							
वर्षों की सं NUMBER OF YEARS	I	30	30	30	30	30	30	30	36		35		30	30	30	23	28	28	78	78	78		30
	II	30	30	30									30	30	30	22							

जलवायवी सारणी
CLIMATOLOGICAL TABLE

1980

स्टेशन :देहरी
STATION : Dehri

महीना MONTH	मौसम परिघटना — के साथ दिनों की संख्या — WEATHER PHENOMENA — No. OF DAYS WITH						पवन — पवन की गति के साथ दिनों की संख्या (कि.मी. प्र. घं.) — WIND — No. OF DAYS WITH WIND SPEED (Km. p. h.)				पवन की दिशा के दिनों की संख्या का प्रतिशत — PERCENTAGE No. OF DAYS WIND FROM										मेघ — मेघ मात्रा (सभी मेघ) सहित दिनों की संख्या - अष्टमांश — CLOUD — No. OF DAYS WITH CLOUD AMOUNT (ALL CLOUDS) OKTAS					मेघ — निम्न स्तरी मेघ मात्रा सहित दिनों की संख्या - अष्टमांश — No. OF DAYS WITH LOW CLOUD AMOUNT OKTAS						दृश्यता — दृश्यता सहित दिनों की संख्या — VISIBILITY — No. OF DAYS WITH VISIBILITY				
	वर्षण 0.3 मि.मी.या अधिक PPT 0.3mm or more	ओले HAIL	गर्जन THUNDER	कुहरा FOG	धूल भरी आंधी DUST STORM	सोंह रहित SOUALL	62 या अधिक 62 or more	20-61	1-19	0	उ N	उ-पू NE	पू E	द-पू SE	द S	द-प SW	प W	उ-प NW	शांत CALM	0	1-2	3-5	6-7	8	0	1-2	3-5	6-7	8	कुहरा FOG	1 कि.मी. तक UP TO 1 Km	1-4 कि.मी. 1-4 Kms	4-10 कि.मी. 4-10 Kms	10-20 कि.मी. 10-20 Kms	20 कि.मी. से अधिक OVER 20 Kms
जनवरी I JAN II	2.3	0.1	0.4	0.1	0.0	0.0	0	0	30	1	2	3	4	11	20	40	9	6	5	23	0	2	2	4	27	0	0	1	3	0	0.1	0.4	0.5	4.0	26.0
							0	0	30	1	18	11	5	1	2	6	34	17	6	24	0	1	2	4	27	0	0	1	3	0	0.0	0.1	0.1	0.7	30.1
फरवरी I FEB II	2.1	0.0	0.2	0.2	0.0	0.0	0	0	28	0	3	3	4	9	17	40	16	7	1	21	0	2	2	3	26	0	0	0	2	0	0.3	0.1	0.3	1.9	25.4
							0	0	28	0	13	8	5	2	2	4	43	21	2	22	0	1	2	3	25	0	0	1	2	0	0.0	0.0	0.0	0.6	27.4
मार्च I MAR II	1.6	0.0	0.6	0.1	0.0	0.0	0	0	31	0	3	3	4	10	15	41	18	5	1	23	0	3	2	3	28	0	0	0	2	1	0.0	0.1	0.1	0.9	29.9
							0	0	31	0	8	9	4	2	2	5	50	20	0	24	0	2	2	3	29	0	0	0	2	0	0.0	0.2	0.2	1.5	29.1
अप्रैल I APR II	1.0	0.0	0.4	0.0	0.1	0.0	0	0	29	1	3	4	9	12	14	31	16	8	3	22	1	3	2	2	29	0	0	0	1	0	0.0	0.0	0.0	1.1	28.9
							0	0	30	0	6	11	6	3	2	6	43	22	1	24	0	2	2	2	29	0	0	0	1	0	0.0	0.0	0.1	0.3	29.6
मई I MAY II	1.7	0.0	0.6	0.0	0.2	0.0	0	0	31	0	5	12	14	17	9	21	12	8	2	25	0	2	2	2	30	0	0	0	1	0	0.0	0.0	0.0	0.2	30.8
							0	0	31	0	9	23	10	2	2	5	28	21	0	25	0	2	2	2	30	0	0	0	1	0	0.0	0.0	0.0	0.2	30.8
जून I JUN II	7.2	0.0	0.9	0.0	0.0	0.0	0	0	29	1	8	11	17	19	8	15	13	6	3	11	0	5	5	9	22	0	1	2	5	0	0.0	0.0	0.4	1.9	27.7
							0	0	30	0	10	20	21	8	2	8	19	11	1	12	0	3	5	10	19	0	1	2	7	1	0.0	0.1	0.4	2.3	27.2
जुलाई I JUL II	16.9	0.0	3.1	0.0	0.0	0.0	0	0	30	1	5	7	16	23	10	19	10	6	4	2	0	6	7	16	10	0	2	4	15	0	0.0	0.0	0.3	3.9	26.8
							0	0	30	1	11	13	20	12	6	11	17	6	4	2	1	5	7	16	10	0	2	5	14	0	0.0	0.0	0.5	5.8	24.7
अगस्त I AUG II	17.6	0.0	5.1	0.0	0.0	0.0	0	0	30	1	5	7	18	27	10	14	10	7	2	2	0	6	9	14	10	0	2	6	13	0	0.0	0.6	0.7	2.7	27.0
							0	0	30	1	10	15	22	10	4	9	19	8	3	3	0	5	8	15	10	0	2	6	13	0	0.0	0.7	1.0	3.6	25.7
सितम्बर I SEP II	11.5	0.0	3.6	0.0	0.0	0.0	0	0	29	1	6	7	16	24	11	11	12	9	4	7	1	5	7	10	15	0	2	4	9	0	0.0	0.1	0.5	2.5	26.9
							0	0	30	0	15	16	19	9	3	4	19	12	3	8	1	5	6	10	13	1	2	4	10	0	0.0	0.1	0.2	3.3	26.4
अक्तूबर I OCT II	4.0	0.0	1.0	0.3	0.0	0.0	0	0	30	1	4	5	10	20	19	26	8	5	3	20	1	3	3	4	26	0	1	1	3	0	0.0	0.1	0.3	0.9	29.7
							0	0	29	2	18	15	12	3	3	5	23	11	10	21	1	3	2	4	25	0	1	1	4	0	0.0	0.0	0.3	0.7	30.0
नवम्बर I NOV II	0.5	0.0	0.0	0.1	0.0	0.0	0	0	29	1	4	3	6	13	21	39	8	3	3	24	0	2	2	2	29	0	0	0	1	0	0.0	0.0	0.3	1.1	28.6
							0	0	28	2	25	11	5	1	2	7	23	15	11	25	0	1	1	2	26	0	0	1	1	0	0.0	0.0	0.2	0.4	29.4
दिसम्बर I DEC II	0.7	0.0	0.0	0.3	0.0	0.0	0	0	30	1	2	2	4	11	23	41	9	5	3	24	0	2	3	2	30	0	0	0	1	0	0.1	0.1	0.7	1.5	28.6
							0	0	29	2	18	9	2	1	2	5	40	16	7	25	0	2	2	2	29	0	0	1	1	0	0.0	0.0	0.1	0.5	30.4
वार्षिक योग या माध्य ANNUAL TOTAL I	67.1	0.1	15.9	1.1	0.3	0.0	0	0	356	9	4	6	10	16	15	28	12	6	3	204	3	41	46	71	282	0	8	18	56	1	0.5	1.5	1.1	22.6	336.3
OR MEAN II							0	0	356	9	13	13	11	5	3	6	30	15	4	215	3	32	42	73	274	1	8	22	59	1	0.0	1.2	3.1	19.9	340.8
वर्षों की सं। NUMBER OF YEARS I	28						24				29									28					28						28							
II							24				29									27					27						27							

ANNEXURE-IV

CLIENT : **NTPC LIMITED**

PROJECT : Geotechnical Investigation for 4 X 250MW Nabinagar Thermal Power Project at Nabinagar

BORE HOLE NO.	: BH-85	SHEET NO.	: 1 OF 3
CO-ORDINATE	: N 1553.73,W 958.78	DATE	: 30/04/2009 to 07/05/2009
LOCATION	: Ash Handling	METHOD	: ROTARY DRILLING.
GROUND R. L.	: 127.955m.	CASING	: 150mm.Ø upto 19.80 m. Below G.L
GROUND W. T.	: 12.85m. Below GL.		

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	C R %	RQD %	CORRECTED SPT 'N'
1.00	150 mm Ø		Brownish, silty CLAY	0.00									
				1.50/									
2.00				1.95	SPT1	05	07	11	--	18			
3.00				3.00/									
				3.50	UDS1								
4.00				4.50									
5.00			Very stiff to hard, yellowish brown, sandy CLAY with gravel	4.95	SPT2	07	09	14	--	23			
6.00				6.00/									
				6.40	UDS2								
7.00				7.50/									
8.00				7.95	SPT3	17	19	29	--	48			
9.00				9.00/									
				9.25	UDS3								
10.00													

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE
UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

REMARKS : CONTINUED ON NEXT PAGE.

DBM GEOTECHNICS AND CONSTRUCTIONS PVT. LTD. MUMBAI.

SCALE : 1: 50
JOB NO. : 2263
Checked By : Ravi Achari
Drawn By: Sandeep

CLIENT : **NTPC LIMITED**

PROJECT : Geotechnical Investigation for 4 X 250MW Nabinagar Thermal Power Project at Nabinagar

BORE HOLE NO. : BH-85 | SHEET NO. : 2 OF 3

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm				SPT N	CR %	RQD %	CORRECTED SPT 'N'
11.00	150 mm Ø		Hard, yellowish brown, sandy CLAY with gravel	10.50/									
				10.95	SPT4	18	29	37	--	66			
12.00				12.00/									
				12.18	UDS4								
13.00				13.50/									
				13.95	SPT5	21	34	39	--	73			
14.00				15.00/									
15.00				15.10	UDS5								
16.00				16.50/									
				16.95	SPT6	24	26	31	--	57			
17.00				18.00/									
18.00				18.18	UDS6								
19.00				19.50/		15	15	07	--	N			
20.00	NX		Highly weathered reddish brown SANDSTONE	19.87	SPT7	29	46	62	--	R	24	NIL	
21.00													

SPT N =STANDARD PENETRATION TEST VALUE | RQD = ROCK QUALITY DESIGNATION | UDS = UNDISTURBED SOIL SAMPLE

CR = CORE RECOVERY | DS = DISTURBED SOIL SAMPLE | VST = VANE SHEAR TEST

REMARKS : CONTINUED ON NEXT PAGE

SCALE : 1: 50 | Checked By : Ravi Achari | Drawn By: Sandeep

JOB NO. : 2263

DBM GEOTECHNICS AND CONSTRUCTIONS PVT. LTD. MUMBAI.

CLIENT : **NTPC LIMITED**

PROJECT : Geotechnical Investigation for 4 X 250MW Nabinagar Thermal Power Project at Nabinagar

BORE HOLE NO. : BH-85 | SHEET NO. : 3 OF 3

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	C R %	RQD %	CORRECTED SPT 'N'
21.00	NX		Highly weathered reddish brown SANDSTONE	21.00							24	NIL	
22.00			Highly weathered, brownish, jointed SANDSTONE	22.50							22	14	
23.00													
24.00				24.00							23	NIL	
25.00				25.00							27	NIL	
26.00													
27.00													
28.00													
29.00													
30.00													
31.00													

SPT N =STANDARD PENETRATION TEST VALUE | RQD = ROCK QUALITY DESIGNATION | UDS = UNDISTURBED SOIL SAMPLE

CR = CORE RECOVERY | DS = DISTURBED SOIL SAMPLE | VST = VANE SHEAR TEST

REMARKS : BORE HOLE IS TERMINATED AT DEPTH 25.00 m. BELOW G. L.

DBM GEOTECHNICS AND CONSTRUCTIONS PVT. LTD. MUMBAI.

SCALE : 1: 50 | JOB NO. : 2263 | Checked By : Ravi Achari | Drawn By: Sandeep

CLIENT : **NTPC LIMITED**

PROJECT : Geotechnical Investigation for 4 X 250MW Nabinagar Thermal Power Project at Nabinagar

BORE HOLE NO.	: BH-86	SHEET NO.	: 1 OF 3
CO-ORDINATE	: N 1557.12,W 868.84	DATE	: 16/02/2009 to 25/02/2009
LOCATION	: ASH HANDLING	METHOD	: ROTARY DRILLING.
GROUND R. L.	: 129.365m.	CASING	: 150mm.Ø upto 21.15 m. Below G.L
GROUND W. T.	: 12.90 Below G.L		

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm				SPT N	C R %	RQD %	CORRECTED SPT 'N'
						15	15	15	15				
1.00	150 mm Ø		Stiff, brownish silty CLAY	0.00									
				1.50/		15	05	07	--	N			
2.00				1.95	SPT1	03	05	07	--	12			
3.00				3.00/									
				3.50	UDS1								
4.00				4.50									
5.00			Very stiff, yellowish brown, sandy CLAY with gravel	4.95	SPT2	06	09	19	--	28			
6.00				6.00/									
				6.50	UDS2								
7.00				7.50/									
8.00				7.95	SPT2	07	10	23	--	33			
9.00			Hard, yellowish brown, sandy CLAY with gravel	9.00/									
				9.47	UDS3								
10.00													

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY
RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE
UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

REMARKS : CONTINUED ON NEXT PAGE.

DBM GEOTECHNICS AND CONSTRUCTIONS PVT. LTD. MUMBAI.

SCALE : 1: 50
JOB NO. : 2263
Checked By :
Drawn By: Sandeep

CLIENT : **NTPC LIMITED**

PROJECT : Geotechnical Investigation for 4 X 250MW Nabinagar Thermal Power Project at Nabinagar

BORE HOLE NO. : BH-86 | SHEET NO. : 2 OF 3

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	C R %	RQD %	CORRECTED SPT 'N'
11.00	150 mm Ø		Very stiff to hard, yellowish brown, sandy CLAY with gravel	10.50/									
				10.95	SPT2	08	21	25	--	46			
12.00				12.00/									
				12.40	UDS4								
13.00				13.50/									
14.00				13.95	SPT2	10	26	31		57			
15.00				15.00/									
				15.36	UDS5								
16.00				16.50/									
17.00				16.95	SPT6	10	28	34		62			
18.00				18.00/									
19.00			Dense, yellowish brown, silty SAND with gravel	18.22	UDS6								
				19.50/									
20.00				19.95	SPT7	16	21	40	--	61			
21.00													

SPT N =STANDARD PENETRATION TEST VALUE | RQD = ROCK QUALITY DESIGNATION | UDS = UNDISTURBED SOIL SAMPLE

CR = CORE RECOVERY | DS = DISTURBED SOIL SAMPLE | VST = VANE SHEAR TEST

REMARKS : CONTINUED ON NEXT PAGE

DBM GEOTECHNICS AND CONSTRUCTIONS PVT. LTD. MUMBAI.

SCALE : 1: 50 | JOB NO. : 2263 | Checked By : Ravi Achari | Drawn By: Sandeep

CLIENT : **NTPC LIMITED**

PROJECT : Geotechnical Investigation for 4 X 250MW Nabinagar Thermal Power Project at Nabinagar

BORE HOLE NO. : BH-86 | SHEET NO. : 3 OF 3

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm				SPT N	C R %	RQD %	CORRECTED SPT 'N'
						15	15	15	15				
21.00	150 mm Ø		Completely weathered, yellowish brown SANDSTONE	21.00/		15	00	--					
				21.15	SPT8	48	52	--	--	R			
22.00	NX		Highly weathered, reddish brown, jointed, SANDSTONE	22.50							20	NIL	
23.00													
24.00				24.00							32	NIL	
25.00				25.00							33	NIL	
26.00													
27.00													
28.00													
29.00													
30.00													
31.00													

SPT N =STANDARD PENETRATION TEST VALUE | RQD = ROCK QUALITY DESIGNATION | UDS = UNDISTURBED SOIL SAMPLE

CR = CORE RECOVERY | DS = DISTURBED SOIL SAMPLE | VST = VANE SHEAR TEST

REMARKS : BORE HOLE IS TERMINATED AT DEPTH 25.00 m. BELOW G. L.

DBM GEOTECHNICS AND CONSTRUCTIONS PVT. LTD. MUMBAI.

SCALE : 1: 50 | JOB NO. : 2263 | Checked By : Ravi Achari | Drawn By: Sandeep

CLIENT : **NTPC LIMITED**

PROJECT : Geotechnical Investigation for 4 X 250MW Nabinagar Thermal Power Project at Nabinagar

BORE HOLE NO.	: BH-87	SHEET NO.	: 1 OF 3
CO-ORDINATE	: N 1555.79,W786.38	DATE	: 13/01/2009 to 18/01/2009
LOCATION	: ASH HANDLING	METHOD	: ROTARY DRILLING.
GROUND R. L.	: 129.384m.	CASING	: 150mm.Ø upto 21.40 m. Below G.L
GROUND W. T.	: 11.40 Below G.L		

DEPTH (m.)	DIA. OF BORE HOLE	LOG	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm				SPT N	C R %	RQD %	CORRECTED SPT 'N'
				0.00									
1.00			Stiff, brownish silty CLAY	1.50/		15	15	15					
2.00				1.95	SPT1	04	06	08	--	14			
3.00				3.00/									
			CH	3.50	UDS1								
4.00	150 mm Ø			4.50		15	15	15					
5.00			Very stiff yellowish brown silty CLAY with gravel.	4.95	SPT2	05	08	12	--	20			
6.00				6.00/									
				6.45	UDS2								
7.00				7.50/		15	15	15					
8.00				7.95	SPT3	08	12	15	--	27			
9.00			Hard, yellowish brown,sandy silty CLAY with gravel.	9.00/									
			CH	9.45	UDS3								
10.00													

SPT N =STANDARD PENETRATION TEST VALUE | RQD = ROCK QUALITY DESIGNATION | UDS = UNDISTURBED SOIL SAMPLE

CR = CORE RECOVERY | DS = DISTURBED SOIL SAMPLE | VST = VANE SHEAR TEST

REMARKS : CONTINUED ON NEXT PAGE.

DBM GEOTECHNICS AND CONSTRUCTIONS PVT. LTD. MUMBAI.

SCALE : 1: 50 | JOB NO. : 2263 | Checked By : | Drawn By:

CLIENT : **NTPC LIMITED**

PROJECT : Geotechnical Investigation for 4 X 250MW Nabinagar Thermal Power Project at Nabinagar

BORE HOLE NO. : BH-87 | SHEET NO. : 2 OF 3

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm				SPT N	C R %	RQD %	CORRECTED SPT 'N'
						15	15	15	15				
				10.50/		15	15	15					
11.00				10.95	SPT4	17	19	26	--	45			
				12.00/		15	15	15					
12.00				12.45	SPT5	15	21	33	--	54			
13.00				13.50/									
				13.90	UDS4								
14.00			Hard, yellowish brown,sandy silty CLAY with gravel.										
				15.00/		15	15	15					
15.00	150 mm Ø		CH	15.45	SPT6	15	18	30	--	48			
16.00				16.50/									
				16.85	UDS5								
17.00													
				18.00/		15	15	15					
18.00				18.45	SPT7	24	38	51	--	89			
19.00				19.50/									
				19.82	UDS6								
20.00													
21.00													

SPT N =STANDARD PENETRATION TEST VALUE | RQD = ROCK QUALITY DESIGNATION | UDS = UNDISTURBED SOIL SAMPLE

CR = CORE RECOVERY | DS = DISTURBED SOIL SAMPLE | VST = VANE SHEAR TEST

REMARKS : CONTINUED ON NEXT PAGE

DBM GEOTECHNICS AND CONSTRUCTIONS PVT. LTD. MUMBAI.

SCALE : 1: 50 | JOB NO. : 2263 | Checked By : Ravi Achari | Drawn By: Sandeep

CLIENT : **NTPC LIMITED**

PROJECT : Geotechnical Investigation for 4 X 250MW Nabinagar Thermal Power Project at Nabinagar

BORE HOLE NO. : BH-87 | SHEET NO. : 3 OF 3

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	CR %	RQD %	CORRECTED SPT 'N'
21.00	150 mm Ø		Completely weathered, reddish brown, SANDSTONE	21.00/		15	15	10					
				21.40	SPT8	34	52	68	--	R			
22.00	NX		Highly weathered, reddish brown, SANDSTONE.	22.50							20	NIL	
23.00				23.50							22	NIL	
24.00											24	NIL	
25.00				25.00									
26.00													
27.00													
28.00													
29.00													
30.00													
31.00													

SPT N =STANDARD PENETRATION TEST VALUE | RQD = ROCK QUALITY DESIGNATION | UDS = UNDISTURBED SOIL SAMPLE

CR = CORE RECOVERY | DS = DISTURBED SOIL SAMPLE | VST = VANE SHEAR TEST

REMARKS : BORE HOLE IS TERMINATED AT DEPTH 25.00 m. BELOW G. L.

DBM GEOTECHNICS AND CONSTRUCTIONS PVT. LTD. MUMBAI.

SCALE : 1: 50 | JOB NO. : 2263 | Checked By : Ravi Achari | Drawn By: Sandeep

CLIENT : **NTPC LIMITED**

PROJECT : Geotechnical Investigation for 4 X 250MW Nabinagar Thermal Power Project at Nabinagar

BORE HOLE NO.	: BH-88	SHEET NO.	: 1 OF 3
CO-ORDINATE	: N 1560.83,W 726.63	DATE	: 06/01/2009 to 11/01/2009
LOCATION	: ASH HANDLING	METHOD	: ROTARY DRILLING.
GROUND R. L.	: 129.408m.	CASING	: 150mm.Ø upto 22.60 m. Below G.L
GROUND W. T.	: 12.70 Below G.L		

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm				SPT N	C R %	RQD %	CORRECTED SPT 'N'
				0.00									
1.00			Very stiff, brownish, silty CLAY	1.50/		15	15	15					
2.00				1.95	SPT1	06	08	10	--	18			
3.00				3.00/									
			CH	3.50	UDS1								
4.00	150 mm Ø			4.50		15	15	15					
5.00			Very stiff to hard, yellowish brown, sandy CLAY with gravel	4.95	SPT2	08	16	18	--	34			
6.00				6.00/									
			CH	6.48	UDS2								
7.00				7.50/		15	15	15					
8.00				7.95	SPT3	10	18	21	--	39			
9.00				9.00/									
			CH	9.50	UDS3								
10.00													

SPT N =STANDARD PENETRATION TEST VALUE | RQD = ROCK QUALITY DESIGNATION | UDS = UNDISTURBED SOIL SAMPLE

CR = CORE RECOVERY | DS = DISTURBED SOIL SAMPLE | VST = VANE SHEAR TEST

REMARKS : CONTINUED ON NEXT PAGE.

DBM GEOTECHNICS AND CONSTRUCTIONS PVT. LTD. MUMBAI.

SCALE : 1: 50 | JOB NO. : 2263 | Checked By : Ravi Achari | Drawn By: Sandeep

CLIENT : **NTPC LIMITED**

PROJECT : Geotechnical Investigation for 4 X 250MW Nabinagar Thermal Power Project at Nabinagar

BORE HOLE NO. : BH-88 | SHEET NO. : 2 OF 3

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm				SPT N	C R %	RQD %	CORRECTED SPT 'N'
						15	15	15	15				
				10.50/		15	15	15					
11.00				10.95	SPT4	12	20	24	--	44			
				12.00/									
12.00				12.30	UDS4								
				13.50/		15	15	15					
13.00				13.95	SPT5	17	21	31	--	52			
14.00			Hard, yellowish brown, sandy CLAY with gravel.	15.00/									
15.00	150 mm Ø		CH	15.38	UDS5								
				16.50/		15	15	15					
16.00				16.95	SPT6	18	25	33	--	58			
17.00				18.00/									
18.00				18.45	UDS6								
				19.50/		15	15	15					
19.00				19.95	SPT7	20	28	35	--	63			
20.00													
21.00													

SPT N =STANDARD PENETRATION TEST VALUE | RQD = ROCK QUALITY DESIGNATION | UDS = UNDISTURBED SOIL SAMPLE

CR = CORE RECOVERY | DS = DISTURBED SOIL SAMPLE | VST = VANE SHEAR TEST

REMARKS : CONTINUED ON NEXT PAGE

DBM GEOTECHNICS AND CONSTRUCTIONS PVT. LTD. MUMBAI.

SCALE : 1: 50 | JOB NO. : 2263 | Checked By : Ravi Achari | Drawn By: Sandeep

CLIENT : **NTPC LIMITED**

PROJECT : Geotechnical Investigation for 4 X 250MW Nabinagar Thermal Power Project at Nabinagar

BORE HOLE NO. : BH-88 | SHEET NO. : 3 OF 3

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	SAMPLE TYPE	BLOWS/15cm 15	15	15	15	SPT N	C R %	RQD %	CORRECTED SPT 'N'
21.00	150 mm Ø		Completely weathered, yellowish brown, SANDSTONE	21.00/ 21.40									
22.00				22.50/		10	--	--					
23.00	NX		Highly weathered, yellowish brown, jointed SANDSTONE.	22.60	SPT8	10	3--	--	--	R	20	NIL	
24.00				24.00									
25.00				25.00							26	NIL	
26.00													
27.00													
28.00													
29.00													
30.00													
31.00													

SPT N =STANDARD PENETRATION TEST VALUE | RQD = ROCK QUALITY DESIGNATION | UDS = UNDISTURBED SOIL SAMPLE

CR = CORE RECOVERY | DS = DISTURBED SOIL SAMPLE | VST = VANE SHEAR TEST

REMARKS : BORE HOLE IS TERMINATED AT DEPTH 25.00 m. BELOW G. L.

DBM GEOTECHNICS AND CONSTRUCTIONS PVT. LTD. MUMBAI.

SCALE : 1: 50 | JOB NO. : 2263 | Checked By : Ravi Achari | Drawn By: Sandeep

SUB-SECTION-III-D

CIVIL WORKS

CLAUSE NO.	SCOPE OF SUPPLY & SERVICES

1.00.00 SCOPE OF CIVIL WORKS

1.01.01 Scope of Bidder shall include all Civil, Structural, Architectural works including underground facilities like drainage, sewerage, trenches, earthing mat/ grounding, of all the facilities associated with complete Flue gas desulfurization (FGD) system, Zero Liquid Discharge (ZLD) system & Chimney as specified elsewhere in the technical specification.

1.02.00 The work to be performed under this specification consists of providing all labour, materials, construction equipment, tools and plant, scaffolding, supplies, transportation, all incidental items not shown or specified, but reasonably implied or necessary for successful completion of the work including Bidder's supervision and in strict accordance with the drawings and specifications. The nature of work shall generally involve earthwork in excavation & deep underground excavation, extensive de-watering, shoring and strutting, sheet piling, back filling around completed structures and plinth protection, paving , disposal of surplus excavated materials, piling, concreting including reinforcement and form work, brick work, fabrication and erection of structural / miscellaneous steel works, inserts, architectural items & finishes such as plastering, painting, flooring, doors, windows & ventilators, glass and glazing, rolling shutters etc., permanently colour coated profiled steel sheeting, anchor bolts, R. C. C. trenches with covers, laying and testing of water pipes, sanitation, water supply, drainage, damp proofing, water proofing and other ancillary items.

1.03.00 The work shall have to be carried out both below and above ground level and shall be involving, basements, equipment foundations, grounding, slabs, beams, columns, footings, rafts, walls, steel frames, brick walls, stairs, trenches, pits, access roads, culverts, trestles, finishes, false ceiling and complete architectural works, etc.

The works covered under the scope of the bidder have to be executed in an operating ***/*** under construction power station. The bidder shall take all necessary precautions to protect the entire existing equipments, structures, facilities and buildings etc. from damage. In case any damage occurs due to activities of the bidder on account of negligence, ignorance, accidental or any other reason what so ever, the damage shall be made - good by the bidder at his own cost to the satisfaction of the Owner. The bidder shall take all necessary safety measures to avoid any harm, injury to his workers/staff from the equipment / facilities of the power station.

1.04.00 If during the execution of works it is found that there is interference with the existing facilities / structures, the bidder shall revise his design / detailed drawings to clear the interference and shall provide all necessary measures for the safety of existing structures. In case the details shown in tender drawings are found to be different from actual details at site, bidder shall revise his design/ detailed drawings to suit the constraints at site. No claim in terms of cost or relaxation in time shall be entertained for any redesign, rework and for safety measures provided. If at any stage of work, any dismantling or modification or relocation of any existing facility is required to be done to complete the work in bidder's scope and which has been agreed by the Employer, the same shall be done by the bidder at no extra cost or time implication to the Employer. All such changes will be as per drawings and work plan approved by the employer.

CLAUSE NO.	SCOPE OF SUPPLY & SERVICES
1.05.00	Analysis, design and preparation of construction drawings for all structure/facilities under the scope of this package and getting the same approved from the owner.
1.06.00	Uniform Finished ground level (FGL) in FGD absorber area shall be made available by the owner at a level specified in tender drawing.
2.00.00	**CONSTRUCTION FACILITIES**

The following are also in the Bidder's scope of work:

1. Providing drinking and service water for Bidder's labour, staff and other personnel working for Bidder at the work site and in his staff/ labour colony. He shall install necessary bore wells with associated pumping or water tankers and treatment facilities to supply quality water as per standards.

2. Developing temporary staff colony and labour colony along with fencing etc. Land if required shall be arranged by the Bidder himself.

   However space required for bidder's office, storage, pre assembly and fabrication areas shall be provided by owner free of charge within the plant premises.

   The area to be allocated to the Bidder shall be discussed & finalized with the bidder after the award, keeping in view the availability of free space & similar requirement of other agencies.

3. Providing all arrangements for distribution of construction power at various locations as per his requirements from the supply point of Owner.

4. Providing all arrangements for the supply of construction water including bore-wells, water tankers etc.

5. Providing temporary construction office, construction stores (open / covered), workshops, material / field testing laboratory, any other temporary buildings

6. Providing all construction equipment, labour and materials. The Bidder shall provide all the tools and tackles required for the work.

7. Development of the pre-assembly and storage yard with fencing, drainage, internal roads, boulder soling, etc.

8. Approach road to project site is available. Further, Owner intends to construct the roads as per the layout shown in the General Layout plan in a progressive manner. Some of these roads may not be available to the bidder for his use. Similarly the drainage network for the plant site being constructed by the owner may not be available to full extent. The bidder shall plan his work within the plant area considering the above constraints of roads and drains. Access roads to his work sites, offices, stores, preassembly / fabrication yard, etc. as required for providing approach/access for men, materials, equipment, cranes, trailor, construction/erection activities etc., what so ever are required by the bidder, shall be constructed and maintained by the bidder. Bidder shall provide permanent access to all facilities/ structures from the nearby existing roads of the owner. Roads shall be in

concrete (M-35 grade) as per IRC standards, with minimum thickness of pavement (PQC) as 250mm. Width of all such roads shall be 7.5M concrete pavement.

9. Area lighting at the construction / erection site, pre-assembly and storage yard, office areas and labour / staff colony.

10. Providing all necessary fire-fighting devices / equipment / fire tender etc. required during the project execution stage. He shall maintain all such equipment / devices in proper working conditions throughout the period of work.

11. Providing first aid facilities at the construction / erection sites, workshops, laboratories, pre-assembly and storage yard and other places of work as per the requirement.

12. The Bidder shall arrange skilled / semiskilled / unskilled manpower from local source(s) as far as available in this country. He shall also arrange supervisory staff for quality execution of all works in his scope.

13. **Bidder's office, store, workshop, laboratory or any other temporary buildings:**

The Bidder shall adopt pre-engineered/ pre-fabricated constructions made of steel with single / double skin, insulated for un-insulated roof and wall coverings (fabricated out of permanently color coated metal sheets) for his site office, covered store workshop, laboratory or any other temporary buildings. Alternatively, bidder can adopt readymade `Portacabin' or similar construction. Bidder shall ensure that all such constructions are well-engineered, neatly constructed and overall present a pleasing look. The above requirements shall be applicable to his sub-vendors also and bidder shall be responsible for enforcing the same on his sub-vendors.

Any other type of construction if proposed by the bidder shall be subject to approval of the owner. However, such construction shall be based on proper design and shall have aesthetic look.

14. **Use of ash and ash based products:**

In line with Gazette Notification on Ash Utilization issued by MOEF and its amendment thereafter, Bidder shall use ash and ash based products in construction of his offices, stores, staff quarters and labour huts etc. He shall furnish a compliance report along with all details of use of ash and ash based products along with each bill. The above requirements shall be applicable to his sub-vendors also and Bidder shall be responsible for enforcing the same on his sub-vendors.

15. **Repair & Maintenance Facilities by the Bidder:**

Bidder shall establish/set up at site suitable repair facilities for construction plant, equipment and machinery (like cranes, hydra, forklifts, welding equipments, etc.) He will also make arrangements/tie up with manufacturers/ suppliers of such construction plant, equipment & machinery, for periodic overhaul/maintenance and for major breakdown, if any. He shall also keep

CLAUSE NO.	SCOPE OF SUPPLY & SERVICES

adequate stock of spares at site for various construction plant, equipment and machinery to meet day to day requirements as recommended by the equipment manufacturer/suppliers or as instructed by the Engineer. Bidder shall deploy dedicated qualified, full time mechanical/electrical foreman/supervisors for manning the repair facilities as specified above.

SUB-SECTION-IV-D

CIVIL WORKS

CLAUSE NO.	TECHNICAL REQUIREMENTS
1.00.00	**GENERAL**
1.01.00	This section of the bidding document deals mainly with the technical specification for the design and preparation of detailed drawings, getting the design and drawings approved by the Employer, fabrication, erection and construction of the necessary civil, structural and architectural works associated with the FGD package for **Lot-1A**. The work shall have to be carried out both below and above ground level and shall be involving, basements, equipment foundations, slabs, beams, columns, footings, rafts, walls, steel frames, brick walls, stairs, trenches, pits, access roads, culverts, trestles, silos, sumps, Limestone storage hopper & shed, Crusher House, Transfer points, Conveyor Galleries, Tunnels, Gypsum storage shed, Chimney, Gypsum dewatering building, Ball Mill building, FGD control room building, Tank Foundations, absorber tower foundation, transformer foundation, MCC Building, finishes, complete architectural aspects, drainage, sanitation, water supply (from terminal points to various buildings/facilities) and all other civil, structural and architectural works associated with the complete FGD package.
1.02.00	The specifications are intended for the general description of the work, quality and workmanship. The specifications are not, however, intended to cover minutest details and the work shall be executed according to the relevant latest Indian Standard Codes / I. R. S. / I. R. C. specifications. In absence of the above, the work shall be executed according to the best prevailing local Public Works Department practices or to the recommendations of relevant American and British Standards or to the instructions of the Engineer. Some of the relevent I. S. Codes to be followed is mentioned in the Technical Specifications. The Contractor is expected to get clarified on any doubts about the specifications, etc. before bidding, in writing with the Employer in respect of interpretation of any portions of this document.
Ref. sl. no-36 of amendment no.5 of TS(section-VI).	
1.03.00	Bidder or his agencies engaged as detailer for fabrication drawings should have the experience of detailing for power plant structures or steel plant or Industrial structures like Petro/ Chemical/ Refinery/ Cement/FGD Plant/Coal Handling Plant/Ash Handling Plant etc. The designer responsible for preparation of scope drawings shall review and approve the fabrication drawings prepared by the detailer before releasing them for fabrication.
2.00.00	**Sub QR for Civil Works:**
2.01.00	Bidder or its agency should have in past executed civil and structural works for 500 MW or higher capacity coal based/Lignite based power plant including earthwork in filling involving mechanical compaction and cutting in hard rock, foundations, Bulk material handling plant involving underground storage hopper and underground tunnels.
2.02.00	Bidder can engage more than one agency, in case the Bidder itself is not able to meet the requirement at 2.01.00. The agency being engaged for a particular work should have in the past executed such works of 500 MW or higher capacity plant.

CLAUSE NO.	TECHNICAL REQUIREMENTS
2.03.00	For Chimney, Bidder or its agency should have in the past built at least one (1) reinforced concrete chimney of minimum 100m height.
2.04.00	In case Bidder or its agency do not meet the requirements at 2.01.00 and the Bidder proposes to engage agency (ies) for civil & structural works on work volume basis (except for Chimney), Bidder or its agency (ies) should have executed such works in the past and the annual rate of execution in the reference works should not be less than eighty percent (80%) of the asking rate of such works, (structural steel fabrication & erection, RCC, earthwork in filling involving mechanical compaction and cutting in hard rock, RCC in underground storage hopper and underground tunnels) for which it is being engaged. Successful Bidder shall finalize the agency (ies) for each work in consultation with Engineer-in-charge at site before engaging them.
	Design agency for Civil & Steel Structural Works:
2.05.00	Bidder or its agency (ies) should have carried out the design and detailed engineering of following works: (i) Civil & Structural works associated with at least one bulk material handling plant for 500 MW or higher capacity coal based/Lignite based power plant. (ii) For Chimney, Bidder or its design agency (ies) should have carried out design & detailed engineering of at least one reinforced concrete chimney with steel flues, of minimum 100m height. (iii) Machine foundations such as Mill foundations/ Block foundations.
2.06.00	Bidder can engage more than one agency (of repute), in case the Bidder itself is not able to meet the requirement at 2.05.00. The design agency (ies) proposed by the Bidder shall be subject to Employer's approval.
3.00.00	**Work Description**
3.01.00	**Truck Hopper, Limestone Storage hopper and Underground Tunnel** Truck Hopper shall consist of underground portion, which shall be of R. C. C. with structural steel shed covered with permanently Colour coated profiled steel sheets. Limestone storage hopper shall be of RCC with structural steel shed covered with permanently Colour coated profiled steel sheets. The structural arrangement to be adopted for the design and construction of Limestone Storage hopper shall essentially consist of R. C. C. frames spaced at approx. 3.0M centers with R. C. C. wall panels on the sides and R. C. C. raft at the bottom, fixed to the frames. Minimum thickness of R. C. C. raft at bottom shall be 600

CLAUSE NO.	TECHNICAL REQUIREMENTS

mm. Minimum thickness of RCC side walls shall be 600 mm at bottom and 300 mm at top.

The vertical and inclined portion of hopper shall be provided with 50 mm thick guniting (shotcreting). Details of shotcreting have been given elsewhere in this specification.

Expansion joints shall be provided at a maximum distance of 40m. 600 mm wide water stop fabricated with 22G copper plate with bitumen board fillers and polysulphide sealing compound as specified elsewhere shall be used as expansion joint material.

Floor shall be provided with cross slope not flatter than 1 in 50 towards side drains. Side drains shall be sloped towards sump where sump pumps as specified elsewhere, shall be provided. The slope of side drains shall not be flatter than 1 in 400. Side drains and sump shall have removable type steel grating cover.

Water proofing / Damp proofing of under ground Truck hopper, Limestone Storage hopper, tunnels and underground (i. e. basement) portion of transfer houses shall be done by providing the following treatments:

Chemical injection grouting for inner faces (details as specified elsewhere).

Polymer modified cementitious coating on earth side face as per the following :

(1) On the outer surface of walls, frames and roof slabs coming in contact with earth, polymer modified cementitious coating in two layers as specified and as per manufacturer's specifications shall be provided directly on the concrete surface.

(2) 50 mm thick P. C. C. (1 : 2 : 4 with 10 mm nominal size stone aggregates) shall be provided under the raft i.e. over the lean concrete, followed by polymer modified cementitious coating in two layers (slurry mix application) as per manufacturer's specification. 50 mm thick P. C. C. (1 : 2 : 4) with 10 mm nominal size stone aggregates shall then be laid over the polymer modified cementitious coating before laying the raft.

Truck hopper and its gratings shall be designed for movement of front end loader/ bulldozer over them. Bull dozer weight shall be considered as about 35T. The gratings shall be built of min. 200x28mm thick flats in main direction and min.100mm x 20mm thick in secondary direction. No painting/galvanization shall be provided in gratings. However, two coats of Red oxide Primer to be provided immediately after fabrication.

Plinth protection along with drains shall be provided along the Hopper complex. However, 5m wide paving shall also be provided around machinery hatches.

Earth pressure to be considered for design shall be due to earth pressure at rest (Ko) condition only. Earth pressure due to surcharge intensity of Uniformly Distributed Load (U. D. L) of intensity 2 T / Sq. M. shall be considered in the design.

A minimum safety factor of 1.2 against uplift due to ground water shall be ensured during execution and after execution, considering dead weight of the structure to be

CLAUSE NO.	TECHNICAL REQUIREMENTS
	0.9 times only, ground water table to be taken at adjoining formation level and soil wedge angle of not more than 15 degrees. Also, FOS against uplift, to be taken as 1.0, considering the dead wt. of structure and soil resting on side projections if any in the vertical plane. Inclined wedge action of soil shall not be considered in this case. Wherever, slope of tunnel exceeds 10^{o}, R. C. C. steps shall be provided for the entire width of each walkway.
3.02.00	**Overhead / Ground Conveyor Galleries and Trestles** Overhead conveyors shall be located in a suitably enclosed gallery of structural steel. The overhead gallery shall consist of two vertical latticed girders having rigid jointed portal frame at both ends. Cross beams at floor level supporting conveyor stringer beams shall be made of single rolled steel beam or single channel section (ISMB or ISMC) or plate girder. Horizontal bracings are to be provided at top & bottom plan of the gallery (latticed girders shall be braced together in plan at the top and bottom). Common end portal frame shall not be used for adjacent conveyor spans. Roof truss shall be provided at upper node points of latticed girders to form an enclosure. Contractor can also use tubular steel sections for roof truss only of conveyor galleries. The tubular steel section shall be of circular/rectangular/square shape. The circular steel tube shall conform to IS 1161 and rectangular/square steel sections shall conform to IS 4923. The steel structures using tubular sections shall be designed and fabricated as per IS 806 – "Code of Practice for use of steel tubes in general building construction." and EN 1993-1-8:2005. The maximum span of overhead gallery shall be limited to 25 meters unless higher span is required due to site conditions, which shall be subject to approval of the Engineer. The gallery should as far as possible be erected as a box section keeping all the vertical and horizontal bracing tied in proper position. The gallery should be checked for all erection stresses that are likely to develop during handling and erection and if required, temporary strengthening of gallery members during erection shall be made. Seal plates under the conveyor galleries shall be provided in such a way that complete gallery bottom shall form a leak proof floor. The ground conveyors shall be located in suitably enclosed gallery of structural steel consisting of rigid portal frames spaced at regular intervals and suitably braced. Plinth protection along with drains shall be routed along the ground conveyors. For double stream conveyor gallery, two side and one central walkway of width 800 mm and 1100 mm respectively shall be provided. The width of two side walkways for single stream conveyor gallery shall be 800 mm and 1100 mm respectively. Both sides of central and side walkways shall be provided with pipe handrails all along the conveyor gallery. Hand railing should not be supported on conveyor supporting stringers. The walkways shall be chequered plate construction with anti - skid arrangement. The anti - skid arrangement will consist of welding of 10 mm square steel bars at a maximum spacing of 500 mm along the length of the gallery. Where the slope of walkway is more than 10^{o}, chequered plate steps with nosing and toe guard shall be provided. The floor of conveyor gallery all along the gallery length, shall be provided with minimum 12 gauge thick seal plates and other drainage arrangements as specified elsewhere

CLAUSE NO.	TECHNICAL REQUIREMENTS

Conveyor gallery shall have permanently colour coated steel sheet covers on roof and both sides. However in roof, a panel of minimum 1.5 m x 1.5 m area at about 6.0 m center shall be provided with translucent sheets of polycarbonate material for natural lighting. A continuous slit opening of 500 mm shall be provided on both sides just below the roof sheeting. Adequate provision of windows shall be kept on both sides of conveyor gallery as appended in Mechanical Section (Belt conveyor system). Windows shall be provided with wire mesh as specified elsewhere in this specification.

Cross - over with chequered plate platform and ladder for crossing over the conveyors shall be provided at approximately every 100 M intervals of conveyor. Crossover shall preferably be located over four-legged rigid trestle location.

For railway tracks passing below overhead conveyor gallery and along conveyors, the railway clearances both underground as well as over ground shall have to be adhered to for design, execution and erection of foundations, trestles, galleries etc., so that movement of locomotives and wagons is not hampered in any way during execution and afterwards. However at the location where the overhead conveyor gallery crosses road / rail line, minimum clearance of 8.0m above the road crest / rail top shall be provided.

For calculation of material load on moving conveyor, a multiplication factor 1.6 shall be used to take care of inertia force, casual over burden and impact factor etc.

Thus material load per unit length of each moving conveyor shall be

$$1.6 \times \frac{\text{Rated capacity of conveyor system}}{\text{Conveyor Belt Speed}} \times F$$

Where, F = 1700/1400 for lime & 1250/900 for gypsum

It should be noted that for structural design, unit weight of lime shall be assumed as 1700 Kgs. / Cu. M. instead of 1400 Kgs. / Cu. M., unit weight of gypsum shall be assumed as 1250 Kgs. / Cu. M. instead of 900 Kgs. / Cu. M. considered for system sizing purpose. Conveyor Gallery structure shall be designed considering both conveyors operating simultaneously.

Conveyor gallery and supporting trestles located between transfer houses / buildings shall be arranged in any one of the following ways.

a) All gallery supporting trestles shall be four legged type only. One end of each gallery span shall be hinged to the supporting trestle and the other end shall be slide type. Slide type support shall be with P. T. F. E. bearings to allow both rotation & longitudinal movements.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	b) In between transfer houses / buildings, four legged trestles shall be placed at a maximum interval of 90 metres. The arrangement shall be such so as to ensure that force in the longitudinal direction (i. e. along the conveyor length) of conveyor gallery of length not more than 90 m is transferred to any four legged trestle. In the space between each successive four legged trestles, two legged trestles shall be provided at regular intervals. The end supports resting on the four-legged trestle can have either ends hinged or one hinge and the other on slide type depending on the arrangements. Slide type support shall be with P. T. F. E. bearings to allow both rotation & longitudinal movements. End of conveyor gallery which will be supported over transfer house, shall be so detailed that only vertical reaction is transferred from conveyor gallery and no horizontal force in longitudinal direction is transferred from conveyor gallery to transfer house structure and vice - versa. For trestles and trestle foundations for conveyor galleries located adjacent to existing structures, over ground and under ground facilities, location and details of these trestles and foundations shall have to be decided such that there is no interference both underground as well as over ground with existing structures and facilities. Trestle columns / ground conveyor portal column base shall be kept 300 mm higher than the existing ground level.
3.03.00	**Transfer Houses** The over ground portion of the transfer house shall be framed structure of structural steel work with permanently colour coated profiled steel sheet side cladding (from lowest working floor level till top) and R. C. C. floors comprising of RCC slab over profiled metal deck sheets (to be used as permanent shuttering) over structural beams. Shear anchor studs shall be provided through metal deck at regular interval on all top flange/flange plate of structural beams. However, the lower portion of side cladding, at ground, for a minimum height of 0.9 m above the finished floor level shall be one brick thick wall plastered on both side. In some areas like MCC floors etc., one brick thick wall cladding shall be provided. Brick wall cladding shall be supported on encased wall beams and suitably anchored to adjoining columns and beams. Contractor shall have option to use tubular steel sections for roof truss only. Vertical bracings shall be provided only on four sides along the periphery. Grade slab with 0.9m height one brick thick wall plastered on both side at periphery shall be provided for all transfer houses. Adequate steel doors and windows for proper natural lighting and ventilation shall be provided. In addition to steel windows, panels of suitable size to suit the architectural treatment and made of translucent sheets of polycarbonate material shall also be provided on the side cladding for natural lighting. The roof of Transfer points shall be provided with pre-fabricated insulated metal sandwich panels. Composition of Insulated Metal Sandwich Panels shall be as described elsewhere in the Technical Specification. Adequate slope shall be provided for quick drainage of rain water.

CLAUSE NO.	TECHNICAL REQUIREMENTS
3.04.00	**Crusher House** The crusher house shall be framed structure of structural steel work with permanently colour coated profiled steel sheet side cladding. However, panels of suitable size to suit the architectural treatment and made of translucent sheets of polycarbonate material shall also be provided on the side cladding for natural lighting. The lower portion of side cladding, at ground, for a height of minimum 0.9m above the finished floor level shall be of one brick thick wall plastered on both faces. Floors shall be of R. C. C. slab over profiled metal deck sheets (to be used as permanent shuttering) over structural beams. Shear anchor studs shall be provided through metal deck at regular interval on all top flange/flange plate of structural beams. Within this building cubicles are to be provided for resting room of operators and these shall be constructed with one brick thick brickwork having both sides plastered and roof slab. Adequate steel doors and windows for natural lighting and ventilation shall be provided. Contractor shall have option to use tubular steel sections for roof truss only . Vertical bracings shall be provided only on four sides along the periphery. The roof of Crusher house shall be provided with pre-fabricated insulated metal sandwich panels. Composition of Insulated Metal Sandwich Panels shall be as described elsewhere in the Technical Specification. Adequate slope shall be provided for quick drainage of rain water. Crushers shall be supported on R. C. C. deck, which in turn will rest on suitable vibration isolation system consisting of springs and dampers. This R. C. C. deck shall be isolated from the floor. However, the vibration isolation system consisting of springs and dampers may rest on main building framework. Detailed specification of vibration isolation system including the unbalanced force, frequency and amplitude criteria and other design requirements are appended elsewhere in this specification
3.05.00	**Control building, M. C. C. Buildings** These shall be steel or RCC framed building with R. C. C. roof and floor. For steel framed building roof /floor shall comprise of RCC slab over profiled metal deck sheets (to be used as permanent shuttering only) over structural beams. Cladding shall be of brickwork/concrete blockwork with plastering on both sides. Roof shall be provided with roof water proofing treatment, as specified elsewhere in the Technical specification. Suitable arrangement shall be provided so as to prevent ingress of water into the cable trenches inside the building from cable entry locations. All air - conditioned areas, shall be provided with the suspended permanently colour coated aluminium false ceiling system (details specified elsewhere) with under deck insulation. Adequate aluminium doors and windows shall be provided for natural lighting, ventilation and view. All windows in air conditioned rooms shall have hermetically sealed double glazing.
3.06.00	**Pent House** These shall be of R. C. C. framed structures with columns, beams, slabs and foundations etc. Cladding shall be of brickwork with plastering on both sides. Roof

CLAUSE NO.	TECHNICAL REQUIREMENTS
	shall be provided with roof water proofing treatment as specified elsewhere. Adequate nos. of steel doors and windows shall be provided for natural lighting and ventilation.
3.07.00	**Gypsum Storage Shed** The Gypsum storage shed shall be RCC framed structure with structural steel work shed with permanently colour coated profiled steel sheet roof and side cladding, grade slab and RCC foundations etc. Roof shall be provided with troughed profile permanently colour coated sheet with adequate slope for quick drainage of rain water.
3.08.00	**Toilets** Toilet with potable water line facilities shall be provided in each of the following locations: (a.) In all M. C. C. Rooms (b.) Control Building
3.09.00	**Staircases, Gratings, Handrails** All floors of transfer points/crusher houses and other facility buildings shall be accessible through staircase. All staircases of Transfer points and crusher house shall be of steel. Cage ladders (min. 450mm wide) shall be provided for access to roof of penthouses, single storey mcc rooms & mumty. All Stairs shall be minimum 1200 mm wide, maximum rise should not be more than 180 mm and minimum tread with 250 mm. Numbers and arrangement (including enclosures etc.) of stair cases shall be such as to meet the fire safety requirement as per guide lines of statutory regulatory bodies. For steel staircases , Stringers shall be of rolled steel channel (minimum ISMC 250) and tread shall be of steel gratings. Out side stairs to transfer points/crusher house shall be open type. Minimum 50 x 50 x 6 mm size angles with lugs shall be provided as edge protection for treads of stairs in underground TP's All gratings shall be electro forged types. Minimum thickness of the grating shall be 40 mm for indoor installation and 32 mm for outdoor installation. However, at entry or road crossing point's minimum thickness of grating shall be 40 mm The opening size shall not be more than 30mmx100mm. The minimum thickness of the main bearing bar shall be 6 mm or as per design requirement whichever is higher. All gratings shall be designed for minimum imposed load of 500Kgs. / Sq. M. If actual expected load is more than the specified load, then actual load is to be considered. All gratings shall be hot dip galvanized at the rate of 610 g. per sq.m. after surface preparation by means of blast cleaning/ acid pickling. Minimum 1000 mm high hand railing shall be provided around all openings, projections / balconies, walkways, platforms, Stairs, etc. All handrails and ladder Pipes shall be 32 mm nominal bore MS Pipes (medium class) as per IS:1161. Handrails shall have top and middle rails at a height of 1000 mm and 500 mm and the vertical post spacing shall not exceed 1.50 M, with provision of kick Plates (100

CLAUSE NO.	TECHNICAL REQUIREMENTS
	mm high and 6 mm thick). All handrails and ladders shall be galvanised at the rate of 610 Gms / Sq. M as per IS:4736.
3.10.00	**Trenches**
	All trenches for cables or any other underground facility as detailed out elsewhere shall be of R. C. C. Cable trenches shall be provided with pre - cast R. C. C. covers / chequered plate cover. Cable trenches as well as pre - cast covers shall be provided with edge protection angles and lifting hooks. All embedments / block outs as required and specified elsewhere in these specifications shall be provided. Proper drainage arrangement shall be provided. Trench pre - cast cover weight shall not be more than 65 Kgs. Trench covers near entry or at road crossings shall be designed for 10 T wheel load at centre. Pre - cast covers shall be designed for central point load of 75 Kgs. R. C. C. cable trenches shall be filled with sand after erection of cables, up to top level and covered with pre - cast R. C. C. covers. For cable trenches outside buildings, top level shall be 200 mm above G. L and sand filling shall be overlaid with 50 thk. PCC. Minimum 50 x 50 x 6 mm size angles with lugs shall be provided as edge protection all around cut outs / openings in floor slabs, edges of drains supporting grating/precast RCC covers, edges of R. C. C. trenches supporting pre - cast covers, supported edges of pre - cast cover
3.11.00	**Cable gallery/trestles**
	Cable galleries/trestles shall be made of structural steel. The contractor can use either rolled sections or tubular steel sections. The tubular steel section shall be of circular/rectangular/square shape. The circular steel tube shall conform to IS:1161 and rectangular/square steel sections shall confirm to IS:4923. The steel structures using tubular sections shall be designed and fabricated as per IS:806 – “Code of Practice for use of steel tubes in general building construction.” and **EN 1993-1-8:2005**.
3.12.00	**Transformer Foundation**
3.12.01	Foundations of transformers shall be designed for seismic and wind loads in addition to other applicable loads. Block foundations shall be provided for the main transformer block. The oil soak pit, if provided, shall be filled with gravel of size 40mm. The volume of the soak pit shall be sufficient to store complete oil of the transformer/reactor along with 10 minutes of fire water considering only 40% of the volume as available voids between gravel filling. However, in case a separate oil collection tank is provided for the transformer/reactor, oil soak pit of volume equivalent to one-third (1/3) the oil volume of transformer/reactor shall be provided around transformer/reactor. The oil collection tank, in such cases, shall be designed for an effective capacity of complete oil of the transformer along with 10 minutes of fire water. The oil soak pit shall also be provided with a sump at the corner to allow drainage of water/oil from the soak pit. Arrangement for moving the transformer into place using rail cum road, jacking pads and pulling blocks including inserts, as required, shall be provided along with the transformer/ reactor foundations.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	RCC Firewall shall also be provided between the transformers wherever required. 300 mm thick PCC M20 encasement all around the Pylon supports inside soak pit for fire fighting system shall be provided up to top of gravel filling. Coarse aggregate filling inside the transformer oil soak pit shall be carried out only after construction/erection of Pylon supports and PCC encasement.
3.12.02	**Fencing** Fencing with toe wall and steel gates shall be provided around the transformers. Fencing shall comprise of PVC coated GI chain link fencing of minimum 8G (including PVC coating) of mesh size 75 mm and of height 2.4 m above the toe wall. The diameter of the steel wire for chain link fence (excluding PVC coating) shall not be less than 12G. Fence posts shall be of pre – cast R. C. C. of minimum M20 grade. All corner posts will have two stay posts and every tenth post will have transverse stay post. Suitable R. C. C. foundation for the post and stays shall be provided based on prevailing soil conditions. Gates shall be sturdy with locking provisions. Toe walls of brick masonry shall be provided between fence posts all along the run of the fence with suitable foundation. Toe wall shall be minimum 200 mm above the formation level with 50 mm thick P. C. C. coping (1: 1. 5: 3) and shall extend minimum 300 mm below the formation level. Toe wall shall be plastered on both sides and painted with two coats of cement paint of approved colour and shade. Toe wall shall be provided with weep holes at suitable spacing
3.13.00	**Booster Fan Foundation** Booster Fan foundations shall be RCC block foundation directly resting on virgin soil/ pile below Ground level. The vertical faces of this block foundation shall be isolated from adjacent footings by providing minimum 100mm thick polystyrene board of type-1 conforming to IS: 4671 with density 20 Kg/cum sandwiched between the vertical face of block foundation and 230 thick brick wall all round.
3.14.00	**CHIMNEY**
3.14.01	**Salient Features** Single-flue or multi-flue chimney(s) shall be provided. Chimney shall be of reinforced concrete construction. There shall be one flue (liner) for each unit. The flue gas emission point shall be minimum 150 meters above the plant grade level. The chimney shell (windshield) shall be constructed using slip form shuttering. Internal platforms of steel structure shall be provided for enabling access to various elevations of the chimney and to provide support to the flue liners. Spacing of internal platforms shall not exceed 45.0 M. The platform beams shall be supported on concrete shell using suitable load bearing arrangement in the recesses provided for the purpose. The platform beams getting supported in the chimney shell shall have complete bearing support within the thickness of shell at that location and shall in no case be supported completely/partially on corbels/ brackets from the shell. "Through openings" in shell if provided to facilitate erection of platform beams shall be closed with cast-in-situ RCC closure wall on the external face of the shell. Necessary dowel

CLAUSE NO.	TECHNICAL REQUIREMENTS

bars shall be provided in the shell during construction for this purpose. Openings in the concrete shell for flue duct entry, access door & truck entry door at ground level, air ventilation etc shall be provided. Hand railing shall be provided all around internal staircase & around the ventilation voids in the internal platform using min. 32 mm nominal bore MS pipes of medium class conforming to IS:1161. Spacing of railing posts shall not be more than 1500 mm centre to centre with a minimum height of 1200 mm. The handrail shall have three rows of horizontal members between the railing posts including the top member. Kick plate of min. size 100x6 thick shall be provided in the hand railing.

The flue duct outside the chimney shall be suitably connected to the flue liner inside the chimney through a transition duct. The transition duct shall be bottom supported and shall be profiled into a circular shape to connect to the flue liner. The flue duct shall be so designed that no load is transferred on the chimney shell due to the duct. The interface between the flue liner and the transition ducting shall be provided with non-metallic fluroelastomeric fabric expansion joint.

The expansion joint in the flue liner shall comprise of non-metallic fluoroelastomeric material suitable to withstand a temperature of 300 Deg C, shall be acid resistant to withstand acidic flue gas condensates arising out of flue gas parameters & operating conditions as specified elsewhere in the specification and shall also prevent dust accumulation. The space between the expansion joint material and the liner shall be packed and sealed by providing a bolster made up of light weight compressible material suitable to withstand a temperature of 300 Deg C and acid resistant to withstand acidic flue gas condensates arising out of flue gas parameters & operating conditions as specified elsewhere in the specification. The bolster shall be confined in texturized glass fabric having a final covering of stainless steel wire mesh.

Chimney roof shall be of RCC slab over a grid of structural steel beams and provided with rainwater drainage system. An internal structural steel staircase supported from chimney shell with chequered plate floor panels and pipe handrails, shall be provided for full height of the chimney and an internal cage ladder for a small height, over last staircase landing to access the chimney roof through a roof access hatch.

The other components of the chimney include liner test ports (for continuous pollution monitoring), liner hatches, grade level slab of RCC with metallic hardener floor finish, acid resistant treatment on roof slab, a large electrically operated grill type roll-up door and personnel access metallic door at grade level, roof drain basin, rain water down comer pipe (150 mm diameter galvanized pipe), connection to plant drains, louvers with bird screens for ventilation and all other openings in the wind shield, mild steel wind strakes (if required), all finishing works, electrical power distribution boards, lighting panels, power & control cabling and wiring systems, stair and platforms lighting, socket outlet, lightning protection and grounding system, aviation obstruction lighting with photoelectric controller etc, communication system, a rack and pinion elevator and other items, though not specifically mentioned but reasonably implied and necessary to complete the job in all respects.

Aviation Warning Lights (AWL) shall be mounted on door panel of required size (open able from interior of chimney shell) fixed to openings in the chimney shell at locations and levels specified elsewhere. Suitable provision for approach to the AWL shall be provided at the platform level. AWL shall be located at about 1-1.5 metre above the top of platform to enable easy handling for maintenance.

The size of roll-up door shall be determined based on minimum requirement for ventilation and transportation & erection of flue segments.

CLAUSE NO.	TECHNICAL REQUIREMENTS
3.14.02	**Design Concept** Design and construction of various components and systems of the chimney shall be in accordance with relevant Indian Standard and where provisions are not covered in Indian Standard, reference shall be made to ACI, BS, CICIND and other international standards. In case of any conflict between this document and the Indian and International Standards, the stipulations of this document shall prevail. Imposed loading for design of all chimney components shall not be less than 5 kN/ Sq.m. An additional 25% of liner load shall be taken as impact loading for liner erection in addition to the liner load. The min. thickness of web for plate girders shall be kept as 12 mm. Seismic forces on the chimney system shall be determined based on site specific seismic information provided elsewhere in this document. Wind forces on the chimney system shall be determined based on site specific wind design criteria provided elsewhere in this document. The chimney and its components shall be designed to resist the most onerous forces resulting from all the possible combinations of the various loadings. Design of all chimney components shall be based on working stress method.
3.14.03	**Wind Shield** The wind shield shall be designed for vertical loading, cross wind loading, seismic loading, circumferential wind loading, thermal gradients etc. The load calculation and load combinations shall be as detailed in IS 4998 (Part 1) : 1992. The wind shield shall be analysed for cases with and without flue liner loads. Forces/stresses in the wind shield due to eccentricity effects of local (e.g. corbel) loadings, insolations effects, rotation of chimney foundations, construction tolerances and moments of second order shall also be considered. Seismic response of the chimney shall be computed by the response spectrum method. At least, the first five modes of vibrations shall be used for this analysis. The cross wind analysis of the chimney shall be carried out irrespective of the value of the Scruton Number for the chimney and other empirical considerations which suggest structural immunity to cross wind oscillations. The effect of the openings/cut-outs in the chimney shell shall be duly considered in the design of the windshield. The minimum thickness of shell shall not be less than 500mm. The stresses for the shell design shall not exceed the limits given in Cl. 7.0 of IS:4998 (PART-I) 1975 for various combinations of loads, excepting the stress in concrete for the case of dead load + wind load which shall not exceed 0.30fck where fck is the characteristic compressive strength of concrete. The minimum vertical reinforcement shall be 0.3% of the concrete area. The maximum spacing of the reinforcement bars shall not be more than 250 mm on each face. The minimum circumferential reinforcement shall be 0.2% of the concrete area. The maximum spacing of the reinforcement bars shall not be more than 200 mm on each face. The circumferential reinforcement in the top 3 meters of the windshield

CLAUSE NO.	TECHNICAL REQUIREMENTS
	shall be twice that required from design forces. The clear cover to reinforcement shall be 50 mm. There shall be a continuous ring of concrete shell without any opening for a height of atleast 5m below the soffit of flue duct openings. There shall not be any reverse (outward) slope in the inside face of chimney shell. Where there is a sudden change in slope/ profile of the shell, the circumferential reinforcement shall be increased to twice the requirement as per the design in a circumferential band extending atleast 3m above and below such slope/profile change level. The diameter of the reinforcing bar for the main vertical reinforcement of shell shall not be less than 25mm for a shell height upto the top level of flue duct opening. Shell thickness between any two 10m reference levels shall not vary more than 150mm. The minimum thickness of shell/closure wall at beam support recess/ opening locations shall be 100mm. Grade of concrete for chimney shell, and other super structure shall be minimum M 30. Only OPC cement shall be used for Chimney shell and other super structure. The final design shall be checked & verified by 'Wind Tunnel Test' and shall be conducted at a reputed institution. Dynamic interference effects due to additional chimney(s)/NDCTS's and other tall structures located in the area or in the future expansion stage of the project shall be determined along with the other topographical features of the local area through model test.
3.14.04	**Flue Liners** The flue gas parameters & various operating conditions for selection of flue liner material, material specification for flue liner and the criteria of flue gas exit velocity for sizing the flue liner shall be as specified elsewhere in the specification. For flue liner with base metal as mild steel, the thickness of the base metal shall be determined from structural considerations. The thickness of any clad metal/coating/block lining etc. provided on the base metal shall not be considered for computing the structural strength of flue liner. The minimum thickness of the mild steel base metal shall, however, not be less than that specified elsewhere in the specification. Two manholes placed diametrically opposite shall also be provided in each flue at all internal platform levels. The supporting/restraining arrangements of the liners should be such that expansion of the liners longitudinally or circumferentially is not restrained. Clean-out door shall be provided below the flue for the removal of ash.
3.14.05	**Internal Platforms** The platforms shall be designed for dead, imposed (live), erection work and other possible loadings and temperatures effects. These platforms shall provide support and lateral restraint to the steel liners and provide access for inspections and maintenance. Forces imposed on the floors due to lateral restraint of flues shall be enhanced aptly for impact effects. These platforms shall also be designed suitably for

CLAUSE NO.	TECHNICAL REQUIREMENTS
	the liner erection works. The platform shall be made up of chequered floor panels supported on grid of structural steel beams. All beams shall have bolted connections. The maximum permissible deflection in main steel girders supporting flue liner shall be span/1000.
3.14.06	**Internal Staircase** The staircase shall have a clear passage way width of not less than 800 mm and a clear headroom of not less than 2100 mm. The riser height shall not be more than 175 mm and tread width shall not be less than 225 mm.
3.14.07	**Foundation** The chimney foundation shall be designed for the most critical combination of forces and moments, resulting from all possible combinations of the various loadings from the chimney system during all stages of constructions. The effect of water table shall be considered and the foundation shall be checked for overturning for minimum and maximum vertical loads. There should be no uplift under any portion of the foundation for any loading condition. Since chimney is a wind sensitive structure no allowance shall be made in the load carrying capacity of the bearing strata / piles under any load case/combination with wind. No allowance shall be made in the stresses for design of foundation for wind loading. The foundation diameter to depth ratio shall be maintained to around 10 and should preferably not exceed 12. The diameter of the reinforcing bar for the main radial and tangential reinforcement for the foundation shall not be less than 25mm. The spacing of radial steel at the outer edge of the foundation shall not be more than 250mm. Grade of concrete for foundation shall be minimum M 25.
3.14.08	**Thermal insulation** The insulation shall be semi-rigid, resin bonded type, in the form of slabs and shall conform to IS: 8183. Blanket type insulation shall not be used. The density of insulation shall not be less than 64 kg/cu.m for resin bonded glass wool insulation and 100 kg/cu.m for resin bonded rock wool. The coefficient of thermal conductivity of insulation shall not be more than 0.52mW/cm/oC at a mean temperature of 100oC. The insulation thickness shall be determined based on the maximum/minimum ambient temperature, surface air velocity worked out based on the draught of ventilation air in the annular space between the flue liner and chimney shell, insulation surface emissivity of 0.3 and the insulation cold face maximum temperature not exceeding 55 degree Celsius. The draught of air in the annular space shall be the natural draught created by the heating of air by the flue liner and the air being vented out through the openings in the chimney shell. The increase in the annulus air temperature due to the rising heated air shall be taken into account while calculating the insulation thickness. The insulation thickness shall not be less than 100 mm, in any case, and shall be provided in two layers with the second layer of insulation covering the joints of the first layer. The insulation shall be wrapped on the outer-most surface with galvanised wire mesh using MS galvanised pins and speed washer.

CLAUSE NO.	TECHNICAL REQUIREMENTS
3.14.09	**Chimney Painting** (i) All exposed steel surfaces (including exterior surface of mild steel flue liner in case the design does not envisage provision of thermal insulation on the exterior surface of flue liner) except surfaces of steel wind strakes shall be painted as specified in corrosion protection clause of this specification. (ii) All exposed surfaces of steel wind strakes shall be painted with epoxy phenolic coating system having total 240 microns DFT. a) All steel surfaces shall be provided with two component epoxy primer coat (having solid by volume minimum 51% ±2%) of minimum 70 micron DFT to be applied over blast cleaned surface conforming to Sa 2½ finish of ISO 8501-1 with surface profile 40-60 Micron. The primer coat shall be applied in shop immediately after blast cleaning by airless spray technique. b) Primer coat shall be followed with the application of Intermediate coat of epoxy phenolic coating (solid by volume minimum 63%) of minimum 100 micron DFT. This coat shall be applied in shop after an interval of minimum 24 hours (from the application of primer coat) by airless spray technique. c) Intermediate coat shall be followed with the application of finish coat of two-pack aliphatic Isocyanate cured acrylic finish paint (solid by volume minimum 55% ±2%) with Gloss retention (SSPC Paint Spec No 36, ASTM D 4587, D 2244, D 523) of Level 2 (after minimum 1000 hours exposure, Gloss loss less than 30 and colour change less than 2.0 ΔE) and minimum 70 micron DFT. This coat shall be applied in shop after an interval of minimum 10 hours and within six (6) months (from the completion of Intermediate coat), Colour and shade of the coat shall be as approved by the Employer. (iii) All steel parts embedded in concrete like Strake embedment assembly including bolts, nuts, washers, pipe sleeves and insert plate shall be galvanized as per IS:4736. The minimum weight for galvanizing shall be 610 g/sq.m and shall comply with relevant IS Codes. (iv) The inside surface of chimney shell above roof, horizontal surface of shell at top, underside of concrete roof slab, external surface of mini-shell above roof etc shall be painted with epoxy phenolic coating system having total 220 microns DFT. a) All concrete surfaces shall be provided with two component transparent polyamide cured epoxy sealer coating (having solid by volume minimum 40% ±2%) of minimum 50 micron DFT to be applied over cleaned surface in multiple coats. Surface to be coated shall be absolutely dry, clean and dust free. b) Sealer coat shall be followed with the application of Intermediate coat of epoxy phenolic coating (solid by volume minimum 63%) of minimum 100 micron DFT. This coat shall be applied after an interval of minimum 24 hours (from the application of primer coat) by airless spray technique. c) Intermediate coat shall be followed with the application of finish coat of two-pack aliphatic Isocyanate cured acrylic finish paint (solid by volume minimum 55% ±2%) with Gloss retention (SSPC Paint Spec No 36, ASTM D 4587, D 2244, D 523) of Level 2 (after minimum 1000 hours

CLAUSE NO.	TECHNICAL REQUIREMENTS
	exposure, Gloss loss less than 30 and colour change less than 2.0 ΔE) and minimum 70 micron DFT. This coat shall be applied after an interval of minimum 10 hours and within six (6) months (from the completion of Intermediate coat), Colour and shade of the coat shall be as approved by the Employer. d) The entire external surface of chimney shell shall be painted with epoxy phenolic coating as specified in (iv) above in alternate bands of 'signal red' and 'bright white' colours.
3.14.10	**Electrical System** 415V, normal and emergency AC power supply for chimney shall be derived from main plant power supply system. Emergency supply shall feed 20% of platform lighting, 50% of staircase lighting, aviation obstruction lighting and elevator load. All other loads shall be connected on normal power supply. Ambient temperature for design of all equipment shall be considered as 55 deg. C which is likely to be encountered inside the chimney. The equipment shall be suitable for installation and render trouble free operation at higher ambient temperature and rigorous weather conditions prevailing at chimney. All equipment supplied shall comply with relevant IS Standards. The distribution boards of chimney shall comprise switch fuse units of appropriate ratings. Emergency board shall have two incomers, one from emergency supply and other from normal AC distribution board itself. Auto changeover scheme shall be provided in emergency board to enable changeover to healthy source on failure of any source. Dry type isolating transformer of Dyn connection shall be provided in emergency board to obtain neutral lead, in case 3 phase 3 wire emergency supply is derived from main plant. Various platforms shall be illuminated by dust tight HPSV well glass lighting fixtures. Average illuminations level of 150 lux shall be maintained on equipment and 70 lux on platforms & 100 lux on staircases (minimum 1 lighting fixture at each landing).Any additional fixture to take care of dark patches/shadows shall also be provided. Lighting system shall be controlled through MCB provided in lighting panel. A lighting and power panel each shall be located at grade level and at other in between levels as required. All distribution boards, aviation lighting controls, etc. shall be located at grade level only. At each platform, 1 No. 63A, 415V welding receptacle and 1 No. 20A, 240V receptacle shall be provided and shall be fed from power panel. Wiring installation for lighting fixture shall be of PVC insulated copper/aluminium wires through galvanised steel conduits. Aviation obstruction lighting system shall conform to the requirements of the latest rules and regulations of the International Civil Aviation Organization (ICAO), National Airports Authority (NAA) and Directorate of Air Routes and Aerodromes (DARA). The type of aviation obstruction lighting system shall be of medium intensity aviation obstruction lights having an effective intensity of 2000 to 20,000 cd depending upon back ground illuminance. Obstacle lights shall have a day time effective intensity of minimum 20000 cd. The intensity of lights shall be 20000 cd ± 25% at twilight and shall reduce automatically to a night time intensity of 2000 cd ± 25% through the use of photo-cell. The obstacle lights shall flash simultaneously at a rate between 20 to 60 per minute. A minimum of three levels will be provided with aviation obstruction

CLAUSE NO.	TECHNICAL REQUIREMENTS
	lights and there will be four light units per level. The lowest level should not be lower than 45 meters above the ground and vertical spacing of the intermediate levels could vary between 45 and 105 meters. The intermediate lights shall be spaced as equally as possible. Aviation obstruction lighting shall be complete with lights, photo cell, controller, special cables, etc.. A temporary aviation obstruction lighting system shall be provided during construction of the chimney. Cables from distribution board to lighting panels/power panels/receptacles shall be 1100V grade, multicore FRLS HR-PVC insulated, PVC inner sheathed, armoured, PVC outer sheathed stranded copper/ Aluminuim laid on galvanised sheet steel cable trays. Cables shall be terminated using double compression type cable glands and solder less crimping type tinned copper cable lugs. Minimum size of the power cable shall not be less than 2.5 sq.mm copper or 4 sq.mm Aluminuim. Minimum size of control cable shall not be less than 1.5 sq.mm. Lightning protection system shall comprise minimum 3 vertical air terminations for each flue liner, horizontal air terminations and minimum 4 Nos. of down conductors spaced 90 degrees apart routed all along chimney height on external surface and connected to the earthing system. Down conductors shall be of minimum 50x6 mm galvanized steel strip. Each down conductor shall be provided with a test link at 1 metre above ground level. Each test link shall be enclosed in a galvanised sheet steel enclosure. Above ground level earthing and lightning protection system shall comprise galvanised steel strips. These materials provided at top 12 meters shall have additional coating of 2 mm thick seamless lead cover and the accessories like nuts, bolts, washers etc. shall be of stainless steel to take care of corrosion. Chimney earthing system shall be interconnected to main plant earthing system. A temporary lightning protection & earthing system shall be provided during construction of the chimney till a permanent lightning protection & earthing system is installed. In no case reinforcement bars of Shell should be used as earthing Down Conductors Communication system comprising of telephone socket at every internal platform level and at grade level, necessary wiring installation, a telephone hand set, junction boxes etc. shall also be provided. Telephone cables shall be of minimum 0.6 mm diameter annealed high conductivity electro copper conductor, PVC insulated, twisted, PVC tape wrapped, screened, rip corded, PVC sheathed, conforming to relevant ITD (Indian Telephones Department) specifications. All equipment to be supplied shall be of type tested quality. The Contractor shall submit for Owner's approval the reports of all type tests as listed below: (A) Distribution boards/panels-Degree of protection tests (B) Aviation lights: (1) Intensity Test (2) Degree of protection test For various equipment, the technical requirements and practices shall conform to the relevant clauses of the main plant electrical specification.
3.14.11	**Rack and Pinion Elevator** A rack and pinion elevator, with a load carrying capacity of 400 kg (min) (passenger cum goods), cabin floor size of 1100 mm x 1000 mm (min.) and an operating speed

CLAUSE NO.	TECHNICAL REQUIREMENTS
	of 40 m/min. (approx.), shall be provided for travel from the grade level to the top of the chimney. A landing platform shall be provided at all access/ platform levels. The elevator shall be of a proven and approved make. Enclosure shall be fabricated from tubular steel and expanded metal or wire mesh, 2.1 m high (Approx.). A Safety device comprising of an over speed governor in constant mesh with the rack by means of a flame hardened steel pinion shall be provided to protect the cab against over speed during the cab downward motion and the same shall actuate the brake mechanism and stop the down ward motion gradually. The lift shall be installed using anchor fasteners. The electrical requirement of the system shall conform to the main electrical specification. Drive motor shall be of S3 duty class with CDF of 25% and maximum number of 120 starts per hour in 55 degree Celsius ambient temperature. The motor shall be provided with internal 220V AC single phase space heaters or an alternate heating system. The elevator shall be supplied, installed, painted, tested, commissioned etc. complete with all mandatory spares (as specified in Part-F of this specification) and operation maintenance manual
4.00.00	**Drainage & Water Supply Works**
4.01.00	Drainage System: The drainage arrangements shall be so planned so as to ensure quick disposal of drainage water without stagnation and / or overflow. It is envisaged to clean the facility buildings etc. with water periodically. Minimum 4 nos. down comers shall be provided in each building at corners. For Conveyors, each down comer shall lead the water / slurry to pit (of 2 Cu.M capacity) to allow settling of lime/gypsum. The water from the pit shall overflow into contractor's R.C.C drain, which will lead the discharge finally into owner's drain routed alongside the nearby road. For Ball Mill building, Gypsum dewatering building, FGD control room building, peripheral drains (Brick drains with steel gratings provided around the building) shall lead the water / slurry to a local pit (of 2 Cu. M. capacity) near each facility to allow settling. The water from the pit shall overflow into contractor's R.C.C drain, and finally into owner's drain routed alongside the nearby road. In case of Control rooms and M. C. C. buildings Pump houses, etc, water / slurry coming from down comers shall discharge into peripheral drains (Brick drains with steel gratings provided around the building) which will lead the water / slurry into contractor's R.C.C drain, which will lead the discharge finally into owner's drain routed alongside the nearby road. Contractor's scope shall also include construction of necessary culverts under the rail lines / roads as per railway / I. R. C. standards and approval of Railway culverts from concern Railway authorities.
4.02.00	**Internal and external water supply, drainage etc.** The scope for potable water supply includes all distribution systems, tanks, pipes, fittings etc. as required and as described here or elsewhere in the specifications.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	The scope for service water supply and dust control water supply shall be as described elsewhere in the specifications. For water supply, medium class galvanized mild steel pipes conforming to IS: 1239 shall be used. All facility buildings shall be provided with open surface brick drains of minimum size of 300 mm width and 300 mm depth all around the periphery. All drains excepting the peripheral drains around facility building shall be of R. C. C. construction. Drains shall have removable steel grating cover and shall be provided with edge protection angles. The scope for foul water from toilets shall include layout and laying of sewers up to the Employer's main sewer line for sewerage system together with all fittings and fixtures and inclusive of ancillary works such as connections, manholes and inspection chambers within the building and from the building to the Employer's sewer line. For rain water down comer and those to be used for conveying water / slurry generated from cleaning of buildings floors, Galvanised MS pipes conforming to IS: 1239 (for 150 mm NB Medium grade pipes) with welded joints shall be used for MCC buildings, penthouse, control rooms, ball mill building, gypsum dewatering building, storage sheds. Galvanising shall be as per IS: 4736. The minimum mass of zinc coating shall not be less than 400 gms/sq.m. as per IS:6745. The zinc coating shall be smooth and shall be subjected to testing as per IS: 2633, for uniformity of coating. The zinc coating shall be free from all defects as per IS: 2629. All rain water down comers shall be provided with roof drain heads and complete with shoes bends, junctions, sockets, adapters, brackets and finished with anti corrosive painting over a coat or primer. For design of building drainage system IS: 1742 shall be followed. For sanitary / sewerage pipes above ground, sand cast iron pipes conforming to IS : 1729 with leak proof lead joints. For underground drain pipes, minimum class NP - 2 pipes conforming to IS: 458. At road crossings, concrete pipes of class NP 3 conforming to IS: 458 and at rail crossing R.C.C. box culvert to be provided. ~~For sewerage below ground stoneware pipes conforming to IS: 651 with con~~crete ~~bedding and haun~~ch.
5.00.00	**COLOUR COATED AND OTHER SHEETING WORK**
5.01.00	**Material** **a) Wall Cladding & Roofing Material** Troughed permanently colour coated sheet of approved shade and colour shall be

CLAUSE NO.	TECHNICAL REQUIREMENTS
	i) either of steel with minimum 0.6mm bare metal thickness (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade G250 as per AS1397 / grade SS255 as per ASTM A653M / grade S250GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150 **ii)** or of minimum 0.5mm BMT (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade G350 as per AS1397 / grade SS340 class 4 as per ASTM A792M / grade S350GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150 **iii)** or of steel of minimum 0.4mm BMT (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade G550 as per AS1397 / grade SS550 as per ASTM A792M / grade S550GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150 Alternatively aluminium feed material of minimum bare metal thickness of 0.7 mm of aluminium alloy of Series 31000 and above as per IS 737 and IS 1254. **b) Metal Deck Roof Material** Troughed permanently colour coated metal decking sheets shall be **i)** either of steel with minimum 0.8mm bare metal thickness (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade G250 as per AS1397 / grade SS255 as per ASTM A653M / grade S250GD as per EN 10326 with zinc coating to class Z275 **ii)** or of minimum 0.6mm BMT (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade G350 as per AS1397 / grade SS340 class 4 as per ASTM A792M / grade S350GD as per EN 10326 with zinc coating to class Z275 **iii)** or of steel of minimum 0.6mm BMT (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade G550 as per AS1397 / grade SS550 as per ASTM A792M / grade S550GD as per EN 10326 with zinc coating to class Z275. Alternatively aluminium feed material of minimum bare metal thickness of 0.9 mm of aluminium alloy of Series 31000 and above as per IS 737 and IS 1254 can also be used for metal decking. Thickness tolerance of (+/-) 0.04mm is permissible. However, all design calculations shall be carried out on the basis of lowest value of sheet thickness provided.
5.02.00	**Colour Coating** Steel shall be colour coated with total coating thickness of at least 40 microns (nominal) comprising of silicon modified polyester (SMP with silicon content of 30% to 50%) paint or Super Polyester paint, of minimum 20 microns (nominal) dry film thickness (DFT) on external face over primer coat of minimum 5 microns (nominal) and minimum 10 microns (nominal) SMP or super polyester paint over primer coat of minimum 5 microns (nominal) on internal face. SMP and Super polyester paint systems shall be of industrial finish of product type 4 of AS/NZ2728.
5.03.00	**Design Criteria** For wall cladding insulated / uninsulated sides and roof, permanently colour coated sheet of troughed profile shall be used. The nominal depth of trough shall be 30 mm.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	For profiled metal decking sheets (to be used for RCC floor slab or roof slab) the sectional modulus and moment of inertia of troughed profile per meter width shall be so as to limit the deflection of sheets to span/250 under total super imposed loading (DL +LL) comprising the self-weight of metal deck sheet, dead weight of green concrete and an additional construction load 100kg per sq.m for two span condition. The section modulus and moment of inertia of troughed profile shall be computed as per the provisions of IS 801 for satisfying the deflection and strength requirements. For metal deck sheets used for roofing (with or without RCC) and side cladding, the sectional modulus and moment of inertia of troughed profile per metre width shall be such that the deflection of sheets is limited to span/250 under design wind pressure for two span condition. The sectional modulus and moment of inertia of troughed profile shall be computed as per the provisions of IS 801 for satisfying the deflection and strength requirements. No increase in allowable stress is permissible under wind load condition.
5.04.00	**Fasteners** Side cladding/roofing/decking sheets shall be fixed to the runner/purlins using self-drilling special coated fasteners confirming to corrosion resistant class 3 of AS3566 and tested for 1000 hours salt spray test. Spacing of Self-drilling fasteners in transverse direction (along runners/purlin) shall be equal to the pitch of trough or 250(+/-100) mm, whichever is lesser and in longitudinal direction at every runner/purlin location. Shear anchor studs shall also be provided through troughed permanently colour coated metal decking sheets metal deck, which are to be used as permanent shuttering, at regular interval on all top flange / flange plate of structural beams. The shear anchor studs for fixing metal deck sheet to floor structural beams shall conform to Type-B studs specified in AWS D1.1/D1.1M or equivalent as shear connector of 19mm diameter and 100mm length manufactured from cold drawn round steel bars conforming to the requirement of ASTM A 29, of grade designation 1010 through 1020, of standard quality with either semi-killed or killed, welded by Drawn Arc Stud Welding through metal deck sheet. The shear anchor studs for fixing metal deck sheet to roof structural purlins shall conform to Type-B studs specified in AWS D1.1/D1.1M or equivalent as shear connector of 16mm diameter and 65mm length manufactured from cold drawn round steel bars conforming to the requirement of ASTM A 29, of grade designation 1010 through 1020, of standard quality with either semi-killed or killed, welded by Drawn Arc Stud Welding through metal deck sheet. Alternatively, J/U type hooks shall be used in roofing which shall be provided in transverse direction (along runners/purlin) at a spacing equal to the pitch of trough or 250(+/-100) mm, whichever is lesser and in longitudinal direction at every runner/purlin location.
5.05.00	**Miscellaneous Details** To minimize the number of joints, the length of the sheet shall preferably be not less than 4.5m, cut pieces shall not be used, unless specifically approved by the Engineer. However, the actual length shall be such so as to suit the purlin / runner spacing.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	Lap between the sheets shall be at least 150mm in the longitudinal direction and at least one crest wide in the transverse direction which shall be properly anchored / fixed with fasteners. Z spacers if required shall be made of at least 2 mm thick galvanised steel sheet of grade 350 as per IS 277 Sealant used for cladding shall be butyl based, two parts poly sulphide or equivalent approved, non stainless material and be flexible enough not to interface with fit of the sheets . Filler blocks as a trough filler shall be used to seal cavities formed between the profiled sheet and the support or flashing. The filler blocks shall be manufactured from black synthetic rubber or any other material approved by the Engineer. All flashings, trim closures, caps etc. required for the metal cladding system shall be made out of plain sheets having same material and any weather/moisture sealants with appropriate material and coating specification as mentioned above for the outer face of the metal cladding. Overlap shall be min. 150 mm or as specified by manufacturer.
5.06.00	**Pre-Fabricated Insulated Metal Sandwich Panels** For structures where Pre-Fabricated Insulated Metal Sandwich Panels shall be used for Roofing, the sandwich panels shall comprise top sheet as troughed permanently colour coated sheet & bottom sheet as plain permanently colour coated with 50mm thick insulation sandwiched between the two sheets. Each sheet shall be **i)** either of steel with minimum 0.6mm bare metal thickness (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade G250 as per AS1397 / grade SS255 as per ASTM A653M / grade S250GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150 **ii)** or of minimum 0.5mm BMT (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade G350 as per AS1397 / grade SS340 class 4 as per ASTM A792M / grade S350GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150 **iii)** or of steel of minimum 0.4mm BMT (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade G550 as per AS1397 / grade SS550 as per ASTM A792M / grade S550GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150. Alternatively aluminium feed material of minimum bare metal thickness of 0.7 mm of aluminium alloy of Series 31000 and above as per IS 737 and IS 1254. Metal sheets (steel or aluminium) shall be colour coated with total coating thickness of at least 40 microns (nominal) dry film thickness (DFT) comprising of Silicon Modified Polyester (SMP with silicon content of 30% to 50%) paint or Polyester paint, of minimum 20 microns (nominal) SMP or polyester paint on one side (exposed face), over minimum 5 micron (nominal) primer coat and minimum 10 micron (nominal) SMP or Polyester paint over minimum 5 micron (nominal) primer coat on other side. SMP and Super Polyester paint shall conform to product type 4 of AS/NZS 2728. Troughed sheet shall be of approved profile, sectional properties, (suitable for the specified loading / deflection and purlins / runners spacing), colour and shade.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	Special coated fastener conforming to corrosion resistant Class 3 of AS3566 and tested for 1000 hours salt spray test shall be used for fixing Pre-Fabricated Insulated Metal Sandwich Panels with the structural members below. The contractor shall prepare working drawings of sheeting system including end and side laps, fixing details etc. before starting sheeting work at site.
5.07.00	**Polycarbonate Sheets** The polycarbonate sheet to be used for cladding and glazing purpose in conveyor galleries, Transfer points & pump houses shall have toughed profile to match with the metal cladding profile. Minimum 3.0mm thick fire retardant and UV resistant polycarbonate clean sheet of approved make shall be used. The polycarbonate sheet shall be installed along with the metal cladding so as to have a watertight lapping arrangement. Suitable detailing shall be made to cater for the thermal expansion. IS 14434 to be referred for other details
6.00.00	**Roof Details**
6.01.00	Roof slab shall be minimum 150 mm thick(**above the top surface (crest) of the metal deck sheet**) and shall have minimum 10 dia HYSD reinforcement bars placed at 200 mm center both ways at top and bottom.
6.02.00	900 mm high and minimum 100 mm thick R. C. C. parapet wall shall be provided over roofs of all buildings. Parapet wall shall have suitable coping. External face of parapet wall of the buildings provided with metal cladding shall also be finished with metal cladding of design and colour as per approved architectural drawings.
6.03.00	Junction of roof and parapet shall be provided with 150 x 150 mm size concrete fillet.
6.04.00	Drain level shall be provided with 45 x 45 cm size khurras having minimum thickness of 30 mm of M-15 concrete over PVC sheet of 1 m x 1m x 400 micron and finished with 12 mm 1 : 3 cement : sand plaster.
6.05.00	Roofs of all control rooms, M. C. C. rooms, penthouse etc., shall have roof water proofing treatment. Roof water proofing treatment shall be as follows: 1) Application of polymerised mastic over the RCC roof to achieve smooth surface as primer coat. 2) Application of high solid content liquid applied urethane based elastomeric water proofing membrane, over the primer coat, to give uniform joint less dry film thickness of minimum 1.5 mm (as per ASTM C 836 and C 898). 3) For efficient disposal of rain water, the run off gradient for the roof shall not be less than 1: 100. This gradient shall be provided by screed concrete M-15 (using 12.5 mm coarse aggregate) and / or cement mortar (1: 4) over the elastomeric water proofing membrane with 25mm thick cement mortar (1:4) topping. 4) Wearing course at top, shall consist of 25 mm thick P. C. C. (M-15) cast in panels of maximum 1.2 x 1.2 m size and reinforced with 0.56 mm diameter galvanized chicken wire mesh and sealing of joints using sealing compound / elastomeric water proofing membrane. Pathways for handling of materials and movement of personnel shall be provided with 22 mm thick chequered cement concrete tiles as per IS : 13801 for a width of 1000 mm in place of P. C. C.
6.06.00	For efficient disposal of rain water, the run off gradient for the roof shall not be less than 1:100. This gradient can be provided either in structure or subsequently by

CLAUSE NO.	TECHNICAL REQUIREMENTS
	screed concrete M-15 (using 12.5 mm coarse aggregate) and/ or cement mortar (1:4). However, minimum 25 mm thick cement mortar (1:4) shall be provided on top to achieve smooth surface.
6.07.00	Medium class galvanised mild steel pipes conforming to IS: 1239/ IS: 3589 with welded joints shall be provided for rain water down comers to drain off rain water from the roof. These shall be suitably concealed with masonry work, to match with the exterior finish. The number and size of down comers shall be governed by IS: 1742 and IS: 2527. RCC roof shall be provided with 45 x 45 cm size Khurras having minimum thickness of 30 mm with M-15 concrete over PVC sheet of 1mx1mx400micron and finished with 12 mm thick cement sand plaster 1:3.
6.08.00	Access to RCC roof of Gypsum dewatering building, FGD Control room building, MCC building, Ball mill building shall be through RCC staircase, and roof access to all other buildings all shall be through cage ladder as per requirement.
6.09.00	Fillets at junction of roof and vertical walls shall be provided with cast - in - situ cement concrete (M-15) nominal mix followed by 12 mm thick 1:4 cement sand plaster.
6.10.00	The rainwater down comers shall be provided with suitable C.I. grating at inlet point.
7.00.00	**RCC Floors, Paving & Grade Slab details** The floor slabs shall be minimum 150 mm thick(above the top surface (crest) of the metal deck sheet) and shall have minimum 10 dia HYSD reinforcement bars placed at 200 mm center both ways at top and bottom. In case Bidder opts for steel super-structure with RCC floors/ roof, the bidder shall necessarily use Troughed permanently colour coated metal decking sheets having minimum thickness of 0.8mm as permanent shuttering. The detailed material property requirement of metal deck sheet is specified elsewhere in the specification. These profiled metal deck sheets shall be fixed to the structural steel beams/ purlins using headed shear anchor studs specified elsewhere in the specification. Chequered plates (used for floors, walkways etc.) shall be minimum 6 mm thick. Mild steel flats/angles of suitable size shall be welded to the bottom portion of chequered plates at a designed spacing to stiffen chequered plates suitably. Chequered plates shall be fixed by staggered welding of suitable size. Floors of trenches shall have integral finish to concrete base. Toe guard of size 100 x 6 mm shall be provided at various openings provided in floors e.g. around stair case openings, chute openings and other similar cutouts. For conveyor walkways, angle runner to act as toe guard shall be provided. R. C. C. floors (where no brick masonry walls are provided) shall be provided with handrails all along the periphery. RCC paving of minimum 150 mm thick with M25 grade concrete, over an under bed as specified herein shall be provided for areas mentioned below. RCC paving shall be designed as rigid reinforced concrete pavement for the crane/ vehicular/ equipment movement loads which the paving has to bear. The under bed for paving shall consist of preparation and consolidation of sub-grade to the required level, laying of stone soling of 200mm compacted thick for normal duty paving and 400mm

CLAUSE NO.	TECHNICAL REQUIREMENTS

compacted thick for heavy duty paving with 63 mm and down aggregate with interstices filled with selected moorum/ non-expansive soil followed by 75 mm thick 1:4:8 PCC (1 part cement, 4 parts sand and 8 parts stone aggregate) with 40 mm nominal size aggregate. For normal duty paving, reinforcement of the RCC paving shall consist of minimum 8mm dia bars @ 200 mm c / c in both directions at the centre of the slab. For heavy duty paving/ passage, reinforcement of the RCC paving shall consist of minimum 10mm dia bars @ 200 mm c / c in both directions at the centre of the slab.

Paving areas shall be provided with the metallic hardener floor finish as specified elsewhere in the specification.

Passages shall be provided inside the FGD block connecting to the outer periphery road to have access to the various facilities/buildings. These passage areas shall be provided with heavy duty paving for movement of heavy vehicles. The top surface of the passages shall be finished with 50 mm thick metallic hardener topping. Heavy duty paving shall also be provided for the areas in the equipment lay down area, unloading & maintenance area with 50 mm thick metallic hardener topping.

Lightly loaded areas such where no heavy traffic movement is envisaged shall be provided with Normal Duty paving.

All facility buildings shall be provided with 750 mm wide plinth protection all around. It consists of 50 mm thick P.C.C. M-20 grade with 12 mm maximum size aggregate over 200 mm thick stone soling using 40 mm nominal size rammed, consolidated and grouted with fine sand

An area of minimum 5 m width all around the tank foundations and other facility buildings shall be paved. This paving shall be beyond the extent of plinth protection. Further, heavy duty paving shall be provided for passages connecting the outer periphery road to have access to the various facilities/buildings.

Plinth level of all buildings shall be kept at least 500 mm above the finished grade / formation level.

Suitable open RCC drains shall be provided to dispose off storm water drain. The paving shall be provided with slope of 1:500 to dispose the surface water/wash water to the nearest drain.

Sewer lines (Cast Iron), interconnected by sewer manholes (RCC) at regular intervals (not exceeding 30 meter centre to centre) shall be provided to dispose off sewage from FGD block to sewage pump house.

GRADE SLAB OF BUILDINGS AT GROUND FLOOR

In buildings, the grade slab shall consist of 150mm thick RCC M25 grade base slab over an under bed as specified below. The under bed for ground floor slab shall consist of 75mm thick 1:4:8 PCC on stone soling of 200mm compacted thick with 63 mm and down aggregate with interstices filled with well graded selected sand/ moorum/ non-expansive soil on compacted and dressed sub - grade. Reinforcement for the slab shall consist of minimum 8mm dia. bars @ 200 mm c/c at top & bottom of the slab in both directions. However, at unloading & maintenance area, stone soiling of minimum 400mm thick and grade slab with minimum 10mm dia bars @ 200 mm c/c at top and bottom in both directions shall be provided.

Further, top surface of grade slabs shall be finished with 50mm thick metallic hardener topping.

CLAUSE NO.	TECHNICAL REQUIREMENTS
8.00.00	**Brickwork and allied masonry works** All brick walls shall be non - load bearing in-filled panel walls. All brickwork shall be designed as per Indian Standards and shall be plastered on both faces. All external walls shall be minimum one brick thick in 1: 6 cement: sand mortar. Brick walls shall be provided with 12 mm and 18 mm thick 1: 6 cement: sand plaster on smooth and rough face of the brick work respectively. Bricks to be used in brickwork shall be of minimum Class designation 50. Brickwork cladding for various structures shall be so provided that there is a clear gap of 40 mm between inside face of external brick wall and outside face of column flange. Structural steel wall beams supporting brickwork shall be suitably encased with plaster or 1: 2: 4 concrete as the case may be. In case of box type steel beam, encasement shall be done with cement sand plaster in specified thickness and proportions over G. I. wire netting of 0.9 mm thickness. Parapets, chajjas, windows and door heads, architectural faces, fins etc. shall be provided with drip course in 1 : 4 cement sand mortar. 50 mm thick Damp proof course shall be provided at plinth level for all brick wall. All R. C. C. ceilings shall be rendered smooth and finished with whitewash unless otherwise specified. Ceiling of control rooms, M. C. C. rooms (except areas provided with false ceiling) shall be provided with 6 mm thick plaster.
9.00.00	**Earthing Mat** 40 mm Dia MS Rods as earthing mat, placed at a distance of 1.0M away and at depths between 0.60M and 1.00M shall be supplied and laid all around the periphery of buildings, structures, and outdoor equipment, as per the approved drawings. Risers of 40 mm Dia MS Rods and connecting to the above Earthing mat shall also be supplied and laid in position by the Contractor, as per the approved drawings. Risers shall be laid up to a height of 300 mm above the local Ground level, at each of the columns of the buildings on outside of the buildings, and minimum 2 (Two) numbers for structures and outdoor equipment. The contractor also supply and lay necessary number of 3.0 M deep vertical 40 mm Dia MS Rods Earthing electrodes and connecting them to the Earthing mat, as per the approved drawings and the supplying and laying of 40 mm Dia MS Rods for connecting the Contractor's earthing mat with the Employer's earthing mat separately at two locations.
10.00.00	**SITE LEVELLING** Site leveling of gypsum storage area , lime storage area , gypsum dewatering area , truck hopper and associated areas to be levelled in one block. Each block shall be finished to the formation level as specified in drawing. Bidder shall deploy adequate number of experienced site leveling contracting agency(s) with requisite earth moving and compacting equipment to complete the work as per schedule. Bidder shall carry out the topographical survey before he commences detailed design and site leveling. This survey shall cover the entire FGD area including gypsum

CLAUSE NO.	TECHNICAL REQUIREMENTS

storage ,gypsum handling area , lime storage area ,gypsum dewatering area , truck hopper area, limestone grinding and slurry storage area in Bidder's scope of work. Based on field observations the contractor shall prepare and submit for Owners review the survey maps of the surveyed sited on suitable scale, indicating grid lines, contour lines and demarcating all permanent features like roads, railways, water-ways, buildings, power lines, natural streams, trees etc. For each area two sets of survey maps shall be prepared and submitted, one showing the spot levels and contours with grid lines and the other showing the grid lines, contours and permanent features

Since the construction of roads and drains for the FGD area including gypsum storage ,gypsum handling area , lime storage area ,gypsum dewatering area , truck hopper area, limestone grinding and slurry storage area is included in the scope of Bidder, it shall be the responsibility of the Bidder to ensure that these facilities are also constructed along with site leveling works. Bidder shall ensure that road access and drainage facilities for each block is available when site leveling in that block is completed. Unless otherwise instructed by the Engineers, all roads and drains within a block shall be constructed by the bidder within a month from the date of completion of site leveling of that block.

The specified formation level(s) shall be achieved either by excavation where the existing ground levels are higher than the specified formation level or by raising by controlled filling with borrowed earth where the existing ground levels are lower than the specified level

All materials arising out of site clearance and excavation shall be the property of owner. They shall be dealt with in the manner specified by the Engineer. Earth / boulders / rock etc. excavated and useful portion (serviceable materials) of trees cut shall be stacked at suitable places within Owner's acquired land for the plant including the reservoir and the ash disposal area in a manner as directed by the engineer. Woods, branches, trunks of trees shall be termed as serviceable material. Other materials like twigs, leaves, roots, vegetable and organic matters etc. shall be termed as unserviceable material and shall be sorted out from the serviceable materials before disposal. They shall be cleared from the area and disposed off at places within Owner's acquired land for the plant including the reservoir and the ash disposal area in a manner as directed by the engineer.

If the excavated material is suitable and accepted by the Engineer as fill material, the same can be used for filling in other areas where raising by filling is required. Otherwise the same shall be taken and stacked at places(s) within the plant boundary as directed by the Engineer.

Filling with rock shall be done only after the written permission of the Engineer in the following manner:

Filling with rock shall be done only in areas identified for laydown and preassembly .

Original ground after removal of all organic and vegetable matters shall be consolidated by rolling as directed by the engineer subject to a minimum of six passes of 8-10 tonnes roller.

CLAUSE NO.	TECHNICAL REQUIREMENTS

- Excavated rock shall be laid (on original ground or after filling 300 mm thick layers of soil as specified), in layers not exceeding 1000 mm and rolled with with vibratory roller (10-15 tonnes static weight) with minimum six passes.

- Over the compacted layer of rock, soil shall be filled in horizontal layers not exceeding 300mm in compacted thickness. The soil shall be compacted as specified elsewhere.

- It shall be ensured that the top soil layer is in minimum 3 layers of 300 mm each. To achieve this the thickness and number of rockfill layers below can be suitably adjusted.

Contour map and spot levels of the area based on the preliminary survey carried out by Owner is enclosed for the purpose of guidance of Bidder. However, Owner does not lake any responsibility about the accuracy of the survey details furnished and any variation of the said data shall not constitute a valid reason for changing the terms and conditions of the contract. Bidder is requested to carry out his independent assessment of the existing ground levels before furnishing his. bid Detailed survey shall be carried out by Bidder after award of work and all findings as stated earlier shall be submitted for Owner's review.

Before commencement of cutting/filling, all organic and vegetable matters like grass. Plants shrubs bushes, weeds, trees (with girth less than 30 cm measured at height of 1m above ground level) etc. in the areas to be filled, shall be completely removed along with their roots and disposed off. .It shall also be ensured that the area
to be filled is clear of any water, slush etc. Original ground shall be compacted by rolling as directed by the Engineer subject to a minimum of six passes of 8 to 10 tonne
roller The earth shall then be spread in horizontal layers not exceeding 300 mm in compacted thickness. Each layer shall be watered and compacted with proper moisture
content and with such equipment as may by required to obtain a compaction of 95% or more of Standard Proctor's maximum dry density. The moisture content of the fill
material shall be controlled to obtain near optimum moisture content during compaction.
The fill material shall be tested for determining optimum moisture content and maximum dry density by Standard Proctor Test as per IS : 2720 (Part-VII). The fill material shall also be tested for determining moisture content before compaction as per IS:2720 (Part-II) For each of the above tests, one sample for every 10,000 cubic metre of fill material shall be tested. Additional samples shall be tested, whenever there is a change in the source or type of fill material. The compacted soil shall be tested for its dry density as per IS2720 (Part-XXIX) or Part-XXVIII). Samples shall be taken at the rate of one sample for every 10,000 sq.m. area for each compacted layer. In addition random checks shall be carried out in compacted soils by means of Proctor needle penetration. Bidder shall submit to the Engineer, the test results immediately after completion of the tests. A sample shall be deemed to have passed the test when the in-situ dry density is equal to or more than the specified percentage of maximum dry density. If a sample taken from a layer fails to pass the test, the layer shall be further compacted till two samples

CLAUSE NO.	TECHNICAL REQUIREMENTS

taken and tested from this layer pass without any negative deviation. Only after this. spreading of further layers shall be taken up.

Before start of filling, the Bidder shall submit to the Owner his proposal for the methodology to be adopted for compaction for each type of fill material. The Bidder shall also carry out compaction trials to establish the proposed methodology. The Bidder
shall start the compaction work only after approval of the methodology by the Owner

The surface of the cut/filled up areas after reaching final level shall be dressed to the required levels and slopes. The difference in levels shall not be more than +/- 10cm
locally.

The borrow areas outside the overall plant boundary limits for obtaining suitable fill material which is required over and above the earth available after cutting high grounds
within the plant area, for site levelling shall be arranged by the Bidder himself and all
expenses in respect of royalties, taxes, duties, etc. for borrow areas/fill material shall
be borne by him. He shall also obtain and submit to the Owner the necessary clearances/permission from the concerned authorities for the borrow areas/fill material.

Material suitable for filling shall be loaded and transported to the filling site by the Bidder.
Any coarse grained or fine grained low plastic soil, free from shingle, salts, organic matter, sod or any other foreign substances, may be used for filling. The Bidder shall
test the fill material to establish its suitability and submit its results to the Owner. Fill material shall be approved by the Owner. The following types of materials shall not be used for filling:

a) Material from swamps, marshes and bogs.

b) Expansive clays

c) Peat, logs, stumps, sod and perishable materials.

d) Materials susceptible to combustion

e) Any material or industrial and domestic produce which will adversely affect other materials in the work.

f) Materials from prohibited areas

Bidder shall include in his offer any extra filling that may be required on account of subsidence of the original ground due to overburden of filling above and/or compaction works for site levelling.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	After levelling, the contractor shall establish concrete pillars at the intersection points of the grid lines for future reference. These pillars shall project at least 450 mm above the formation level and shall be labelled permanently with their respective coordinates and reduced levels. Filling upto the specified formation level shall extend at least 2.0m beyond the outside face of boundary wall/fence. Thereafter, it shall be finished at a suitable slope (not steeper than 1 Vertical:2 Horizontal) and provided with good quality dry stone pitching minimum 300mm thick for slope upto level difference of 3m. If the level difference is more than 3m, the stone pitching shall be provided with RCC bands with suitable design and benching.
11.00.00	**FENCING** Fencing with toe wall and steel gates shall be provided around the gypsum storage area , lime storage area , gypsum dewatering area , truck hopper and associated areas . Fencing shall comprise of PVC coated GI chain link fencing of minimum 8G (including PVC coating) of mesh size 75 mm and of height 2.4 m above the toe wall. The diameter of the steel wire for chain link fence (excluding PVC coating) shall not be less than 12G. All Fence posts shall be of 75 x 75 x 6 MS angles spaced at 2.5 m c/c distance. All corner posts will have two stay posts and every tenth post will have transverse stay post. Suitable R. C. C. foundation for the post and stays shall be provided based on prevailing soil conditions. Gates shall be sturdy with locking provisions. Toe walls of brick masonry shall be provided between fence posts all along the run of the fence with suitable foundation. Toe wall shall be minimum 200 mm above the formation level with 50 mm thick P. C. C. coping (1: 2. 4) and shall extend minimum 300 mm below the formation level. Toe wall shall be plastered on both sides and painted with two coats of cement paint of approved colour and shade. Toe wall shall be provided with weep holes at suitable spacing.
12.00.00	**ROADS** All roads shall be of rigid pavements unless otherwise specified. The design of rigid pavement shall be carried out as per IRC: 58. The effects of design wheel load, maximum tyre inflation pressures, tyre contact area for the vehicle, traffic loads, environmental factors such as temperature changes in the pavement, other factors, like impact, load repetitions, etc., are to be taken. Detailed plate load tests to determine the modulus of sub grade reaction “K” shall be carried out as per the procedure outlined in IS: 1888. The design traffic load shall be a minimum value of 4 million standard axles. The road shall be designed for 30 years of life and considering a minimum traffic growth rate of 1 per cent per annum. The concrete pavement for roads shall be minimum 250 mm thick slab. The road construction including its shoulders, base, sub base and concrete pavement shall be as per IRC standards. IRC: 58 shall be followed for the pavement design and IRC: 15 shall be followed for the construction of the concrete pavement.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	The road base shall be with minimum 150 mm thick dry lean concrete over granular sub base. Dry lean concrete shall be laid by a mechanical paver and compacted by vibratory rollers. Concrete pavement of the road shall be done with fully mechanized paver fitted with electronic sensors for construction techniques. Dry lean concrete shall be minimum M10 grade and concrete pavement slab shall be minimum M35 grade concrete. The finished top (crest) of all roads shall be 350 mm above the surrounding finished ground level. The sub grade under all roads and its shoulders shall be compacted to achieve 95 per cent or more of Standard Proctor's Density MDD using mechanical means. Cutting / extending / rerouting / remaking of existing roads including associated works to maintain continuity of road system / network shall also be carried out. All culverts and RCC bridges at crossings of all roads / rail tracks / facilities with drains / nallahs / channels / roads / rail tracks / pipes / other facilities, etc. are to be designed and constructed. Unless otherwise specified, all roads shall be double lane roads.
13.00.00	**GATE ALONG BOUNDARY WALL:** The gate shall be complete with fabricated hinges, MS aldrops with locking arrangement, tempered steel pivot, guide track of MS tee, bronze aluminum ball bearing, castor wheel etc. All gates shall be given anti-corrosive treatment in three coats. The structural steel shall confirm to IS: 2062 (latest) and all other relevant IS codes. Beside the each gate one room of size not less than 3m X 3m shall be provided for security guards. The room shall be made of brick/ RCC and with RCC roof. In addition to the room, one toilet block shall also be provided.
14.00.00	**LIME & GYPSUM HANDLING AND ASSOCIATED BUILDINGS STORM WATER DRAINAGE SYSTEM** Storm water drain shall be designed taking into account the finished ground levels of the plant area, drainage pattern, intensity of rainfall, etc with a return period of 50 years. These values shall be based on rainfall intensity of 90mm/hr. All RCC drains shall be either RCC Cast-in-Situ or RCC Pre-cast drains. The minimum grade of concrete shall be M25 for RCC Cast-In-Situ drains and M30 for RCC Pre-cast drains. The maximum velocity for RCC open drains shall be limited to 1.8 metre per second. However, minimum velocity of 0.6 metre per second for self - cleansing shall be ensured. Bed slope not milder than 1 in 1000 shall be provided. Open RCC rectangular section, unless required otherwise due to functioned requirement, shall be provided for all drains. The thickness of side walls and bottom slab of RCC drains shall be minimum 150mm or as per design considerations whichever is higher for drains upto depth of 1m from formation level. For depth of drain more than 1m from formation level, the thickness of side walls and bottom slab

CLAUSE NO.	TECHNICAL REQUIREMENTS
	of RCC drains shall be minimum 200mm or as per design considerations whichever is higher. The drains shall be provided on both sides of roads .These shall be designed to drain the road surface as well as all the free and covered areas, etc. Box culverts shall be provided at all rail, road and other crossings. All drains inside the building shall have minimum 40 mm thick grating covers. In areas where heavy equipment loads would be coming, precast RCC covers shall be provided in place of steel grating. The invert levels of the in-plant and plant peripheral drains shall be kept such that water can be discharged by gravity to the main / trunk drains under all conditions. The invert levels of the drains shall be decided in such a way that the water can easily be discharged to the natural water bodies above the high flood.
15.00.00	**SEWERAGE SYSTEM** The connection of sewer pipe line for the associated buildings of FGD and Lime and gypsum handling area to nearest owner's sewage network is in bidder's scope. Cement concrete pipes of class NP-3 as per IS:458 shall be used below ground level for sewage disposal in all areas . However, for pressure pipes and under roads spun C.I. pipes conforming to IS:1536 of required class shall be used. RCC manholes with CI cover shall be provided at every 30m along the length, at connection points, and at every change of alignment, gradient or diameter of a sewer pipeline. This shall be as per IS:4111. Sewage pump house shall be provided as per IS:4111.
16.00.00	**LOADING**
16.01.00	For consideration of loads on structures IS : 875 - 'Code of practice for structural safety of buildings' shall be followed. In addition to the dead load, live load, equipment load (including impact / vibration). Temperature loads etc. various loading conditions arising due to operation and maintenance of equipment shall be considered in the design. The structure and equipment shall also be designed for seismic loads as per the **"Criteria for Earthquake Resistant Design of Structures and equipment"** and the **"Criteria for Wind Resistant Design of Structures and equipment"** specified in the **"Project Information section"** of technical specification. Wind and seismic forces shall not be considered to act simultaneously. The following minimum live loads shall be adopted for the design of various structures. If actual expected load is more than the specified load, then actual load is to be considered.

CLAUSE NO.	TECHNICAL REQUIREMENTS	
	a) Roofs	150 Kgs. / Sq. M. for accessible roofs and 75 Kgs. / Sq. M. for non - accessible roofs. In addition to this dust load (Dead load) of 150 Kgs. / sq. m. on flat roofs & 75 Kgs. / sq. m. on inclined roofs shall also be considered.
	b) R. C. C. floors	500 Kgs. / Sq. M.
	c) Stair and balconies	500 Kgs. / Sq. M.
	d) Toilet rooms	200 Kgs. / Sq. M.
	e) Chequered plate floors	400 Kgs. / Sq. M.
	f) Walkways (including walkways in conveyor galleries)	300 Kgs. / Sq. M.
	g) Conveyor galleries	In addition to the live loads, loads due to cable trays, fire fighting / service water pipes shall also be considered @ 125 Kgs. / m (minimum) on each of the longitudinal girder. Roof-truss members are to be checked for supporting fire fighting pipes/ Service water pipes.
	h) Road Culverts and its allied structures including R. C. C. pipe crossing & road crossing of trenches.	For class 'AA' loading and checked for class A loading as per IRC standard.
	i) Channels / trenches	In addition to earth pressure and water pressure, etc. additional earth pressure due to surcharge of 2T / Sq. M. shall also be considered for design.
	j) Covers for trenches / channels	Covers for channels & trenches, shall be designed for a live load of 0.4T Sq. M. and loading as mentioned under clause in trenches, whichever is critical.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	k) Sumps and tanks and other underground basement type structures — In addition to earth pressure with a surcharge of 2T / Sq. M. (or surcharge due to Railway loading whichever is critical for Railway load bearing structures etc.) and sub - soil water pressure etc. These are also to be designed for the following conditions : i) Water / liquid inside and no earth outside (applicable only to such structures which are liable to be filled up with water or any liquid). ii) Earth with surcharge outside and no water / liquid inside iii) For underground (basement) structures protection against buoyancy during execution and after execution shall be ensured without superimposed loadings with minimum factor of safety of 1.2 against buoyancy.
	If the erection load is higher than the specified live loads on any floor or part thereof, then the erection loads are to be considered for the design. Permissible increase in stresses of materials and bearing pressure of soil due to wind load or seismic load shall be as per relevant I. R. S. and I. S. code.
16.02.00	**Crane load** For crane loads, an impact factor of 25% and lateral crane surge of 10% (of lifted weight + trolley weight) shall be considered in the analysis of frame according to the provisions of IS:875. The longitudinal crane surge shall be 5% of the static wheel load. Longitudinal surge and lateral surge shall not be considered to act simultaneously.
16.03.00	**Temperature load** For temperature loading, the total temperature variation shall be considered as 2/3 of the average maximum annual variation in temperature. The average maximum annual variation in temperature for this purpose shall be taken as the difference between the mean of the daily minimum ambient temperature during the coldest month of the year and mean of daily maximum ambient temperature during the hottest month of the year. The structure shall be designed to withstand stresses due to 50% of the total temperature variation. Suitable expansion joints shall be provided in the longitudinal direction wherever necessary with provision of twin columns. The maximum distance of the expansion joint shall be as per the provisions of IS: 800 and IS: 456 for steel and concrete structures respectively.
17.00.00	**DESIGN CRITERIA**
17.01.00	The design of all R. C. C. structures shall be carried out as per 'code of practice for plain and reinforced concrete for general building construction', IS : 456 (latest).

CLAUSE NO.	TECHNICAL REQUIREMENTS
17.01.00	Design of steel structures shall be done as per provisions of IS:800: 2007 (Limit state design) and other relevant IS standards.
17.02.00	Minimum size of the angle section to be used as structural members shall be 50 X 50 X 6. Minimum weld size shall be 6 mm. Connections shall be designed for 70 % of shear capacity of the member or the actual shear force, whichever is higher. The steel structures using tubular sections shall be designed and fabricated as per IS:806 – "Code of Practice for use of steel tubes in general building construction." and EN 1993-1-8:2005. Minimum grade of steel & thickness of Tubular/Hollow sections shall be Yst 240 Mpa & 4.0mm respectively
17.03.00	The building shall conform to local bye - laws, rules and regulations for industrial buildings and also B. I. S. publications, SP 32 and 41.
17.04.00	Slotted holes shall not be assumed to act as expansion joint for relieving of stresses and suitable bearings shall be provided at the supports.
17.05.00	Stresses for all structures shall be checked for the higher of the forces obtained from gust factor method and the peak wind speed method.
17.06.00	Horizontal bracing system shall be provided at floor levels around the openings.
17.07.00	Shear force in steel columns shall be transferred to the pedestals / foundations exclusively either through foundation bolts or the shear key arrangement.
17.08.00	For design of liquid retaining structures, IS : 3370 (Part - I to IV) (latest) shall be followed. Face of the structure in contact with liquid shall be designed as un - cracked section. For design of R. C. C. pipes for culverts, latest editions of IS : 458, IS : 783 should be followed.
17.09.00	For design of all underground structures / foundations, ground water table shall be assumed at the formation level (i. e. the adjoining ground level). For all underground structures like tunnel, underground transfer point and underground hopper etc. crack width shall be limited to 0.2mm.
17.10.00	Design of masonry walls shall be made as per IS : 1905.
17.11.00	Civil task drawing indicating various equipment loading and supporting arrangement and floor loads to be submitted along with the design calculation.
17.12.00	Minimum 0.12% of reinforcement shall be provided on the top face of the foundation concrete on either direction and minimum percentage of reinforcement at bottom face of foundation shall be same as that stipulated for beam as per IS:456.
17.13.00	Foundations for all tanks shall be designed for as per IS: 803.
17.14.00	Footings shall be so proportioned to as to minimise the differential settlement.
17.15.00	All gallery supporting trestles shall be so proportioned that the transverse deflection of gallery due to wind / seismic load should not exceed trestle height / 1000 as stipulated in IS: 11592. This deflection condition shall be strictly followed. Peak wind speed method shall be considered for checking the transverse deflection.

CLAUSE NO.	TECHNICAL REQUIREMENTS

17.16.00 The crusher and transfer house structures shall be so designed that transverse deflection at places where conveyor galleries meet, should be equal to the respective transverse deflection of conveyor supporting trestles.

17.17.00 **Deflection criteria**

The maximum Horizontal Deflection for various structures shall not exceed and be limited to the following:

Sl. No.	Description	Maximum value of
1.	For Trestles and transfer points (Transverse deflection at Conveyor gallery supporting level)	Height/1000 (For Wind load by Peak Wind Speed Method / Seismic Load)
2.	For other Buildings	Height/325

17.18.00

a) Permissible deflection (unless specified otherwise in this specification) for latticed framework and beams of floors other than drive floor shall be span/325.

b) The allowable deflection for beams directly supporting drive machinery shall be restricted to span/500 unless specified otherwise in this specification.

c) The deflection for manually operated cranes & monorail supporting beams shall not exceed span/500.

For electric overhead cranes :

1) upto 50 t capacity : span/750

2) over 50 t capacity : span/1000

d) The vertical deflection of metal deck sheet for roofing and side cladding shall be limited to span/250

e) The permissible vertical deflection for beams supporting drive machinery shall be restricted to span / 500 and for other beams it shall be within span / 325.

f) Permissible deflection for all purlins, cladding runners, roofing/cladding sheets and grating / chequered plates shall be span/250. However, the maximum vertical deflection of Grating/ Chequered plate shall be limited to 6 mm.

17.19.00

a) Dispersion of load in any direction through soil shall be as per IS: 8009 (relevant part).

b) Dispersion of load through concrete shall be considered at an angle of 45 degrees with horizontal from the edge of contact area.

17.20.00

a) The design and construction of RCC structures shall be carried out as per IS: 456. Working stress method shall be adopted for the design wherever

CLAUSE NO.	TECHNICAL REQUIREMENTS
	specifically mentioned in this specification. b) For design and construction of steel-concrete composite members, IS: 11384 shall be followed. c) For reinforcement detailing, IS: 5525 and SP: 34 shall be followed. d) Two layers of reinforcement (on both inner and outer faces) shall be provided for RCC wall sections having thickness 150 mm or more.
17.21.00	a) All RCC liquid retaining/conveying shall be designed by working stress method as outlined in clause no. 4.5 of IS 3370 (Part-2) 2009 unless specified other wise. b) Water proofing treatment shall be provided for liquid retaining/ carrying structures and basement type structures (requiring dry working condition). Dense and durable concrete with water cement ratio not more than 0.45 shall be used. Plasticiser /super-plasticiser cum water proofing compound shall be added to the concrete. All the construction/expansion joints shall be provided with PVC water bar and/or chemical injection grouting as per IS:6494. As applicable internal/external surface of such structures shall be provided with acrylic based polymer modified cementitious composite coating system for critical structures. For liquid carrying/retaining structures, minimum two coats of such coating shall be applied. For external application wherever the surface is in contact with the earth, fine silica/quartz sand of 0.6 mm nominal size shall be added in the coating mix for better abrasion resistance and total nominal thickness of such coating shall be minimum 1.5 mm. For non critical structures minimum two coats of bitumen grade 85/25 as per IS:702, mixed with 1% of anti-stripping compound meeting the requirement of IS:6241, shall be applied. The total application of bitumen shall not be less than 1.7 kg/sq.m. Bidder shall submit a comprehensive scheme for water proofing treatment based on above or any other alternative scheme, internationally accepted for Employer's approval prior to commencement of work. c) All liquid retaining/carrying structures shall be tested for water tightness as per the provisions of IS: 3370 and IS: 6494 and in case of leakage, the same shall be rectified by chemical injection grouting through nozzles.
17.22.00	For design of all underground structures, foundations, etc. ground water table shall be assumed at the finished ground level unless specified otherwise.
17.23.00	Earth pressure for all underground structures shall be calculated using coefficient of earth pressure at rest or co-efficient of active earth pressure, whichever is applicable, depending upon the structural configuration. However, for the design of substructure of pump houses, earth pressure at rest shall be considered. Co-efficient of passive earth pressure shall be used only in design of shear keys for stability against sliding.
17.24.00	a) Following loading conditions shall be considered in addition to the loading from super structure for the design of substructure of pump house, channels, sumps, tanks, trenches and other underground structures containing liquid i) Water pressure from inside and no outside pressure, like earth pressure, ground water and surcharge pressure (applicable only to structures, which are liable to be filled up with water or any other liquid.) ii) Earth pressure, surcharge pressure and ground water pressure from outside and no water pressure from inside.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	iii) Design shall also be checked against buoyancy due to the ground water during construction as well as after construction stages. Minimum factor of safety of 1.2 against buoyancy shall be ensured considering empty condition inside and ignoring the superimposed loadings. Provision of pressure relief valves/flap valves, etc., shall not be permitted to counter the buoyancy unless specified otherwise. iv) Base slab and piers of the pump houses shall also be designed for the condition of different combination of pump sumps being empty during maintenance stages with maximum ground water level. b) Intermediate dividing pier of pump sumps and partition wall (if applicable) in channel shall be designed considering water on one side only and other side being empty for maintenance. c) All pump houses and other substructures (wherever applicable) shall be checked for stability against sliding and overturning during construction as well as operating conditions for various combinations of loads.
17.25.00	**Design of Block Foundation** a) Block foundation resting on soil shall be analyzed using elastic half space theory. In case the foundation is supported over piles, Novak's approximation shall be used for determining the spring constant and damping ratio of pile groups. The mass of the RCC block shall be at least three times the mass of machine. Free vibration analysis of the foundation shall be carried out to evaluate the natural frequencies. The fundamental natural frequency shall be kept at least 20% away from the operating frequency (speed). Forced vibration analysis shall be carried out if the dynamic forces are made available by the machine supplier in which case the amplitude limits stipulated by the machine supplier and ISO 10816, whichever is lower, shall be satisfied. Reinforcement design shall be done by working stress method as per IS:456-2000 and IS:2974 (Part-IV). b) For the foundations supporting minor rotating equipment weighing less than one ton or if the mass of the rotating parts is less than one hundredth of the mass of the foundation, no dynamic analysis is necessary. However, if such minor equipment is to be supported on building structure, floors, etc., suitable vibration isolation shall be provided by means of springs, neoprene pads, etc., and such vibration isolation system shall be designed suitably.
18.00.00	**Coating on RCC water retaining structures (other than drinking water)** Epoxy phenolic coating shall be applied on internal surfaces of the RCC water retaining structures, as per details specified below: All concrete surfaces shall be provided with two component transparent polyamide cured epoxy sealer coating (having solid by volume minimum 40% ±2%) of minimum 50 micron DFT. Surface to be coated shall be absolutely dry, clean and dust free. Sealer coat shall be followed with the application of epoxy phenolic coating (solid by volume minimum 63%) of minimum 400 micron DFT. This coat shall be applied after an interval of minimum 24 hours (from the application of primer coat) by airless spray technique.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	Coating on RCC water retaining structures (drinking water) Internal surfaces of RCC water retaining structures shall be provided with minimum 400 micron Food grade epoxy coating complying to FDA Title 21, Part 175.300. Surface to be coated shall be absolutely dry, clean and dust free
.	
19.00.00	**Fabrication**
	All steel structures shall be fabricated in factory, transported and erected at site. All factory fabricated structures shall have bolted field connections. Chimney flue liners can either be fabricated at factory in segments, transported and welded at site before erection or fabricated at site. For Chimney flue liners, to prevent flue gas leakages, the applicable field joints shall necessarily be welded.
20.00.00	**Electrodes**
20.01.00	The electrodes used for welding shall be of suitable type and size depending upon specifications of the parent material, the method of welding, the position of welding and quality of welds desired. Only low hydrogen electrodes shall be used for welding of medium /high tensile steel and for mild steel plate thickness above 20 mm.
20.02.00	All low hydrogen electrodes shall be baked and stored before use as per manufacturer's recommendation. The electrodes shall be re-baked at 250°C - 300°C for one hour and later on cooled in the same oven to 100° C. It shall be transferred to a holding oven maintained at 60°C - 70°C. The electrodes shall be drawn from this oven for use.
20.03.00	Where coated electrodes are used they shall meet the requirements of IS: 814 and relevant ASME - Sec. II. Covering shall be heavy to withstand normal conditions of handling and storage.
20.04.00	Only those electrodes that give radiographic quality welds shall be used for welds, which are subjected to radiographic testing.
20.05.00	Where bare electrodes are used these shall correspond to specification of the parent material. The type of flux-wire combination for submerged arc welding shall conform to the requirements of F-60 class of AWSA-5-17-69 and IS: 3613. The electrodes shall be stored properly and the flux shall be baked before use in an oven in accordance with the manufacturer's requirements as stipulated.
20.06.00	The contractor shall take specific approval of the weld for the various electrodes proposed to be used on the works before any welding is started.
20.07.00	**Edge Preparation for Welding**
	Suitable edge as per weld joint detail shall be prepared either by machines or by automatic gas cutting. All edges cut by flame shall be ground before they are welded.
20.08.00	**Pre Heating and Post Heating**
	Mild steel and medium / high tensile steel plates thicker than 20mm, will require Pre-Heating of the parent plate prior to welding as mentioned in Table - 1 for mild steel and Table - 2 for medium / high tensile steel, however, higher pre heat temperature

CLAUSE NO.	TECHNICAL REQUIREMENTS

may be required as per approved welding procedure and it shall be followed. In welding materials of unequal thickness, the thicker part shall be taken for this purpose.

Base metal shall be preheated, not withstanding provisions of IS: 9595 to the temperature given in Table - 1 for mild steel and Table - 2 for medium / high tensile steel, prior to welding or tack welding. When base metal not otherwise required to be pre heated is at a temperature below 0°C it shall be pre heated to atleast 20°C., prior to tack welding or welding. Pre heating shall bring the surface of the base metal to the specified pre heat and this temperature shall be maintained as minimum inter-pass temperature welding is in progress.

TABLE - 1
MINIMUM PREHEAT AND INTERPASS TEMPERATURE FOR WELDING MILD STEEL

	Welding Using	
Thickness of thicker part at Point of welding	**Low hydrogen electrode or submerged arc welding**	**Other than low hydrogen electrode**
Upto and including 20mm	None	None
Over 20mm and up to and including 40mm	20°C	Not allowed
Over 40mm and up to and including 63mm	66°C	Not allowed
Over 63mm	110°C	Not allowed

Note: Type of electrode and the preheating requirements for welding shall be as per approved welding procedure.

TABLE - 2
MINIMUM PREHEAT AND INTERPASS TEMPERATURE FOR WELDING MEDIUM / HIGH TENSILE STEEL

	Welding Using	
Thickness of thicker part at Point of welding	**Low hydrogen electrode or submerged arc welding**	**Other than low hydrogen electrode**
Upto and including 20mm	None	Not Allowed
Over 20mm	120oC - 140°C	Not Allowed

Note : Type of electrode and the preheating requirements for welding of medium and high tensile steel shall be as per approved welding procedure.

20.09.00 Pre heating may be applied by external flame which is non-carbonizing like LPG, by electric resistance or electric induction process such that uniform heating of the

CLAUSE NO.	TECHNICAL REQUIREMENTS
	surface extending up to a distance of four times the thickness of the plate on either side of the welded joint is obtained.
20.10.00	Thermo-chalk, thermo-couple or other approved methods shall be used for measuring the plate temperature.
20.11.00	All butt welds with plates thicker than 50mm and all site butt welds of main framing beam supporting the bunker shall require post weld heat treatment as per procedure given in AWS D-1.1. Post heating shall be done up to 600oC and rate of application shall be 200oC per hour.
20.12.00	The post heat temperature shall be maintained for 60 minutes per 2.5cm thickness. For maintaining slow and uniform cooling, asbestos pads shall be used for covering the heated areas.
21.00.00	**Paving, Drainage and Sewage**
	RCC paving of minimum 150 mm thick with M25 grade concrete, over an underbed as specified herein shall be provided. RCC paving shall be designed as rigid reinforced concrete pavement for the crane/ vehicular/ equipment movement loads which the paving has to bear. The under bed for paving shall consist of preparation and consolidation of sub-grade to the required level, laying of stone soling of 200mm compacted thick for normal duty paving with 63 mm and down aggregate with interstices filled with selected moorum followed by 75 mm thick 1:4:8 PCC (1 part cement, 4 parts sand and 8 parts stone aggregate) with 40 mm nominal size aggregate. Paving areas shall be provided with the metallic hardener floor finish as specified elsewhere in the specification. 2.5 m wide paving with metallic hardener around periphery of all sumps and underground tanks shall be provided. Suitable drains shall be provided to dispose off storm water as well as floor wash of the FGD area block. The paving shall be provided with slope of 1:500 to dispose the surface water/wash water to the nearest drain. Sewer lines (Cast Iron), interconnected by sewer manholes (RCC) at regular intervals (not exceeding 30 meter centre to centre) shall be provided to dispose off sewage from FGD area to the nearest available manhole of the owner. The plant storm water drainage shall be designed taking into account the finished grade levels of the plant area, drainage pattern, intensity of rainfall, etc., The storm water drainage shall cater to storm water run off resulting from one hour rainfall intensity, with a return period of 50 years. The value of minimum rainfall intensity shall be taken as 75mm/hr. The maximum velocity for pipe drains and open drains shall be limited to 2.4m/sec and 1.8 m/sec. respectively. However, minimum velocity of 0.6m/sec. for self-cleansing shall be ensured. Bed slope not milder than 1 in 1000 shall be provided. The open drains shall be open rectangular drains of RCC unless required otherwise due to functional requirement. RC box culverts shall be provided at rail, road or other crossings. Sewers shall be designed for a minimum self-cleansing velocity of 0.75m/sec and the maximum velocity shall not exceed 2.4m/sec.
22.00.00	**Statutory Requirements** Bidder shall comply with all the applicable statutory rules pertaining to Factories Act, Fire Safety Rules at Tariff Advisory Committee. Water Act for pollution control, Explosives Act, etc.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	Provisions of safety, health and welfare according to Factories Act shall be complied with. These shall include provision of continuous walkways along the crane - girder level on both sides of building, comfortable approach to EOT crane cabin, railing, fire escape, locker room for workmen, pantry, toilets, rest room etc. Provisions for fire proof doors, number of staircases, fire separation wall, lath plastering/encasing the structural members (in fire prone areas), type of glazing etc. shall be made according to the recommendations of Tarrif Advisory Committee. Statutory clearances and norms of State Pollution Control Board shall be followed. Bidder shall obtain approval of Civil/Architectural drawings from concerned authorities before taking up the construction work.
23.00.00	**INSPECTION, TESTING AND QUALITY CONTROL** Sampling and testing of major items of civil works viz. earthwork, concreting, structural steel work (including welding), piling, sheeting, etc. shall be carried out in accordance with the requirements of this specification. Wherever nothing is specified relevant Indian Standards shall be followed. In absence of Indian Standard equivalent International Standards may be used. The Bidder shall submit and finalise a detailed field Quality Assurance Programme before starting of the construction work according to the requirement of this specification. This shall include frequency of sampling and testing, nature/type of test, method of test, setting of a testing laboratory, arrangement of testing apparatus/equipment, deployment of qualified/experienced manpower, preparation of format for record, Field Quality Plan, etc. Tests shall be done in the field and/or at a laboratory approved by the Engineer. The Bidder shall furnish the test certificate from the manufacturer's of various materials to be used in the construction.
24.00.00	**CONCRETE** All R. C. C. works to the done under this specification, unless specified otherwise shall be design mix concrete. Minimum grade of concrete for various structures shall be as follows: a) M25 - For all underground / sub-structural/ super-structure R. C. C. work. b) M30- For Block Foundation c) M35- For spring supported RCC deck and rail load bearing structure (if applicable). Minimum 75 mm thick P.C.C M-7.5 shall be provided as mud mat below all foundations. For concreting of underground structures requiring water tightness, plasticizer cum water proofing admixture shall be added to the concrete mix. Both coarse and fine aggregates shall conform to IS: 383 for concrete, shotcreting etc. unless otherwise mentioned.

CLAUSE NO.	TECHNICAL REQUIREMENTS
25.00.00	**Excavation, Backfilling, Disposal and Stacking of materials Details**
25.01.00	**Excavation in Soil** Excavation for foundation shall be to the bottom of lean concrete and as shown on drawing or as directed by the Engineer. The bottom of all excavations shall be trimmed to required levels and when excavation is carried below such levels by error, it shall be brought back to the specified level by filling with concrete of nominal mix 1 : 3 : 6 (cement: coarse sand: 40 mm down aggregates), as directed by the Engineer. The Contractor shall ascertain for himself the nature of materials to be excavated and the difficulties, if any, likely to be encountered in executing this work. Cofferdams, sheet piling, shoring, bracing to maintain suitable slopes, draining etc. shall be provided and installed by the contractor, to the satisfaction of the Engineer. Surplus excavated materials shall be disposed off by the contractor at locations up to a lead of 5 kms from the plant boundary wall as directed by the engineer. The Contractor shall have to constantly pump out any water collected in excavated pits and other areas due to rain water, springs etc. and maintain dry working conditions at all times until the excavation, placement of reinforcement, shuttering, concreting, Backfilling is completed. The Contractor shall remove all slush/muck from the excavated areas to keep the work area dry. The Contractor, if required, shall employ sludge pumps, for this purpose. For other details, excavation clauses as given at “Foundation system and Geotechnical Data Chapter” given at “Project Information section” of technical specification, are to be referred.
25.02.00	**Excavation in Rock** For the work of excavation in rock, Contractor shall engage specialised agency having experience of excavation in rock involving wedging and blasting. The agency shall be subject to approval of Engineer and the Contractor shall furnish details of relevant experience in support while seeking approval for the agency. Blasting shall be resorted to only with the written permission of the Engineer. All the statutory laws, (Explosives Act etc.) rules, regulations, Indian Standards etc. pertaining to the acquisition, transport, storage, handling and use of explosives etc. shall be strictly followed. The contractor shall obtain Licenses from Competent Authorities for undertaking blasting work as well as for procuring, transporting to site and storing the explosives as per Explosives Act. The Contractor shall be responsible for the safe transport, use, custody and proper accounting of the explosive materials. Surplus excavated materials shall be disposed off by the contractor at locations up to a lead of 5 kms from the plant boundary wall as directed by the engineer. The Contractor shall have to constantly pump out any water collected in excavated pits and other areas due to rain water, springs etc. and maintain dry working conditions at all times until the excavation, placement of reinforcement, shuttering, concreting, backfilling is completed. For other details for excavation in rock, clauses as given at

CLAUSE NO.	TECHNICAL REQUIREMENTS
	"Foundation system and Geotechnical Data Chapter" given at "Project Information section" of Technical specification, are to be referred.
25.03.00	**Backfilling, Disposal and Stacking of materials** Backfilled earth shall be compacted as per "Foundation system and Geotechnical Data Chapter" given at "Project Information section" of technical specification. However, the backfill under the rail lines and roads shall be compacted to minimum 95 % of the standard proctor density at OMC unless otherwise stated by rail Authorities. The contractor is required to excavate upto any depth as shown on the drawings or as directed by the Engineer. Lifting of excavated materials shall be done either by manual or mechanical or both means if called for by the Engineer. The disposal / stacking areas for excavated materials shall be indicated by the Engineer. The carriage of excavated materials shall be done by the methods mentioned below: The excavated materials shall be carried beyond the initial lead of 50 m but upto 500 m by manual / animal labour or by mechanical means. If directed by the Engineer this material shall be used directly for filling purposes. For leads exceeding 500 m the Contractor shall transport the excavated materials by mechanical means only and as directed by the Engineer. The Contractor may be allowed to carry materials through Kuccha roads. Providing and maintaining of the Kuccha roads shall be the responsibility of the Contractor. The transported material shall be neatly stacked as directed by the Engineer. Some excavated materials required for filling purposes, may have to be carried upto a lead of 500 m and stacked as per instructions of the Engineer. Excavated materials carried beyond 500 m shall normally be for disposal purpose only. Double handling of materials shall be avoided as far as possible. However, depending on site condition excavated materials carried beyond a lead of 500 m may also be required to be brought back for filling purpose. Materials to be used for filling purpose shall be stone, sand or other inorganic materials and they shall be clean and free from shingle, salts, organic matter, large roots and excessive amount of sod, lumps, concrete or any other foreign substances which could harm or impair the strength of the substances in any manner. All clods shall be suitably broken to small pieces. When the material is mostly rock boulders, these shall be broken into pieces not larger than 150 mm size before backfilling and shall be backfilled in layers of 300mm interstices filled with sand. In case of broken rock boulders used for back filling, the top cover shall be with 1.0m thick soil. The layers of rock boulders, interstices filled with sand shall be compacted by plate vibrators. Sand used for filling shall be clean, medium grained and free from impurities. Fines less than 75 microns shall not be more than 20%. In any case, the materials to be used for filling purposes shall have the prior written approval of the Engineer.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	In case the materials have to be brought from pits / quarries, then it shall be the Contractor's responsibility for identification of such quarry areas, obtaining approval from their use from concerned authorities, excavation / quarrying loading and carriage of such material, unloading and filling at specified locations. The Contractor shall pay any fees, royalties etc. that may have to be pain for utilisation of borrow areas.
26.00.00	**GALVANISING**
	All burrs and irregular edges of the structural steel members to be galvanised shall be ground smooth before galvanising. Purity of Zinc to be used for galvanising shall be 99.5 % as per IS : 209 (latest edition). The weight of the zinc coating shall be at least 610 Gms. / m^2 unless noted otherwise.
27.00.00	**CHEMICAL INJECTION GROUTING**
	Minimum, 12 mm dia (NB) threaded nozzle of suitable length, shall be provided over the surface and along the construction joint line in a grid pattern at a spacing not exceeding 1.5 m c / c before concreting operation. Adequate precaution shall be taken to keep the nozzles plugged at both ends to prevent them from getting closed by concrete. For fixing of any nozzle in set concrete suitable size hole shall be drilled, preferably by using repercussive hammer drill electrically operated, in grid pattern and grouting nozzle shall be fixed in these holes. After the nozzles are fully set, neat cement slurry admixed with water soluble non - shrink polymer / monomer based chemical shall be injected through the net - work of nozzles with low pressure grout pumps at a pressure of about 2.0 Kgs. / cm^2. Cement slurry shall be prepared by mixing cement with non-shrink polymer/monomer @ 500 gm/50 kg bag of cement and water, ensuring that Water: Cement ratio does not exceed 2 (by weight). Wetter the structure, lesser should be the water cement ratio. The property of the polymer/monomer should be such that when it is mixed with water @0.5% by weight of water, the viscosity of the resultant solution (water and polymer/monomer) should not be more than 1.2 centipoises. Plasticizing agent shall be added wherever required. The grouting shall be started at very low pressure and increased gradually to a required pressure. The grouting shall continue, till the hole refuses to take any further grout, even at an increased pressure. Applied pressure shall not be more than the designed strength of the concrete. After completion of grouting operation, the nozzles shall be sealed properly to the satisfaction of the Engineer.

CLAUSE NO.	TECHNICAL REQUIREMENTS
28.00.00	**POLYMER MODIFIED CEMENTITIOUS COATING**
28.01.00	**Materials** Modified liquid polymer blend shall be a dispersion containing 100 % acrylic based polymer solids. Polymer shall be mixed in the ratio of 1 cement: 0.5 polymer (for minimum solid content of polymer 30%). Portland cement based dry powder. Clean, fine specially prepared quartz sand approximately 0.6 mm size.
28.02.00	**Mixing** The liquid polymer shall be stirred well and cement based powder shall then be added slowly to make a Slurry Mix. For preparation of Brush Topping Mix, quartz sand shall be added slowly and mixed well till a homogeneous mixture is obtained. The mix shall be used within half an hour of the preparation. Addition of quartz sand may not be necessary, in case dry power contains the same.
28.03.00	**Properties of Coating** It must adhere to wet surface. It should develop adequate bond strength, with the concrete surface, not less than 2 N / Sq. mm. Co - efficient of permeability shall be about $5x10^{-10}$ Cm / Sec. Water absorption after continuous soaking shall not be more than 1 %. The materials shall be permeable under water vapour. The material shall be resistant to acids and alkalies present in the soil and underground water with normal pH value between 4 and 14. The co - efficient of thermal expansion of the material shall be close to that of concrete.
28.04.00	**Application** The concrete surface shall be cleaned and made free from grease, oils or loosely adhered particles. The surface shall be damp without any free water. For exterior underground part, application (b) pertaining to Brush topping Mix shall be followed. **(a) For Slurry Mix** A minimum of 2 coats shall be applied on the surface. The first coat being applied, when the surface is still damp and left to harden for 4 to 6 hours. After 4 to 6 hours of the application of second coat, it shall be finished by rubbing down with a soft dry

CLAUSE NO.	TECHNICAL REQUIREMENTS
	sponge. The coverage shall not be less than 1 : 1 Kgs. / m^2 in the 2 coats. A lap of 75 mm shall be provided at the joints. The coating shall be air dried for 4 to 6 hours and, thereafter, cured for 7 days after the application of last coat. **(b) For Brush Topping Mix** This shall be applied in two coats. A primary coat of slurry mix can also be first applied on the surface as first coat. After the coating has dried up, a coat of Brush Topping Mix shall be applied over it with a push broom or any other similar brush. It shall be left in broom finished condition. The nominal thickness shall be 1.5 mm and minimum thickness shall be 1.0 mm. A lap of 75 mm shall be provided at the joints. It shall be ensured that no pinhole exists and rebrushing shall be done to cover the pinholes, if any. The Coating shall be air dried for 4 to 6 hours and thereafter cured for 7 days after the application of last coat. Rate of application of coating shall be established to achieve the required thickness.
29.00.00	**Architectural Concepts** Buildings shall be architecturally treated in such a way that it presents a pleasing composition of mass and void with suitable and functionally designed projections and recesses. The overall impact of the building shall be one of aesthetically unified architectural composition having a comprehensive scale, blending with the surroundings and taking full consideration of the climatic conditions and the building orientation. All the buildings shall be architecturally treated in such a way so as to be in harmony with the surroundings. The over all composition may have straight or curvilinear profiles. Necessary projections, fins, parapets, chajjas etc. in addition to the minimum area specified elsewhere in this specification shall be provided as required. Nothing extra shall be payable for any changes required while getting the drawings / scheme approved and for executing the same. All structures, buildings and facilities shall be designed as per provisions of National Building Code 2005 and Local building by - laws as applicable including provisions of the Factories Act of the State concerned, with regard to requirement of free access, stairs, minimum head room, walkways, ventilation, toilets etc. and safety requirements like railings, fire escapes etc. Further all layouts and detailed drawings shall meet the relevant statutory requirements specified in recommendations of Petroleum act, Explosives act and Indian Electricity rules' as applicable.
29.01.00	**FINISHING SCHEDULE**
29.01.01	**Flooring** The nominal total thickness of floor finish shall be 50mm i.e. underbed & topping. The floor shall be laid on an already laid and matured concrete base.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	Flooring of tiles / stone shall be fixed with 18 mm thk cement sand mortar 1:4, above PCC under bed (M 20 (with graded aggregate of nominal size 12.5mm) design mix) Flooring of Concrete hardener topping shall be provided above the PCC underbed (M 20 (with graded aggregate of nominal size 12.5mm) design mix).
29.01.02	Wherever specified Heavy duty ceramic tiles of size 300x300x7 mm thick (minimum) of reputed manufacturer (Kajaria, Orient, Johnson or equivalent) of approved finish shade and colour to be used. Vitrified ceramic tiles wherever specified shall be 600x600 mm with minimum 9.5 mm thickness and of reputed manufacturer (Kajaria, Johnson, Orient or equivalent).
29.02.00	**Floor finish & skirting:** The nominal thickness of floor finish shall be 50 mm. Floors of toilets, pantries / kitchen shall be finished with Heavy duty (grade-5) dust pressed ceramic tiles 300mmx300mm x7 mm thick as per IS:15622, including pointing the joints with white cement mixed with matching pigment, of approved make, size & colour shade. (1) Floors of Office Room, Labs, Control Rooms, RIO Rooms and all other A/c Room shall be finished with Mirror polished Vitrified ceramic tiles (minimum 9.5 mm thk) with 3 mm groove joints as per approved pattern, pointed neatly with 3X4mm stainless epoxy grout SP- 100 of Laticrete or approved equivalent in approved colour to match colour of tile. (2) Suitable supporting arrangement shall be provided with M.S. angles / channels on cable trenches in MCC and Control rooms for mounting Control panels / MCC. (3) In rest of the areas, IPS (Cement concrete flooring) with Concrete hardener topping shall be 12mm thick with ordinary grey cement using uniformly graded, properly treated iron particles shall be provided. (4) Floors and sides of under ground RCC structures like valve pits, trenches and tanks shall have simultaneous (integral) neat cement finish at the time of concreting. (5) The interconnecting walkway between various structures, buildings and facilities shall be finished with 22 mm chequered concrete tiles at top. 1000 mm wide walkway of 22mm thick chequered concrete tiles shall be provided on terrace for maintenance purpose, in all RCC /Metal deck roof buildings. (6) Skirting in general shall be 150mm high, Dado in toilet, kitchen & pantry shall be up to specified height (up to 2200 mm for toilets, up to 600 mm high above counter top in kitchen and pantry area). The dado height shall be measured from finished floor level. Skirting and Dado shall match with the floor finish. (7) Battery Room shall be provided with Acid resistant tile on horizontal and vertical surfaces, at all levels for all type of works, including One coat of bitumen primer followed by 12 mm thick bituminastic layer, 20 mm thick Acid Resistant tiles, 6 mm thick under-bed by potassium silicate mortar, 6 mm thick pointing of joints of tiles with acid/alkali resistant epoxy/furane mortar up

CLAUSE NO.	TECHNICAL REQUIREMENTS
	to a depth of 20 mm and bituminastic end sealing. 1200 mm high dado on wall shall be with 12 mm thk Acid resistant tiles of the similar finish and the joints to be finished as per flooring tiles, with the rest of wall height and ceiling finished in chemical resistant paint (chlorinated rubber based). (8) Well polished 18 mm thick Kota stone jointed with neat cement slurry mixed with pigment to match the shade of the stone including rubbing and cleaning, complete, to be provided in entrance area, entrance steps, Entrance area, staircases (tread, riser, landings, skirting).
29.03.00	Sunken RCC slab shall be provided in false flooring area and toilet, Kitchen and pantry, so as to keep the finished floor level of these areas same as that of the surrounding area.
29.04.00	Water proofing treatment to be provided on sunken portion of all vertical and horizontal surfaces of depressed portions of all toilets, W.C., kitchen, Pantry and the like consisting of : (i) Ist course of applying cement slurry @ 4.4 kg/sq.m mixed with water proofing compound conforming to IS 2645 in recommended proportions including rounding off junction of vertical and horizontal surface. (ii) IInd course of 20 mm cement plaster 1:3 (1 cement: 3 coarse sand) mixed with water proofing compound in recommended proportion including rounding off junction of vertical and horizontal surface. (iii) IIIrd course of applying blown or residual bitumen applied hot at 1.7 kg. per sq.m of area. (iv) IVth course of 400 micron thick PVC sheet. (Overlaps at joints of PVC sheet should be 100 mm wide and pasted to each other with bitumen @ 1.7 kg/sq.m).
29.05.00	**Acid / Alkali Resistant Treatment:** Acid / alkali resistant lining treatment shall be provided in different areas as follows: Neutralization Pit: The walls shall be provided with one coat of bitumen primer, followed by 18 mm thick bitumastic layer, 115 mm thick A.R. bricks, 6 mm thick under bed of potassium silicate mortar, pointing the joints of bricks with acid / alkali resistant epoxy / furane mortar upto a depth of 20 mm and bitumastic end sealing. Suitable plasters shall be provided with A.R. bricks at regular intervals depending upon the height of lining, as per the specification. The floor of neutralization pit shall be provided with acid / alkali resistant lining treatment as given in the above para, except that the 115 mm thick A.R.tile layer shall be replaced by 75 mm thick A.R. tile layer and pilasters shall be omitted. The ceiling of neutralization pit shall be provided with one coat of epoxy primer followed by 2 coats of epoxy paint (150 micron). Acid / Alkali storage area / projections above the floor, pedestals projecting from the floor / saddles. : The floor shall be provided with one coat of bitumen primer followed

CLAUSE NO.	TECHNICAL REQUIREMENTS
	by 12 mm thick bitumastic layer, 20 mm thick A.R. tiles, 6 mm thick under - bed by potassium silicate mortar, 6mm thick pointing of joints of tiles with acid / alkali resistant epoxy / furane mortar up to a depth of 20 mm and bitumastic end sealing. Dado of 12 mm thk Acid Resistant tiles up to 1.0M high shall also be provided if applicable in case of walls nearby. Alum/Lime Storage area and first floor of Chemical House : One coat of bitumen primer followed by 12mm thick bitumastic layer, 20 mm thick A.R. tiles, 6 mm thick underbed of potassium silicate mortar, 6mm thick pointing of joints of tiles with acid /alkali resistant epoxy /furane mortar up to a depth of 20 mm and bitumastic end sealing. Alum solution preparation tank: The wall shall be provided with one coat of bitumen primer followed by 12 mm thick bitumastic layer, 75 mm thick A.R. tiles, 6 mm thick underbed by potassium silicate mortar, pointing of joints of tiles with acid / alkali resistant epoxy / furane mortar upto a depth of 20 mm and bitumastic end sealing. The floor shall be provided with acid / alkali resistant lining treatment as given in the above para except that the 75 mm thick A.R. tile layer shall be replaced by 12 mm thick A.R. tile layer. Basket of Alum solution preparation tank: 5 mm thick epoxy lining over a coat of epoxy primer. Curved surfaces of saddles shall have minimum 12 MM thick bitumastic layer to support the vessel / tanks. Effluent Drains: Acid Resistant lining treatment indicated for the storage area shall be provided on the bed as well as walls of the drains with 38 MM AR tiles. The underside of the pre-cast slab cover shall be applied with one coat of epoxy primer and two coats of epoxy coating, total DFT 150 microns. Lime tank: Two coats of bitumen paint conforming to IS: 9862, with total DFT 150 microns.
29.06.00	**Walls**
29.06.01	All walls shall be non-load bearing infilled panel walls. All external walls shall be minimum one brick thick masonry wall.
29.06.02	All external and internal walls shall be with minimum one brick masonry (230 or 250 mm) including toilet walls. Toilet partition low height walls shall be minimum half brick masonry.
29.06.03	For all air conditioned areas/ rooms, wherever metal cladding is envisaged as cladding material, additional brick masonry wall (230m thick) shall also be provided in addition to metal cladding for effective air conditioning. This brick wall shall be plastered & painted as specified elsewhere in the specification.
29.06.04	RCC transoms and mullions of size 115x115mm with suitable reinforcement shall be provided wherever necessary to reinforce the brickwork.
29.06.05	50 mm thick DPC in Cement concrete (M-20) with water proofing compound followed by two layers of bitumen coating 85/ 25 grade as per IS: 702 @ 1.7 kg/ sq.m. shall be provided at plinth level before starting the masonry work.

CLAUSE NO.	TECHNICAL REQUIREMENTS
29.06.06	The bricks shall be laid with cement mortar (1:6) for one brick thick walls and (1:4) for half brick thick walls IS: 1905, IS: 2212 and SP -- 20 shall be followed for brick work design and construction.
29.07.00	**Plastering**
29.07.01	External (rough) surface of walls shall be plastered with 18 mm thick cement plaster, consisting first (base) layer of 12 mm thick plaster in cement sand mortar (1:6) and second (finishing) layer of 6 mm thick plaster in cement sand mortar (1:4). The internal (smooth) surface of walls shall have 12 mm thick plaster in cement sand mortar (1:6). All external / internal RCC surfaces including RCC parapet walls shall be provided with minimum 12mm thick plaster in cement sand mortar (1:4) except walls of underground structures like cable trenches / valve pits etc.
29.07.02	All exposed faces of R.C.C. walls of structures, buildings and facilities shall have minimum 12 mm thick cement sand plaster 1:6.
29.07.03	All RCC ceilings (except areas provided with false ceilings and cable vault ceiling) shall be provided with 6 mm thick cement sand plaster 1:4.
29.07.04	All plastering work shall conform to IS: 1661.
29.08.00	**Painting**
29.08.01	All painting on masonry or concrete surface shall preferably be applied by roller. If Applied by brush then same shall be finished off with roller.
29.08.02	All paints shall be of approved make including chemical resistant chlorinated rubber paint.
29.08.03	Minimum two finishing coats of paint shall be applied over a coat of primer.
29.08.04	The thinner shall not be used with textured paint (Sandtex Matt or equivalent) finish.
29.09.00	**Internal Finish** All Air conditioned areas shall have 2mm of polymer based water resistant putty (wall putty) to given an even and smooth surface.
29.09.01	Acrylic emulsion paint shall be as per IS: 5411 (Part - 1). Acrylic distemper shall be as per IS: 428. Air - conditioned areas shall be applied with minimum 2 coats of acrylic emulsion paint. All other areas shall be applied with minimum 2 coats of Acrylic distemper.
29.09.02	Toilet, Pantry / Kitchen areas shall have dado with Designer ceramic tiles, 300x200mw (matt finish) upto 2.2 m height and shall match with floor finish. Above dado, Acrylic distemper shall be applied.
29.09.03	Areas coming in contact with chlorine fumes or acid / alkali shall have two coats of acid / alkali resistant chlorinated rubber paint over suitable primer on walls above dado & ceiling. The paint shall be of approved colour shade and make.
29.10.00	**External Wall Finish** One pack, ready mix and ready to use, resin / polymer bonded granular textured coating finish of 2.5 mm (natural coloured graded stone chips), of approved colour, and shade for all types of plastered and / or exposed concrete surface, in all kinds of works, at all levels, including preparation of surface, preparation of working drawing,

CLAUSE NO.	TECHNICAL REQUIREMENTS
	labour, material, equipment, handling, transportation, mixing, laying, applying finishing, testing, curing, making grooves, scaffolding, staging, etc., all complete, as per specifications, drawings and instructions of the Engineer-in-charge.
	Toe wall of chain link fencing shall be provided with two coats of Acrylic Smooth Exterior Paint
	The finish shall be of approved colour shade and make.
29.11.00	**Ceiling Finish**
	Ceiling shall have min. two (2) coats of Acrylic distemper except AC areas & Battery room.
29.11.01	For painting on concrete, masonry and plastered & surface, IS: 2395 shall be followed. For painting on steel work and ferrous metals, IS: 1477 shall be followed.
29.11.02	Fire resistant transparent paint (confirming to IS: 162) shall be provided on all wood work, over French police or flat oil paint. French polish shall confirm to IS : 348. Flat oil paint shall confirm to IS: 1237.
29.12.00	**Doors, Windows, Ventilators, Louvers, Rolling Shutters & Glazing**
29.12.01	Adequate Doors, Windows, Louvers and Ventilators shall be provided for proper lighting and ventilation of all buildings. The area of windows shall be at least 10% of the floor area of the respective building. In addition to the above, wherever room height is more than 3.5 m, a band of ventilators of 600 mm height (minimum) shall be provided at the top.
29.12.02	Unless specified all doors, of air conditioned areas, entrance lobby of all buildings shall have electro colour coated (anodised) aluminium frame work with glazing. Windows, ventilators & partitions of all buildings shall have electro colour coated (anodised) aluminium frame work with glazing. All doors of toilet, kitchen, pantry & store areas shall be of factory made pre - laminated solid core flush door shutters, as per IS: 2202 (Part-II) with pressed steel door frame. Control room shall have Aluminium glazed door & partitions. All other doors (unless otherwise specified) shall be of steel.
29.12.03	All steel doors shall consist of double plate flush door shutters. The door shutter shall be 45 mm thick with two outer sheets of 18 G rigidly connected with continuous vertical 20 G stiffeners at the rate of 150 mm centre to centre. Side, top and bottom edges of shutters shall be reinforced by continuous pressed steel channel with minimum 18 G. The door shall be sound deadened by filling the inside void with mineral wool. Doors shall be complete with all hardware and fixtures like door closer, tower bolts, handles, stoppers, aldrops, etc.
29.12.04	Wherever functionally required, rolling shutters of suitable size approved by the Owner, with suitable operating arrangement manual/ electric shall be provided to facilitate smooth operations. Rolling shutters shall conform to IS: 6248.
29.12.05	All windows and ventilators at ground floor level shall be provided with suitable anodised aluminum grill.
29.12.06	Fire proof doors with panic devices shall be provided at all fire exit points as per the requirements. However minimum Fire rating shall be 2 hours. These doors shall be double cover plated type with mineral wool insulation.
29.12.07	Hollow excluded Section of minimum 2 mm wall thickness as manufactured by INDAL, Jindal, Hindalco or equivalent shall be used for all Aluminium doors, windows, ventilators and Partitions.

CLAUSE NO.	TECHNICAL REQUIREMENTS
29.12.08	The doors, Windows & ventilators frame shall be of suitable size & thickness for fixing the glazing. The Glazing thickness shall be minimum 6 mm thk clear toughened glass for all glazed doors, windows, ventilators & partitions. Windows in air conditioned areas shall be provided with 24mm thick hermetically sealed composite double glazing.
29.12.09	Doors and windows on external walls shall be provided with sunshade over the openings with width 600 mm more than the opening width. The projection from the finished face of the wall for sunshade shall generally be 450 mm over window openings, 750 mm over door openings and 900 over Rolling shutters, or as decided and approved by the Engineer.
29.12.10	Float glass or flat transparent sheet glass shall conform to IS: 2835.
29.12.11	All glazing work shall conform to IS: 3548.
29.12.12	Windows in conveyor gallery shall be provided with welded wire fabric of 1.6mm thick wire as per IS: 4948 and 12mm x 30mm mesh size.
30.00.00	**WATER SUPPLY, DRAINAGE AND SANITATION**
30.01.00	Polyethylene water storage tank conforming to IS: 12701 shall be provided (for the use of toilet, pantry and kitchen) over the roof, with adequate capacity depending on the number of users and 8 hours requirement complete with all fittings including float valve, stop cock etc. The capacity of tank shall be calculated minimum 500 liters, per toilet, pantry and kitchen
30.02.00	Galvanised MS pipe of medium class conforming to IS: 1239 shall be used for internal piping works for potable water supply.
30.03.00	Sand C.I. pipes with lead joints conforming to IS: 1729 shall be used for sanitary works above ground level.
30.04.00	The facilities provided in the toilet block shall depend on the number of users. However, minimum facilities to be provided shall be as stipulated below. IS: 1172 shall be followed for working out the basic requirements for water supply, drainage and sanitation. In addition, IS: 2064 and IS: 2065 shall be also be followed.
30.05.00	Each toilet block shall have the following minimum facilities. Unless specified all the fittings shall be of chromium plated brass (fancy type). The common toilet area shall have finished floor level at 15 mm below the finished floor level of surrounding area. Following minimum fittings & fixtures together with associated plumbing works shall be provided as specified below.

Sl. No.	**Type of Fitting / Fixtures**	**Gents Toilet**
i)	1 no wall mounted coloured glazed vitreous china European water closet with flush valve.	1 No.
ii)	Coloured glazed vitreous china flat back lipped urinals with photo voltaic controlled automatic flushing system including all requisite fittings and fixtures	1
Iii)	Wash Basin (oval shape) with photo voltaic control system and all requisite fittings and fixtures to be fixed on concrete platform finished with 18mm thick first	1 No.

CLAUSE NO.	TECHNICAL REQUIREMENTS

	grade polished granite stone	
iv)	Wall to wall mirror minimum 450 mm high (minimum 6mm thick float glass) including all fittings	1 No.
v)	Stainless steel Towel Rail 600mm Long x 20 mm dia.	1 No.
vi)	Stainless steel Liquid soap holder cum dispenser with requisite fittings.	1 No.
vii)	Overhead Drinking water storage tank (Minimum 500 Litres capacity)- High density polyethylene (cylindrical/vertical) molded seamless type.	1
viii)	Overhead Service water storage tank (Minimum 500 Litres capacity)- High density polyethylene (cylindrical/vertical) molded seamless type	1 No.

One No. drinking water connection with C.P. brass valve for fixing water cooler by Owner.

Required plumbing work from Owner's service water terminal point to the service water tank and from tank to the toilet accessories mentioned above.

Required plumbing work from Owner's potable water terminal point to the drinking water tank and from tank up to the water coolers.

Janitor room. Adequate space shall be provided.

Provision for installation of water cooler.

30.06.00 All structures, buildings, facilities, liquid storage tanks shall be provided with peripheral surface brick drains of all around periphery and suitably connected to nearest Owner's drain. Overflow and drains from storage tanks shall be laid to and suitably connected to Owner's open surface drains.

30.07.00 The sewerage and waste water disposal system shall consist of providing all associated plumbing and underground pipe works together with all fittings and fixtures and inclusive of ancillary works such as connections, manholes and inspection chambers, including connection to Owner's nearest main sewer line or as directed by Engineer. If required, R.C.C. septic tank and soak pit of required capacity shall be provided by the Bidder.

30.08.00 Miscellaneous Architectural Items

(a.) In all buildings suitable arrangement with provision of floor traps for draining the water collected from leakage, floor washing, fire fighting etc. shall be provided on all floors which shall be connected to rain water down comers.

(b.) Wherever required minimum 1000 high hand railing with 32 NB M.S. pipes medium class as per IS : 1239 shall be provided, with toe & knee rail and toe guard plate, around all floor / roof openings, around periphery of Neutralisation Pit, projections of balconies, walkways, platforms, steel staircase etc.

(c.) However for RCC staircases in structures, buildings and facilities, railings with 20 mm square MS bar balustrades with suitable anti corrosive paint of approved colour MS flats for knee & toe guard with 50mm Ø NB MS pipe hand rail at top shall be provided.

(d.) All air conditioned areas / common corridors shall be provided with false ceiling constructed from 15 mm mineral Fibre Board in tile form of

CLAUSE NO.	TECHNICAL REQUIREMENTS
	600x600mm with supporting system as per manufacture guidelines. 50 mm thick mineral wool insulation (conforming to IS : 8183) shall be provided with as under deck insulation). Additional hangers and height adjustment clips shall be provided for return air grills, light fixtures, Air conditioning ducts etc. Minimum headroom below false ceiling shall be 3.0 m.
	(e.) Under - deck insulation shall be provided on the ceiling (underside of roof slab) and underside of floor slab of air - conditioned areas depending upon the functional / air - conditioning requirements. The under - deck insulation shall consist of 50 mm thick mineral wool insulation conforming to IS : 8183 backed with 0.05 mm thick aluminium foil & 24 G x 25 mm mesh wire netting and shall be fixed to ceiling with 24 G wire ties and suitable fixing arrangements.
	(f.) Parapets, chajjas, window / door heads, architectural facias, fins etc., shall be provided with drip course in cement mortar (1 : 3).
	(g.) 150mm thick fillets at junction of roof slab / chajja slab and parapet / vertical walls shall be provided with cast - in - situ cement concrete 1 : 2 : 4 nominal mix, followed by 12 mm thick cement sand plaster (1 : 4).
	(h.) Suitable provision shall be made for fixing of ceiling fans in office areas of different structures, buildings and facilities.
31.00.00	**CORROSION PROTECTION**
31.01.00	GENERAL
	(a) All Steel structures shall be provided with painting as given in the specification. Further, painting system shall also meet the requirements of Corrosivity category C3 (durability High) as per ISO 12944.
	Painting system for steel surfaces embedded in Concrete is given separately.
	(b) All Painting shall be done as per technical specification. Painting scheme shall be submitted by the bidder for approval of employer.
	(c) All steel structures shall be designed by following basic design criteria in ISO 12944 Part 3. However, where it is not feasible to follow the design criteria given in ISO 12944 Part 3 where the steel surface are inaccessible for application of protective coating, corrosion allowance of 1.5 mm shall be kept in thickness(over the design thickness) of structural steel members.
	d) Painting scheme shall be resubmitted by the Bidder for approval of employer.
31.02.00	PAINTING OF STEEL SURFACES EMBEDDED IN CONCRETE:
	a) For the portion of Steel surfaces embedded in Concrete, the surface shall be prepared by Manual Cleaning and provided with Primer Coat of Chlorinated Rubber based Zinc Phosphate Primer of Minimum 50 Micron Dry Film Thickness (DFT).
	b) All threaded and other surfaces of foundation bolts and its materials, insulation pins, Anchor channels, sleeves, etc. shall be coated with temporary rust preventive fluid and during execution of civil works, the dried film of coating shall be removed using organic solvents.
31.03.00	PAINTING OF STEEL SURFACES (OTHER THAN THOSE EMBEDDED IN CONCRETE)

CLAUSE NO.	TECHNICAL REQUIREMENTS
	a) All steel surfaces shall be provided with two component moisture curing zinc (ethyl) silicate primer coat (having minimum 80% of metallic Zinc content in dry film, solid by volume minimum 60% ±2%) of minimum 70 micron DFT to be applied over blast cleaned surface conforming to Sa 2 ½ finish of ISO 8501-1 with surface profile 40-60 Micron. The primer coat shall be applied in shop immediately after blast cleaning by airless spray technique. Zinc dust composition and properties shall be Type-II as per ASTM D520-00. b) Primer coat shall be followed with the application of Intermediate coat of two component polyamide cured epoxy with MIO Content (containing lamellar MIO minimum 30% on pigment, solid by volume minimum 80% ±2%) of minimum 100 micron DFT. This coat shall be applied in shop after an interval of minimum 24 hours (from the application of primer coat) by airless spray technique. c) Intermediate coat shall be followed with the application of finish coat of two-pack aliphatic Isocyanate cured acrylic finish paint (solid by volume minimum 55% ±2%) with Gloss retention (SSPC Paint Spec No 36, ASTM D 4587, D 2244, D 523) of Level 2 (after minimum 1000 hours exposure, Gloss loss less than 30 and colour change less than 2.0 ΔE) and minimum 70 micron DFT. This coat shall be applied shop after an interval of minimum 10 hours and within six (6) months (from the completion of Intermediate coat), Colour and shade of the coat shall be as approved by the Employer. Notes: 1. For Primer, high quality surface preparation is necessary and good amount of moisture is required for proper curing. Below 70 % relative humidity, curing time may go up to 7 days or more. In such a case additional water sprinkling may be ensured for completion of curing. Additionally Inorganic zinc silicate cannot be recoated; even with itself. Typically it should be used when coating bare steel surface for first time. 2. The most frequent problem associated when top coating Primer is bubbling/pin holing especially with non-weathered zinc silicate coatings. To a great extent, this bubbling of finish paint can be eliminated by applying a mist coat of intermediate/topcoat as the first pass of the product, allow the bubbles to subside and then apply a full coat, as required. 3. In case top coating of zinc silicate with epoxy/polyurethane coatings, is expected to be delayed, it is advisable to use a suitable tie coat to avoid formation of white rust. However, if white rust forms then clean the surface with high pressure water, dry and apply the subsequent coats as required. 4. Touch up paintings on damaged areas: Surface preparation by manual tools, wire brush/ emery paper etc. Minimum 6 inches peripheral area, adjoining to damaged area to be covered. If metal surface is exposed, it is to be painted with Zinc rich epoxy (70 micron) or suitable primer with existing paint scheme. If primer is intact, intermediate & top coat to be done with specified DFT in scheme.
31.04.00	**COATING FOR MILD STEEL PARTS IN CONTACT WITH WATER.** a) All mild Steel parts coming in contact with water or water vapour shall be hot dip galvanised. The Minimum Coating of Zinc shall be 610 Gms / Sq. M. for galvanised Structures and shall comply with IS: 4759 and other relevant Codes. Galvanising shall be checked and tested in accordance with IS: 2629.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	b) The galvanising shall be followed by the application of an etching Primer and dipping in black bitumen in accordance with BS: 3416, unless otherwise specified.
31.05.00	**Gratings** All gratings shall be blast cleaned to Sa 2 ½ finish or cleaned by acid pickling as per ISO 8501-1 and shall be hot dip galvanized at the rate of 610 Gms / Sq. M.
31.06.00	**Hand Railings and Ladders** All Mild steel handrails and ladders shall be galvanised at the rate of 610 Gms / Sq. as per IS: 4736. However, Stainless steel handrails shall be provided as specified in General Architectural Specification clause 9.0.0.
31.07.00	**Sea Worthiness** All Steel Sections and fabricated Structures, which are required to be transported on sea, shall be provided with anti corrosive Paint before shipment to take care of sea worthiness.
31.08.00	**For Reinforced Concrete Work.** i) The protection for concrete sub-structure shall be provided based on aggressiveness of the soil, chemical analysis of soil/sub-soil water and presence of harmful chemicals/salts. ii) The protection to super structure shall depend on exposure condition and degree of atmospheric corrosion. This shall require use of dense and durable concrete, control of water cement ratio, increase in clear cover, use of special type of cement and reinforcement, etc., coating of concrete surface, etc., Bidder shall furnish the details of corrosion protection measures.
32.00.00	**Miscellaneous**
32.01.00	Ordinary form work shall be used in roofs and floor slabs in transfer houses, footings, pedestals, cable trenches, pits etc., Plywood form work shall be used for all over ground exposed work like columns, beams, floors and ceilings in control room and M. C. C. buildings.
32.02.00	Monorail girders and fixtures shall be provided for monorails at the locations as required and as described elsewhere in these specifications or drawings. Monorail openings in the walls shall be provided with steel frame doors preferably sliding type or otherwise open able inside, access platforms and ladders.
32.03.00	Steel frame around openings in roof and on external walls for mounting of exhaust fans shall be provided.
32.04.00	Ready mix non - shrink cementitious grout of reputed manufacturer as approved by the Employer shall be used for grouting of block outs and foundation bolts, underpinning of base plates and machine bases. Crushing strength of grout shall be one grade higher than the foundation concrete. Minimum crushing strength shall be 30 N / mm^2 unless higher strength requirement is specified by the equipment supplier or the grout manufacturers.

CLAUSE NO.	TECHNICAL REQUIREMENTS
32.05.00	The bottom of steel in case of cable / pipe galleries and trestles shall be generally 3m above the ground except for rail / road crossing where it shall be 8m above the rail top / road crest/ground. Further in bunker areas it shall be 8 m above the ground.
32.06.00	Polysulphide Sealing Compound shall be two-part polysulphide sealant and shall be from approved manufacturer, conforming to IS : 12118. Materials shall consist of polysulphide polymer and a curing agent. Gun grade material shall be used unless otherwise specified. The application of the sealant shall be strictly followed as per manufacturer's guidelines.
33.00.00	**SHOTCRETING**
33.01.00	**General Requirements**
33.01.01	Generally, shotcreting shall be done in accordance with IS : 9012.
33.01.02	Reinforcement for shotcreting shall be as detailed below, unless specified otherwise. Reinforcement in one direction consisting of 6 mm M. S. bars at 750 mm c / c shall be connected to the lugs for fastening of the wire fabric. This shall be used in case of 50 mm or above thick shotcreting.
33.01.03	Wire fabric conforming to IS : 1566 shall be used as reinforcement and shall consist of wire, 3 mm diameter, spaced 50 mm both ways and shall be electrically cross welded. Wire fabric shall be securely tied to 6 mm bars for 50 mm thickness. Adjacent sheet of wire fabric shall be lapped at least 100 mm and tied.
33.01.04	Clear cover to reinforcement mesh shall not be less than 15 mm.
33.01.05	Minimum thickness of shotcreting shall be 50 mm. for abrasion resistant work and 25 mm for ordinary surface protection work.
33.02.00	**Material** Generally, the materials shall be in accordance with aggregates specification given hereunder.
33.02.01	Fine aggregate shall consist of natural sand or crushed stone from a known source and shall be strong, hard, coarse, sharp, chemically inert, clean and free from any coating. It shall be free from clay, coal or coal residue, organic or any other impurities that may impair the strength or durability of the concrete and shall conform to IS : 383.
33.02.02	Fine aggregate (Sand) shall be well graded and particles shall range in size within the following limits. The Engineer, may approved the use of any other grading as per requirement or as per IS : 9012.
33.02.03	The fineness modulus shall be preferably between 2.5 and 3.3. Any other value can be used, with prior approval of the Engineer.

CLAUSE NO.	TECHNICAL REQUIREMENTS
33.03.00	**Application**
33.03.01	After the placement of reinforcement and / or welded mesh and not more than six hours prior to the application of shotcrete, the surface shall be thoroughly cleaned of all loose materials and dirt. The Contractor shall properly prepare the surfaces, reinforcement and / or welded mesh to receive the shotcrete. Cleaned surfaces shall be wetted not more than hour prior to shotcreting.
33.03.02	The mix as placed on surface shall be one part cement to three parts approved sand by mass. Cement and sand shall be dry mixed; not water shall be added after mixing and before using in the gun. The quantity of water when added shall be only that which is sufficient to hydrate the cement. For average atmospheric conditions, the water cement ratio for shotcrete in place shall be between 0.35 and 0.5 by mass. Suitable admixture shall be used wherever required.
33.03.03	A uniform pressure of not less than 3 Kg/cm^2 at the nozzle shall be maintained. Necessary adjustments shall be made to ensure this pressure, taking into account the length of hose and height of the place to be shotcreted, above location of the machine.
33.03.04	The application shall proceed in an upward direction. Beams, stiffeners and intermediate walls, if any, shall be wrapped with wire fabric and completely covered with shotcreting. All rebound shall be removed from the area of application as the work progresses and such rebound material shall not be reused.
33.03.05	As soon as the freshly shotcreted surface shows the first dry patches, a fine spray of water shall be applied to keep too moist. After the surface has hardened, it shall be kept continuously moist for minimum seven days. If there is extreme heat, especially when accompanied by hot winds, the shotcreted surface, immediately upon completion, shall be covered with burlap or similar covering, which must be kept continuously moist for 14 days after shotcreting. The temperature of the lining shall not be permitted to exceed 38^0C during placing of concrete.
34.00.00	**VIBRATION ISOLATION SYSTEM** These specifications are meant for the design, supply and erection of vibration isolation system for supporting crushers.
34.01.00	**Supporting Arrangement**
34.01.01	**For Crushers:** The crushers shall be supported on vibration isolation system consisting of steel helical springs and viscous dampers. The supporting arrangement for each crusher shall consist of an R. C. C. deck supported on steel helical spring units and viscous damper units which in turn shall be supported on girders. The girders shall be an integral part of the crusher house building. The part of the structure consisting of the R. C. C. deck, springs and viscous dampers shall hitherto be referred to as “spring supported foundation”. The part of the structure, which is below the spring shall hitherto be called “supporting structure”.

CLAUSE NO.	TECHNICAL REQUIREMENTS
34.01.02	The Contractor should do the Engineering / design, supply and erection of vibration isolation system consisting of steel helical spring units and viscous dampers supporting the top deck which in turn would support the crushers. The vibrations isolation system supplied shall be of a proven make. The Contractor or his sub - contractor who designs and supplies the system should have designed, supplied and installed such systems for not less than five machines of speeds and unbalance forces comparable to the machine proposed by the vendor. The vibration isolation systems installed by the contractor or his sub - contractor in such machines should have been working satisfactorily for at least five years.
34.02.00	**Scope of Work**
34.02.01	Scope of work shall include the following : (a.) Engineering (1.) Design of the vibration isolation system using steel helical springs and viscous dampers to support an R. C. C. top deck supporting the equipment. This includes the static and dynamic analysis of the vibration isolation system with the R. C. C. top deck and the equipment. (2.) Structural design of the R. C. C. top deck including preparation of General Arrangement drawings, detailed reinforcement drawings, bar - bending schedules etc. (3.) Calculation of loads on the structure supporting the springs and viscous dampers, their points of application and the stiffness requirements of the supporting structure. (4.) Drawings showing embedments and their locations and details on the R. C. C. top deck. (5.) Drawings showing blockouts, recesses etc. on the top deck. (6.) Design of the supporting structure, including preparation of detailed drawings and bill of materials. **(b.) Supply including packing and transportation to site** (1.) Steel helical spring units and viscous dampers, including associated auxiliaries for installation of the spring units and dampers like steel shims, adhesive pads etc. (2.) Frame (s) for pre-stressing of spring elements. (3.) Suitable hydraulic jacks system including electric pumps, high pressure tubes etc. required for the installation, alignment etc. of the spring units, two extra hydraulic jacks, one hand operated pump and spares for the hydraulic jack system as required.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	(c.) Erection and Commissioning (1.) Complete erection and commissioning of the vibration isolation system including : (2.) Pre-stressing of spring elements, placing of spring elements in position, checking clearances on the shuttering of the R. C. C. top deck, construction of the supporting structure and the R. C. C. top deck, releasing to pre-stress in spring elements and making final adjustments and alignments after machine installation etc. (3.) The scope of work shall be deemed to include all activities which may not have been explicitly mentioned but are reasonably implied for the successful completion of the work for which these specifications are intended. (4.) This part of the specifications is for vibration isolation system. For the construction of the supporting structure for the crusher and the top deck, the relevant parts of the specification should be referred to. **(d.) Documentation** (1.) Submission of detailed design calculation, analysis (static and dynamic) and drawings for Employer's acceptance and approval. (2.) Furnishing methodology of providing shuttering and its removal as well as concreting of deck slab, installation of springs and dampers and the sequence of operation. (3.) Furnishing installation and maintenance manual indicating equipment, procedure etc., necessary for installation, maintenance of vibration isolation system. (4.) Furnishing a check list for confirming the readiness of the civil fronts for the installation of vibration isolation system and equipment required at each stage installation. (5.) Bill of materials of various elements such as springs, visco-dampers, with their rating, stiffness etc., included in supply. (6.) Detailed specifications of the vibration isolation system and various items included in the supply and the standard (local or international) to which they conform. (7.) Proposed erection strategy of the entire system.
34.03.00	**Design Requirements for Crusher Foundation**
34.03.01	**Dynamic Analysis** Detailed dynamic analysis shall be done for the top deck together with springs and dampers and the natural frequencies and amplitudes of vibration shall be

CLAUSE NO.	TECHNICAL REQUIREMENTS
	determined. A mathematical model of the top deck shall be formulated with three - dimensional beam / plate finite elements for the purpose of analysis with the spring idealised with vertical and horizontal stiffnesses. The mass of the machine together with that of the top deck shall be considered for the analysis. Natural frequencies upto at least 10 % above the operating speed shall be determined and these frequencies shall be checked against the design criteria. Forced response dynamic analysis shall be carried out for the operating condition unbalance forces using a sinusoidal forcing function. Unbalance forces as given by this specifications shall be used for his purpose. The amplitudes shall be checked against the design criteria. The dynamic forces from this analysis shall be used for structural design with a suitable fatigue factor.
34.03.02	**Isolation Efficiency** The vibration isolation system shall be designed for about 90 % isolation efficiency.
34.03.03	**De-coupling** A ratio of the least 10 (ten) shall be ensured between the stiffness of the supporting structure and the stiffness of the spring system in the vertical direction to achieve de-coupling between the two (the stiffness of the spring system being lower). This ensures that dynamic analysis of the supporting structure need not be carried out.
34.03.04	**Frequency Criteria** The frequency criterion has already been laid down implicitly by the isolation efficiency criteria and de-coupling required. The first bending mode frequency of the top deck shall be at least 20 % above the operating speed.
34.03.05	**Unbalance Forces for Crushers** Unbalance forces arising out of all the following cases shall be considered for checking the design and amplitudes. (a.) Balance quality grade Q 40 as per VDI 2060 - 1966. (b.) One hammer broken condition. The missing hammer shall be assumed to be closest to the crusher non - drive end of the crusher. (c.) Three hammers broken condition. All the three hammers broken shall be assumed to be from the same suspension bar and located at the non - drive end of the crusher.
34.03.06	**Amplitude Criteria for Crushers** The calculated amplitudes (mean to peak values) shall not exceed following limits under the specified conditions.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	1) Operating speed of 750 RPM (a.) 150 microns for an unbalance force arising out of balance quality grade Q 40 as per VDI 2060 - 1966. (b.) 300 microns in case of a one hammer broken condition. (c.) Amplitudes need not be checked for a three hammer broken condition. 2) Operating speed of 450 RPM (a.) 200 microns for an imbalance force arising out of balance quality grade Q-40 as per VDI -2060-1966. (b.) 400 microns in case of a one hammers broken condition. (c.) Amplitude need not be checked for a three hammer broken condition. For intermediate operating speed between 450 to 750 RPM the amplitude limits can be linearly interpolated. The amplitude limits mentioned above are in both vertical and horizontal directions. The amplitudes shall be calculated at critical points on the top surface of the R. C. C. deck. The amplitudes shall be checked for the most unfavorable superposition of modes in any direction. However, phase difference between the maximum amplitude occurring in different directions due to the rotating vetor may be considered while superimposing the modes.
34.03.07	**Unbalance force and Amplitude Criteria** The unbalance forces and amplitude criteria shall be as per the equipment manufacturer's recommendations or as per VDI 2060/ VDI 2056, whichever is more stringent.
34.03.08	**Transient Resonance** Transient resonance, which may occur during the start - up or coasting down condition of the crusher, shall be checked, and the amplitudes in such a condition should not exceed one - and - half times those at operating speed for each design condition.
34.04.00	**Strength Criteria** The following criteria shall apply for the design of top deck : (a.) Dead loads, live loads, Seismic loads and dynamic loads shall be considered for the design. The most unfavorable combination shall considered for design. (b.) Seismic loads shall be assumed to act together with dynamic loads for a one millimeter eccentricity in the rotor. However, seismic loads and dynamic loads arising out of hammer breakage need not be considered together

CLAUSE NO.	TECHNICAL REQUIREMENTS
	(c.) Fatigue shall be considered while designing for dynamic forces. A fatigue factor of 2.0 shall be used on all dynamic forces to arrive at the equivalent static force for the purpose of design. (d.) Working stress method shall be used for the design of R. C. C. deck. In survival condition, 10 % overstressing may be permitted. (e.) The R. C. C. top deck shall be at least of M35 grade of concrete as per IS : 456. (f.) Fatigue need not be considered for the three hammer broken condition. (g.) For calculating unbalance forces, the heaviest hammer (plain or toothed) shall be considered.
34.05.00	**Approval of Designs and Drawings** All design calculation, drawings and documents shall be in English. All design calculations and drawings shall be submitted to Employer for approval. However, approval of such designs and drawings shall not relieve the contractor of his responsibility regarding the adequacy of the foundation to carry the design forces.
34.06.00	**Standards** Latest revisions of the following Codes shall be used for the design of the crusher foundations. (a.) IS : 456 Code of Practice for Plain and Reinforced concrete. (b.) IS : 2974 (Part IV) Code of Practice for Design and Construction of Machine Foundations (Part IV) for rotary type machine of low frequency. (c.) IS : 1893 (Criteria for Earthquake Resistant Design of Structures). (d.) DIN 4024 Machine Foundations : Flexible supporting structures for machines with rotating masses. (e.) DIN 2089 Helical Compression Springs out of round wire and rod; calculation and Design. (f.) DIN 2096 Helical Compression Springs out of round wire and rod; quality requirements for hot formed compression springs. (g.) VDI 2056 - Criteria for assessing mechanical vibrations of machines. (h.) VDI 2060 - Criteria for assessing the state of balance of rotating rigid bodies.not be permitted to exceed 38^{o}C during placing and curing

CLAUSE NO.	TECHNICAL REQUIREMENTS
35.00.00	**Packaging and Transportation.** All the equipment shall be suitably protected coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection. While packing all the materials the limitations from the point of view of availability of railway wagon sizes in India should be taken into account. The contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing.
36.00.00	**Plant Life** The plant shall be designed for a minimum operating life of 30 years under the conditions of operation. Assurance shall be given that plant components are adequate for this lifetime. If there are any exceptional items of the plant on which an assurance of meeting this clause cannot be given, life of such components and the difficulties associated with them shall be stated.
37.00.00	**PTFE (Poly Tetra Fluoroethylene) Bearing** The bearing shall be of reputed make and manufacturer as approved by the Engineer, for required vertical load and end displacement/rotation. PTFE bearing shall be sliding against highly polished stainless steel and the coefficient of friction between them shall be less than 0.06 at 55 kg/sq.cm. In order to prevent cold flow in PTFE surface it shall be rigidly bonded by a special high temperature resistance adhesive to the stainless steel substrata. The stainless steel surface that slides against the PTFE is mirror polished. The stainless steel shall be bonded to the top plate by special high strength adhesive. The thickness of stainless steel plate shall be between 1.0 mm to 1.5 mm.
38.00.00	**TESTS FOR MATERIAL / WORKMANSHIP** All tests required for all materials, quality of workmanship or any other tests as desired by the Engineer shall be at contractor's cost.
39.00.00	**MATERIALS**
39.01.00	**For Civil, Structural and Architectural works** Employer will not supply any material. All materials including cement, reinforcement steel and structural steel, whatsoever required for execution and completion of the entire scope of work covered under this specification shall be arranged by the contractor at his own cost. All materials procured by the contractor shall meet the quality requirements specified in this specification. The contractor shall keep sufficient stock of cement and steel at site at any point of time when the work is in progress excluding what has been already incorporated in the works, so that any disruption / delay in availability of these materials during procurement will not affect the progress of work at site. The minimum quantity of such materials in stock at site shall not be less then the Requirement of one (1) month in case of Cement and Requirement of two (2) Consecutive months in case of Steel.

CLAUSE NO.	TECHNICAL REQUIREMENTS
39.02.00	**Structural steel** Structural Steel (including embedded Steel) shall be straight, sound, free from twists, cracks, flaw, laminations and all other defects. Structural steel shall comprise of mild steel, medium strength steel and high tensile steel as specified below.
39.02.01	**Mild Steel** a) Rolled sections shall be of grade designation E250, Quality A/BR, Semi-killed/ killed conforming to IS 2062. All steel plates shall be of Grade designation E250, Quality BR (fully killed), conforming to IS 2062 and shall be tested for impact resistance at room temperature. Plates beyond 12mm thickness and up to 40mm thickness shall be normalized rolled. Plates beyond 40mm thickness shall be vacuum degassed & furnace normalised and shall also be 100% ultrasonically tested as per ASTM –A578 level B-S2. b) Pipes shall conform to IS 1161. c) Hollow (square and rectangular) steel sections shall be hot formed conforming to IS: 4923 and shall be of minimum Grade Yst 240. d) Chequered plate shall conform to IS 3502 and shall be minimum 6 mm thick excluding projection. Steel for chequered plate shall conform to grade E250A semi killed of IS: 2062 or equivalent grade conforming to ASTM & BS standards only.
39.02.02	**Medium and High Tensile Steel** Rolled Sections and plates shall be of grade designation E350 or higher, Quality B0 (Fully killed), conforming to IS 2062. Plates beyond 12mm thickness and up to 40mm thickness shall be normalized rolled. Plates beyond 40mm thickness shall be vacuum degassed & furnace normalised and shall also be 100% ultrasonically tested as per ASTM –A578 level B-S2.
39.03.00	Fly ash based Portland pozzolona cement conforming to IS: 1489 Part - I shall preferably be used. However, the contractor may use other types of cements conforming to IS: 269, IS: 8112, IS: 12269, & IS: 455.
39.04.00	**Reinforcement steel shall conform to:** a) Mild steel bars of grade I of IS: 432 Part – I or grade A of IS: 2062. b) High yield strength deformed TMT steel bars of grade Fe-500 having minimum elongation of 14.5 % or Fe-500D, and conforming to other requirements of IS 1786.
40.00.00	**CODES AND STANDARDS** All standards, specifications, acts and code of practice referred to herein shall be the latest editions including all applicable official amendments and revisions. Other Indian, foreign Codes and Standards not listed here but referred to elsewhere within this specification shall also be deemed to be part of this list. In case of conflict between this specification and those (IS standards, codes etc.) referred to herein, the former shall prevail.

CLAUSE NO.	TECHNICAL REQUIREMENTS

Some of the relevant Indian standards, Acts and Codes applicable to this section of the specification are listed below

IS : 383	Specification for coarse and fine aggregates from natural sources for Concrete.
IS : 432	Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement.
IS : 456	Code of practice for plain and reinforced concrete.
IS : 458	Specification for concrete pipes.
IS : 516	Method of test for strength of concrete.
IS : 800	Code of practice for use of structural steel in general building construction.
IS : 814	Specification for covered electrodes for metal arc welding for weld steel.
IS : 816	Code of practice for use of metal arc welding for general construction.
IS : 817	Code of practice for training and testing of metal arc welders.
IS : 875 (Pt. I to V)	Code of practice for design loads other than earthquake) for buildings and structures.
IS : 1038	Steel doors, windows and ventilators.
IS : 1172	Basic requirements for water supply, drainage and sanitation.
IS : 1361	Steel windows for industrial buildings.
IS : 1786	Specification for high strength deformed steel bars and wires for concrete reinforcement.
IS : 1892	Code of practice for subsurface investigation for foundation.
IS : 1893	Criteria for earthquake resistant design of structures.
IS : 1904	Code of practice for design and construction of foundations in soils; general requirements.
IS : 1905	Code of practice for structural safety of buildings - Masonry walls.
IS : 1948	Specification for aluminium doors, windows and ventilators.
IS : 2062	Steel for general structural purposes.

CLAUSE NO.	TECHNICAL REQUIREMENTS

IS : 2131	Method of standard penetration test for soils.
IS : 2212	Code of practice for brickwork.
IS : 2645	Specification for Integral cement water proofing compounds.
IS:2720 (Part-II, IV TO VIII, XIV, XXI, XXIII, XXIV, XXVII TO XXIX, XL)	Methods of test for soils - determination for water content etc code of practice for earth work on canals.
IS : 2911	Code of practice for design and construction of pile foundations.
(Part-1/Sec.1)	Driven cast in situ concrete piles.
(Part-1/Sec.2)	Bored cast-in-situ concrete piles.
(Part-IV)	Load test on piles.
IS : 2974 (Part - I TO V)	Code of practice for design and construction of machine foundations.
IS : 3370 (Part I to IV)	Code of practice for concrete structures for the storage of liquids.
IS : 3658	Code of practice for liquid penetrant flaw detection.
IS : 3664	Code of practice for ultra sonic testing by pulse echo method.
IS : 4326	Code of practice for earthquake resistant design and construction of buildings.
IS : 4990	Specification for plywood for concrete shuttering work.
IS : 5624	Specification for foundation bolts.
IS : 7215	Tolerances for fabrication steel structures.
IS : 8112	Specification for 43 grade Ordinary Portland Cement.
IS : 9103	Specification for admixtures for concrete.
IS : 9595	Code of procedure of manual metal arc welding of mild steel.
IS : 10262	Recommended guidelines for concrete mix design.
IS : 13311	Method of non - destructive testing of concrete.
IS : 13755	Dust pressed ceramic tiles with water absorption of 3%, E6% (Group B11a)

CLAUSE NO.	TECHNICAL REQUIREMENTS

ASTM 898 -89	Standard guide for use of high solid content, cold liquid-applied elastomeric water proofing membrane for use with separate wearing course.
AS/NZS 2728	Pre finished / pre painted sheet metal product for interior / exterior building applications – Performance requirements.
AS : 1365	Standards for steel manufacturing.
AS : 1397	A steel sheet & strip – hot – dipped-zinc-coated or Aluminium-Zinc coated.
AS : 3566	Self drilling screws for building and construction industry.
IRC : 37	Guidelines for the design of flexible pavements.
-	Manual on sewerage and sewage treatment (Published by CPH & EEO) As updated.

Indian Explosives Act. 1940 as updated.

For "Foundation System and Geotechnical Data" refer "Project Information section" of Technical specification.

(CIVIL WORKS)

SUB-SECTION-V-QD1

Clause No	QUALITY ASSURANCE PROGRAMME

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,

Clause No	QUALITY ASSURANCE PROGRAMME

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:

Clause No	QUALITY ASSURANCE PROGRAMME
	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

Clause No	QUALITY ASSURANCE PROGRAMME
	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

Clause No	QUALITY ASSURANCE PROGRAMME
	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

Clause No	QUALITY ASSURANCE PROGRAMME

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

Clause No	QUALITY ASSURANCE PROGRAMME

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 ± 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.

Clause No	QUALITY ASSURANCE PROGRAMME

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.

Clause No	QUALITY ASSURANCE PROGRAMME

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

Clause No	QUALITY ASSURANCE PROGRAMME

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,

Clause No	QUALITY ASSURANCE PROGRAMME

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.

Clause No	QUALITY ASSURANCE PROGRAMME
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

Clause No	QUALITY ASSURANCE PROGRAMME

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.

Clause No	QUALITY ASSURANCE PROGRAMME

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

Clause No	QUALITY ASSURANCE PROGRAMME

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.

Clause No	QUALITY ASSURANCE PROGRAMME
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.

ANNEXURE -I

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.

Clause No	QUALITY ASSURANCE PROGRAMME

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.

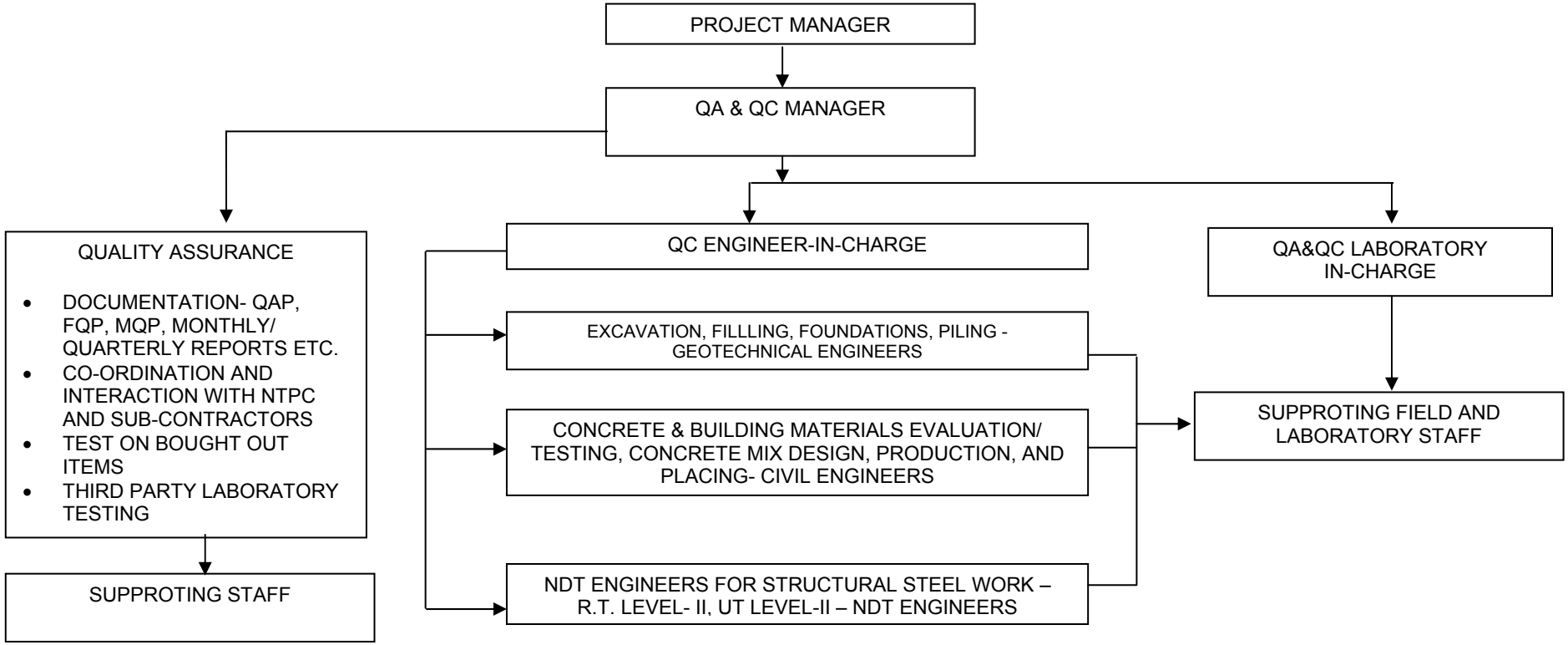
Clause No	QUALITY ASSURANCE PROGRAMME

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	√	

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		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

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
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

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		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	

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
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

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		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										

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	**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**										

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)	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 &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.
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	√	
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:				
		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
5.04	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		

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
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

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
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					For Owner USE	**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**									
Signature		This document shall be read in conjunction with Owner Tech. Specifications, BOQ, Drawings						**REVIEWED BY**	**APPROVED BY**		**APPROVAL SEAL**

LIST OF CODES AND STANDARDS

Indian Standards	Title	International and Internationally recognised standards
IS:277	Galvanised steel sheets (plain or corrugated)	
IS:655	Specification for metal air duct	
IS:800	Code of practice for use of structural steel in general building construction	BS 449:1969 BS 5950 ASA A57, 1-1952
IS:807	Code of practice for design, manufacture, erection and testing (Structural portion) of cranes and hoists 6588 (Issued by Standards Association of Australia). DIN 120:1936 (Sheet 1) DIN 120:1936 (Sheet 2) 327 part-I, 1951 BS 466 part-II, 1960 BS 644:1960 BS 1757:1951 BS 2573:part-I:1960	Draft Revision of A.S. NO. CS.2 SAA Crane and Hoist code Doc:No. BU/4 Rev
IS:875	Code of practice for design loads (other than earthquake) for buildings and structures Leading standards (issued by Canadian Standard) DIN-1055-1955 (Issued by ASA)	National Building code of Canada (1953)-Part-IV Design section 4.1

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	IS:1239 Part-I	Mild steel tubes	(ISO/R 65-1957) (ISO/R-64-1958) (ISO/R-65-1958) (BS 1387 : 1957)
	IS:1239 Part-II	Mild steel tubulars and other wrought steel pipe fittings	BS 1387 : 1967 BS 1387 :1967 BS 1740 :1965
	IS:2825	Code for unfired vessels	
	IS:1520	Horizontal centrifugal pumps for clear cold and fresh water	
	IS:1600	Code for practice for performance of constant speed IC Engines for general purpose	
	IS:1601	Specification for perform-ance of constant speed IC Engines for general Purpose	
	IS:1893	Criteria for earthquake resistant design of structures	
	IS1978-1971	Line Pipe April 1969.	API Standards 5L
	IS:2254-1970	Dimensions of vertical shaft motor for pumps	IEC Pub 72-1 part I NEMA Pub MG 1 1954
	IS:2266	Steel wire ropes for general engineering purposes	BS :302 : 1968
	IS:2312	Propellant type Ventilation fans	
	IS:2365	Steel wire suspension ropes for lifts and hoists	BS : 1957

IS:3346	Method for the determination of thermal conductivity of thermal insulation materials (two slab guarded hot plate method)	DIN 52612 (Deutscher Normenausschuss) ASTM C 163-1964 (American Society of Testing and materials) ASTM C 167-1974 ASTM C 177-1963
IS:3354	Outline dimensions for electric lifts.	
IS:3401	Silica gel	
IS:3588	Specification for electrical axial flow fans	
IS:3589	Electrically welded steel pipes for water, gas and sewage (200mm to 2000 mm Nominal Diametre)	
IS:3677	Unbonded rock and slag wool for thermal insulation	
IS:3815	Point hook with shank for general engineering purposes	BS 482 - 1968 Doc.:67/3 1284 (Revision of BS 2903) (Issued BS)
IS:3895	Specification for monocrystallines semiconductor rectifier cells and stacks	
IS:3963	Roof extractor unit	
IS:3975	Mild steel wires, strips and tapes for armouring cables	
IS:4503	Shell and tube type heat Exchanger	

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	IS:4540	Specification for monory-stallines rectifire assembly equipment	
	IS:4671	Expanded polystyrene for thermal insulation purpose	
	IS:4736	Hot dip zinc coating on steel tubes	
	IS:4894	Centrifugal fans	
	IS:5456	Code of practice for testing of positive displacement type air compressors and exhauster (For Test Tolerance Only)	
	IS:5749	Forged ramshorn hooks	Entwurf DIN 15402 Blett 1 Entwurf DIN 15402 BS 3017-1958
	IS:6392	Steel pipe flanges	BS 4504 : 1969
	IS:6524 Part-I	Code of practice for design of tower cranes Static and rail mounted	BS 2799 : 1956
	IS:7098	Cross linked Polyethylene insulated PVC sheathed cables	Standard No. 1 to IPCEA (USA) Pub. No. 5-66-524
	IS:7373	Specification for wrought aluminium and aluminium sheet and strips	
	IS:7938	Air receivers for compressed air installation	
	ISO:1217	Displacement compressor-Acceplance test	
	ASHRAE-33 and air heating coils.	Methods of testing for rating of forced circulation air cooling	
	ASHRAE-52-76 particle matter.	Air cleaning device used in general ventilation for removing	

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS

ASHRAE-22-72	Method of testing for rating of water cooled refrigerant condensers.
ASHRAE 23-67	Methods of testing for rating of positive displacement refrigerant compressors.
ARI-450-6	Standard for water cooled refrigerant condensers.
ARI-550	Standard for centrifugal water chilling packages.
ARI-410	Standard for forced circulation air cooling and air heating coils
ARI-430/435 BS:848 (Part-1,2)	Central station AHU/Application of Central Station AHU Fans
BS:400	Low carbon steel cylinders for the storage & transport of permanent gases.
BS:401	Low carbon steel cylinders for the storage & transport of liquified gases.
CTI Code ACT-105	Acceptance test code for Water Cooling Tower.
ANSI-31.5	Refrigerant piping
ASME-PTC- 23-1958	Atmospheric Water Cooling Equipment
AMCA A-21C	Test Code for air moving devices
API:618	Reciprocating Compressor for general refinary services.

HYDRAULIC INSTITUTE STANDARDS.

HYDRANT SYSTEM MANUALS OF TAC.

TAC MANUALS OF SPRAY SYSTEM

NFPA USA/ NSC UK/ UL USA/ FM USA STANDARDS.

INDIAN EXPLOSIVES ACT.

INDIAN FACTORIES ACT.

STANDARD OF TUBULAR EXCHANGER MANUFACTURER'S ASSOCIATION.

CODE AND STANDARD FOR CIVIL WORKS

Some of the applicable Standards, Codes and references are as follows:

Excavation & Filling

IS: 2720 (Part-II, IV TO VIII, XIV, XXI, XXIII, XXIV, XXVII TO XXIX, XL) Methods of test for soils-determination for water content etc.

IS: 4701 Code of practice for earth work on canals.

IS: 9758 Guide lines for Dewatering during construction.

IS: 10379 Code of practice for field control of moisture and compaction of soils for embankment and sub-grade.

Properties, Storage and Handling of Common Building Materials

IS: 269 Specification for ordinary Portland cement, 33 grade.

IS: 383 Specification for coarse and fine aggregates from natural sources for concrete.

IS: 432 Specification for mild steel and (Parts 1&2) medium tensile steel bars and hard-drawn steel wires for concrete reinforcement.

IS: 455 Specification for Portland slag cement.

IS: 702 Specification for Industrial bitumen.

IS: 712 Specification for building limes.

IS: 808 Rolled steel Beam channel and angle sections.

IS: 1077 Specification for common burnt clay building bricks.

IS: 1161 Specification of steel tubes for structural purposes.

IS: 1363 Hexagon head Bolts, Screws and nuts of production grade C.

IS: 1364 Hexagon head Bolts, Screws and Nuts of Production grade A & B.

IS: 1367 Technical supply conditions for Threaded fasteners.

IS: 1489 Specification for Portland-pozzolana cement:

(Part-I) Fly ash based.

(Part-II)	Calcined clay based.
IS: 1542	Specification for sand for plaster.
IS: 1566	Specification for hard-drawn steel wire fabric for concrete reinforcement.
IS: 1786	Specification for high strength deformed bars for concrete reinforcement.
IS: 2062	Specification for steel for general structural purposes.
IS: 2116	Specification for sand for masonry mortars.
IS: 2386 (Parts-I to VIII)	Testing of aggregates for concrete.
IS: 3150	Hexagonal wire netting for general purpose.
IS: 3495 (Parts-I to IV)	Methods of tests of burnt clay building bricks.
IS: 3812	Specification for fly ash, for use as pozzolana and admixture.
IS: 4031	Methods of physical tests for hydraulic cement.
IS: 4032	Methods of chemical analysis of hydraulic cement.
IS: 4082	Recommendations on stacking and storage of construction materials at site.
IS: 8112	Specification for 43 grade ordinary portland cement.
IS: 8500	Medium and high strength structural steel.
IS: 12269	53 grade ordinary portland cement.
IS: 12894	Specification for Fly ash lime bricks.

Cast-In-Situ Concrete and Allied Works

IS: 280	Specification for mild steel wire for general engineering purposes.
IS: 456	Code of practice for plain and reinforced concrete.

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	
	IS: 457	Code of practice for general construction of plain & reinforced concrete for dams & other massive structures.
	IS: 516	Method of test for strength of concrete.
	IS: 650	Specification for standard sand for testing of cement.
	IS: 1199	Methods of sampling and analysis of concrete.
	IS: 1791	General requirements for batch type concrete mixers.
	IS: 1838 (Part-I)	Specification for preformed fillers for expansion joints in concrete pavements and structures (non-extruding and resilient type).
	IS: 2204	Code of practice for construction of reinforced concrete shell roof.
	IS: 2210	Criteria for the design of reinforced concrete shell structures and folded plates.
	IS: 2438	Specification for roller pan mixer.
	IS: 2502	Code of practice for bending and fixing of bars for concrete reinforcement.
	IS: 2505	General requirements for concrete vibrators, immersion type.
	IS: 2506	General requirements for concrete vibrators, screed board type.
	IS: 2514	Specification for concrete vibrating tables.
	IS: 2645	Specification for Integral cement water proofing compounds.
	IS: 2722	Specification for portable swing weigh batches for concrete. (single and double bucket type)
	IS: 2750	Specification for Steel scaffolding.
	IS: 2751	Code of practice for welding of mild steel plain and deformed bars for reinforced concrete construction.
	IS: 3025	Methods of sampling and test waste water.
	IS: 3366	Specification for Pan vibrators.
	IS: 3370	Code of practice for concrete structures for the storage of

	(Part I to IV)	liquids.
	IS: 3414	Code of practice for design and installation of joints in buildings.
	IS: 3550	Methods of test for routine control for water used in industry.
	IS: 3558	Code of practice for use of immersion vibrators for consolidating concrete.
	IS: 4014 (Parts I & II)	Code of practice for steel tubular scaffolding.
	IS: 4326	Code of practice for earthquake resistant design and construction of buildings.
	IS: 4461	Code of practice for joints in surface hydro-electric power stations.
	IS: 4656	Specification for form vibrators for concrete.
	IS: 4925	Specification for batching and mixing plant.
	IS: 4990	Specification for plywood for concrete shuttering work.
	IS: 4995 (Parts I & II)	Criteria for design of reinforced concrete bins for the storage of granular and powdery materials.
	IS: 5256	Code or practice for sealing joints in concrete lining on canals.
	IS: 5525	Recommendations for detailing of reinforcement in reinforced concrete work.
	IS: 5624	Specification for foundation bolts.
	IS: 6461	Glossary of terms relating to cement concrete.
	IS: 6494	Code of practice for water proofing of underground water reservoirs and swimming pools.
	IS: 6509	Code of practice for installation of joints in concrete pavements.
	IS: 7861	Code of practice for extreme weather concreting. (Parts I & II)
	IS: 9012	Recommended practice for shot concreting.
	IS: 9103	Specification for admixtures for concrete.

IS: 9417	Recommendations for welding cold worked steel bars for reinforced concrete construction.
IS: 10262	Recommended guidelines for concrete mix design.
IS: 11384	Code of practice for composite construction in structural steel and concrete.
IS: 11504	Criteria for structural design of reinforced concrete natural draught cooling towers.
IS: 12118	Specification for two-parts poly sulphide.
IS: 12200	Code of practice for provision of water stops at transverse contraction joints in masonry and concrete dams.
IS: 13311	Method of non-destructive testing of concrete.
Part-1	Ultrasonic pulse velocity.
Part-2	Rebound hammer.
SP:23	Handbook of concrete mixes
SP: 24	Explanatory Handbook on IS: 456-1978
SP: 34	Handbook on concrete reinforcement and detailing.

Precast Concrete Works

SP: 7(PartVI/	National Building Code- Structural design of prefabrication and Sec.7) systems building.
IS: 10297	Code of practice for design and construction of floors and roofs using precast reinforced/prestressed concrete ribbed or cored slab units.
IS: 10505	Code of practice for construction of floors and roofs using pre-cast reinforced concrete units.

Masonary and Allied Works

IS: 1905	Code of Practice for Structural Safety of Buildings-Masonry walls.
IS: 2212	Code of Practice for Brickwork.

IS: 2250	Code of Practice for Preparation and use of Masonry Mortar.
SP: 20	Explanatory hand book on masonry code.

Sheeting Works

IS:277	Galvanised steel sheets (plain or corrugated).
IS: 459	Unreinforced corrugated and semi-corrugated asbestos cement sheets.
IS: 513	Cold-rolled carbon steel sheets.
IS: 730	Specification for fixing accessories for corrugated sheet roofing.
IS: 1626	Specification for Asbestos cement building pipes and pipe fittings, gutters and gutter fittings and roofing fittings.
IS: 2527	Code of practice for fixing rain water gutters and down pipe for roof drainage.
IS: 3007	Code of practice for laying of asbestos cement sheets.
IS: 5913	Methods of test for asbestos cement products.
IS: 7178	Technical supply conditions for tapping screw.
IS: 8183	Bonded mineral wool.
IS: 8869	Washers for corrugated sheet roofing.
IS: 12093	Code of practice for laying and fixing of sloped roof covering using plain and corrugated galvanised steel sheets.
IS: 12866	Plastic translucent sheets made from thermosetting polyster resin (glass fibre reinforced).
IS: 14246	Specification for continuously pre-painted galvanised steel sheets and coils.

Fabrication and Erection of Structural Steel Work

IS: 2016	Specification for plain washers.

	IS: 814	Specification for covered Electrodes for Metal Arc Welding for weld steel.
	IS: 1852	Specification for Rolling and Cutting Tolerances for Hot rolled steel products.
	IS: 3502	Specifications for chequered plate.
	IS: 6911	Specification for stainless steel plate, sheet and strip.
	IS: 3757	Specification for high strength structural bolts
	IS: 6623	Specification for high strength structural nuts.
	IS: 6649	High Tensile friction grip washers.
	IS: 800	Code of practice for use of structural steel in general building construction.
	IS: 816	Code of practice for use of Metal Arc Welding for General Construction.
	IS: 4000	Code of practice for assembly of structural joints using high tensile friction grip fasteners.
	IS: 9595	Code of procedure of Manual Metal Arc Welding of Mild Steel.
	IS: 817	Code of practice for Training and Testing of Metal Arc Welders.
	IS: 1811	Qualifying tests for Metal Arc Welders (engaged in welding structures other than pipes).
	IS: 9178	Criteria for Design of steel bins for storage of Bulk Materials.
	IS: 9006	Recommended Practice for Welding of Clad Steel.
	IS: 7215	Tolerances for fabrication steel structures.
	IS: 12843	Tolerance for erection of structural steel.
	IS: 4353	Recommendations for submerged arc welding of mild steel and low alloy steels.
	SP: 6 (Part 1 to 7)	ISI Hand book for structural Engineers.

IS: 1608	Method of Tensile Testing of Steel products other than sheets, strip, wire and tube.
IS: 1599	Method of Bend Tests for Steel products other than sheet, strip, wire and tube
IS : 228	Methods of chemical Analysis of pig iron, cast iron and plain carbon and low alloy steel.
IS : 2595	Code of Practice for Radio graphic testing.
IS : 1182	Recommended practice for Radiographic Examination of fusion welded butt joints in steel plates.
IS : 3664	Code of practice for Ultra sonic Testing by pulse echo method.
IS : 3613	Acceptance tests for wire flux combination for submerged Arc Welding.
IS : 3658	Code of practice for Liquid penetrant Flaw Detection.
IS : 5334	Code of practice for Magnetic Particle Flaw Detection of Welds.

Plastering and Allied Works

IS : 1635	Code of practice for field slaking of Building lime and preparation of putty.
IS : 1661	Application of cement and cement lime plaster finishes.
IS : 2333	Plaster-of-paris.
IS : 2402	Code of practice for external rendered finishes.
IS : 2547	Gypsum building plaster.
IS : 3150	Hexagonal wire netting for general purpose.

Acid and Alkali Resistant Lining

IS : 158	Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali & heat resisting.
IS : 412	Specification for expanded metal steel sheets for general purpose.

IS : 4441	Code of practice for use of silicate type chemical resistant mortars.
IS : 4443	Code of practice for use of resin type chemical resistant mortars.
IS : 4456	Method of test for chemical resistant tiles. (Part I & II)
IS : 4457	Specification for ceramic unglazed vitreous acid resistant tiles.
IS : 4832	Specification for chemical resistant mortars.
	Part I Silicate type
	Part II Resin type
	Part III Sulphur type
IS : 4860	Specification for acid resistant bricks.
IS : 9510	Specification for bitumasitc, Acid resisting grade.

Water Supply, Drainage and Sanitation

IS : 458	Specification for concrete pipes.
IS : 554	Dimensions for pipe threads, where pressure tight joints are made on thread.
IS : 651	Specification for salt glazed stoneware pipes.
IS : 774	Flushing cisterns for water closets and urinals.
IS : 775	Cast iron brackets and supports for wash basins and sinks.
IS : 778	Copper alloy gate, globe and check valves for water works purposes.
IS : 781	Cast copper alloy screw down bib taps and stop valves for water services.
IS : 782	Caulking lead.
IS : 783	Code of practice for laying of concrete pipes.

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	
	IS : 1172	Basic requirements for water supply, drainage and sanitation.
	IS : 1230	Cast iron rain water pipes and fittings.
	IS : 1239	Mild steel tubes, tubulars and other wrought steel fittings.
	IS : 1536	Centrifugally cast (Spun) iron pressure pipes for water, gas and sewage.
	IS : 1537	Vertically cast iron pressure pipes for water, gas and sewage.
	IS : 1538	Cast iron fittings for pressure pipe for water, gas and sewage.
	IS : 1703	Ball valves (horizontal plunger type) including float for water supply purposes.
	IS : 1726	Cast iron manhole covers and frames.
	IS : 1729	Sand cast iron spigot and socket, soil, water and ventilating pipes, fittings and accessories.
	IS : 1742	Code of practice for building drainage.
	IS : 1795	Pillar taps for water supply purposes.
	IS : 1879	Malleable cast iron pipe fittings.
	IS : 2064	Code of practice for selection, installation and maintenance of sanitary appliances.
	IS : 2065	Code of practice for water supply in building.
	IS : 2326	Automatic flushing cisterns for urinals.
	IS : 2470 (Part-I & II)	Code of practice for installation of septic tanks.
	IS : 2501	Copper tubes for general engineering purposes.
	IS : 2548	Plastic seat and cover for water-closets.
	IS : 2556 (Part 1 to 15)	Vitreous sanitary appliances (vitreous china).
	IS : 2963	Non-ferrous waste fittings for wash basins and sinks.

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	
	IS : 3114	Code of practice for laying of cast iron pipes.
	IS : 3311	Waste plug and its accessories for sinks and wash basins.
	IS : 3438	Silvered glass mirrors for general purposes.
	IS : 3486	Cast iron spigot and socket drain pipes.
	IS : 3589	Electrically welded steel pipes for water, gas and sewage (200mm to 2000mm nominal diameter).
	IS : 3989	Centrifugally cast (Spun) iron spigot and socket soil, waste and ventilating pipes, fittings and accessories.
	IS : 4111 (Part I to IV)	Code of practice for ancillary structure in sewerage system.
	IS : 4127	Code of practice for laying of glazed stone-ware pipes.
	IS : 4764	Tolerance limits for sewage effluents discharged into inland-surface waters.
	IS : 4827	Electro plated coating of nickel and chromium on copper and copper alloys.
	IS : 5329	Code of practice for sanitary pipe work above ground for buildings.
	IS : 5382	Rubber sealing rings for gas mains, water mains and sewers.
	IS : 5822	Code of practice for laying of welded steel pipes for water supply.
	IS : 5961	Cast iron grating for drainage purpose.
	IS : 7740	Code of practice for road gullies.
	IS : 8931	Cast copper alloy fancy bib taps and stop valves for water services.
	IS : 8934	Cast copper alloy fancy pillar taps for water services.
	IS : 9762	Polyethylene floats for ball valves.
	IS : 10446	Glossary of terms for water supply and sanitation.

IS : 10592	Industrial emergency showers, eye and face fountains and combination units.
IS : 12592	Specification for precast concrete manhole covers and frames.
IS : 12701	Rotational moulded polyethylene water storage tanks.
SP: 35	Hand book on water supply and drainage.
-	Manual on Sewerage and sewage treatment (Published by CPH & EEO) As updated.

Doors, Windows and Allied Works

IS : 204	Tower Bolts
Part-I	Ferrous metals.
Part-II	Nonferrous metals.
IS : 208	Door Handles.
IS : 281	Mild steel sliding door bolts for use with padlocks.
IS : 362	Parliament Hinges.
IS : 420	Specification for putty, for use on metal frames.
IS : 1003 Part-I door	Specification for timber panelled and glazed shutters- (Part-I) shutters.
IS : 1038	Steel doors, windows and ventilators.
IS : 1081	Code of practice for fixing and glazing of metal (steel and aluminium) doors, windows and ventilators.
IS : 1341	Steel butt hinges.
IS : 1361	Steel windows for industrial buildings.
IS : 1823	Floor door stoppers.
IS : 1868	Anodic coatings on Aluminium and its alloys.
IS : 2202 (Part-II)	Specification for wooden flush door shutters (solid core type); particle board face panels and hard board face panels

	IS:2209	Mortice locks (vertical type).
	IS:2553	Safety glass
	IS:2835	Flat transparent sheet glass.
	IS:3548	Code of practice for glazing in buildings.
	IS:3564	Door closers (Hydraulically regulated).
	IS : 3614	Fire check doors; plate, metal covered and rolling type.
	IS:4351	Steel door frames.
	IS:5187	Flush bolts.
	IS:5437	Wired and figured glass
	IS:6248	Metal rolling shutters and rolling grills.
	IS:6315	Floor springs (hydraulically regulated) for heavy doors.
	IS:7196	Hold fasts.
	IS:7452	Hot rolled steel sections for doors, windows and ventilators.
	IS:10019	Mild steel stays and fasteners.
	IS:10451	Steel sliding shutters (top hung type).
	IS:10521	Collapsible gates.
	R oof Water Proofing and AlliedWorks	
	IS:1203	Methods of testing tar and bitumen.
	IS:1322	Specification for bitumen felts for water proofing and damp proofing.
	IS:1346	Code of practice for water proofing of roofs with bitumen felts.
	IS:1580	Specification for bituminous compound for water proofing and caulking purposes.

IS:3067	Code of practice for general design details and preparatory work for damp proofing and water proofing of buildings.
IS:3384	Specification for bitumen primer for use in water proofing and damp proofing.

Floor Finishes and Allied Works

IS:1237	Specification for cement concrete flooring tiles.
IS:1443	Code of practice for laying and finishing of cement concrete flooring tiles.
IS:2114	Code of practice for laying in-situ terrazzo floor finish.
IS:2571	Code of practice for laying in-situ cement concrete flooring.
IS:3462	Specification for unbacked flexible PVC flooring.
IS:4971	Recommendations for selection of industrial floor finishes.
IS:5318	Code of practice for laying of flexible PVC sheet and tile flooring.
IS:8042	Specification for white portland cement.
IS:13801	Specification for chequered cement concrete flooring tiles.

Painting and Allied Works

IS:162	Specification for fire resisting silicate type, brushing, for use on wood, colour as required.
IS:1477	Code of practice for painting of ferrous metals in buildings.
Part-I	Pretreatment.
Part-II	Painting.
IS:1650	Specification for colours for building and decorative finishes.
IS:2074	Specification for red oxide-zinc chrome, priming, ready mixed paint air drying.
IS:2338	Code of practice for finishing of wood and wood based materials.
Part-I	Operations and workmanship

Part-II	Schedules
IS:2395	Code of practice for painting concrete, masonry and plaster surfaces.
Part-I	Operations and workmanship.
Part-II	Schedule.
IS:2524	Code of practice for painting of nonferrous metals in buildings.
Part-I	Pretreatment.
Part-II	Painting.
IS:2932	Specification of synthetic enamel paint, exterior, under-coating and finishing.
IS:2933	Specification enamel paint, under coating and finishing.
IS:4759	Code of practice for hot dip zinc coating on structural steel and other allied products.
IS:5410	Specification for cement paint
IS:5411 (Part-I)	Specification for plastic emulsion paint-for exterior use
IS:6278	Code of practices for white washing and colour washing.
IS:10403	Glossary of terms relating to building finishes.
Piling and Foundation	
IS:1080	Code of practice for design and construction of simple spread foundations.
IS:1904	Code of practice for design and construction of foundations in Soils; General Requirements.
IS:2911	Code of practice for designs and construction of Pile foundations (Relevant Parts).
IS:2950 (Part-I)	Code of practice for designs and construction of Raft foundation.
IS:2974 (Part-I TO V)	Code of practice for design and construction of machine foundations.
IS:6403	Code of practice for determination of Allowable Bearing pressure on Shallow foundation.

IS:8009	Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads.
Part-I	Shallow foundations.
Part-II	Deep foundations.
IS:12070	Code of practice for design and construction of shallow foundations on rocks.
DIN:4024	Flexible supporting structures for machines with rotating machines.
VDI:2056	Criteria for assessing mechanical vibrations of machines.
VDI:2060	Criteria for assessing rotating imbalances in machines.
Stop Log and Trash Rack	
IS:4622	Recommendations for fixed - wheel gates structural design.
IS:5620	Recommendations for structural design criteria for low head slide gates.
IS:11388	Recommendations for design of trash rack for intakes.
IS:11855	General requirements for rubber seals for hydraulic gates.
Roads	
IRC:5	Standard specifications and Code of practice for road bridges, section-I general Features of Design.
IRC:14	Recommended practice of 2cm thick bitumen and tar carpets.
IRC:16	Specification for priming of base course with bituminous primers.
IRC:19	Standard specifications and code of practice for water bound macadam.
IRC:21	Standard specifications and Code of practice for road bridges, section-III - Cement concrete (plain and reinforced).
IRC:34	Recommendations for road construction in waterlogged areas.
IRC:36	Recommended practice for the construction of earth embankments for road works.
IRC:37	Guidelines for the Design of flexible pavements.
IRC:56	Recommended practice for treatment of embankment slopes for erosion control.
IRC:73	Geometric design standards for rural (non-urban) highways.
IRC:86	Geometric Design standards for urban roads in plains.

IRC:SP:13	Guidelines for the design of small bridges & culverts.
IRC - Publication	Ministry of Surface Transport (Roads Wing), Specifications for road and bridge works.
IS:73	Specification for paving bitumen

Loadings

IS:875 (Pt. I to V)	Code of practice for design loads other than earthquake) for buildings and structures.
IS:1893	Criteria for earthquake resistant design of structures.
IS:4091	Code of Practice for design and construction of foundation for transmission line towers & poles.
IRC:6	Standard specifications & code of practice for road bridges, Section-II Loads and stresses.
M.O.T.	Deptt. of railways Bridge Rules.

Safety

IS:3696 (Part I & II)	Safety code for scaffolds and ladders.
IS:3764	Safety code for excavation work.
IS:4081	Safety code for blasting and related drilling operations.
IS:4130	Safety code for demolition of buildings.
IS:5121	Safety code for piling and other deep foundations.
IS:5916	Safety code for construction involving use of hot bituminous materials.
IS:7205	Safety code for erection on structural steelwork.
IS:7293	Safety code for working with construction machinery.
IS:7969	Safety code for handling and storage of building materials
IS:11769	Guidelines for safe use of products containing asbestos.

- Indian Explosives Act. 1940 as updated.

Architectural design of buildings

SP:7	National Building Code of India
SP:41	Hand book on functional requirements of buildings (other than industrial buildings)

Miscellaneous

IS:802	Code of practice for use of structural steel in
(Relevant parts)	overhead transmission line towers.
IS:803	Code of practice for design, fabrication and erection of vertical mild steel cylindrically welded in storage tanks.
IS:10430	Creteria for design of lined canals and liner for selection of type of lining.
IS:11592	Code of practice for selection and design of belt conveyors.
IS:12867	PVC handrails covers.
CIRIA	Design and construction of buried thin-wall pipes.
Publication	

REFERENCE CODES AND STANDARDS FOR CONTROL AND INSTRUMENTATION

The design, manufacture, inspection, testing & installation of all equipment and system covered under this specification shall conform to the latest editions of codes and standards mentioned below and all other applicable VDE, IEEE, ANSI, ASME, NEC, NEMA, ISA AND Indian Standards and their equivalents.

Temperature Measurements

1. Instrument and apparatus for temperature measurement - ASME PTC 19.3 (1974).
2. Temperature measurement - Thermocouples ANSI MC 96.1 - 1982.
3. Temperature measuremnet by electrical Resistance thermometers - IS:2806.
4. Thermometer - element - Platinum resistance - IS:2848.

Pressure Measurements

1. a) Instruments and apparatus for pressure measurement - ASME PTC 19.2 (1964).
   b) Electonic transmitters BS:6447.
2. Bourdon tube pressure and vacuum gauges - IS:3624 - 1966.
3. Process operated switch devices (Pr. Switch) BS-6134.

AMENDMENT NO. 3 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. No.	Section / Part	SUB SECTION	Clause No.	Page No.	EXISTING	READ AS
1.	PART-B	IV-D	3.07.00	8 OF 69	**Gypsum Storage Shed** The Gypsum storage shed shall be RCC framed structure with structural steel work shed with permanently colour coated profiled steel sheet roof and side cladding, grade slab and RCC foundations etc. Roof shall be provided with troughed profile permanently colour coated sheet with slope of 1 in 5 for quick drainage of rain water	**Gypsum Storage Shed** The Gypsum storage shed shall be RCC framed structure with RCC/ Brick infill wall **(upto Tripper floor)** and structural steel shed with permanently colour coated profiled steel sheet roof and side cladding **(above tripper floor)**. Roof shall be provided with troughed profile permanently colour coated sheet with slope of 1 in 5 for quick drainage of rain water. **At grade level Heavy duty paving as detailed elsewhere in the specification shall be provided inside the shed.**

AMENDMENT NO. 3 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. No.	Section / Part	SUB SECTION	Clause No.	Page No.	EXISTING	READ AS
2.	VI/B	IV-D	3.14.01, Para 1	10 of 69	Single-flue or multi-flue chimney(s) shall be provided. Chimney shall be of reinforced concrete construction. There shall be one flue (liner) for each unit. The flue gas emission point shall be minimum 150 meters above the plant grade level.	Single-flue chimney(s) shall be provided. Chimney shall be of reinforced concrete construction. There shall be one flue (liner) for each unit. The flue gas emission point shall be minimum 150 meters above the plant grade level. **The centre to centre distance between the proposed chimney(s) and the existing chimney(s) in any direction shall not be less than 150 metres.**
3.	VI/B	IV-D	3.14.08	14 of 69	**Thermal insulation** The insulation shall be semi rigid, resin bonded type, in the form of slabs and shall conform to IS: 8183. Blanket type insulation shall not be used. …….. pins and speed washer.	**Thermal insulation (Applicable in case of Titanium / C-276 Flue Liner)** The insulation shall be semi rigid, resin bonded type, in the form of slabs and shall conform to IS: 8183. Blanket type insulation shall not be used. …….. pins and speed washer.

AMENDMENT NO. 3 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. No.	Section / Part	SUB SECTION	Clause No.	Page No.	EXISTING	READ AS
4.	VI/B	IV-D	3.14.09,	15 of 69	(iv) The inside surface of chimney shell above roof, horizontal surface of shell at top, underside of concrete roof slab, **external surface of mini-shell above roof** etc shall be painted with epoxy phenolic coating system having total 220 microns DFT.	(iv) The inside surface of chimney shell above roof, horizontal surface of shell at top, underside of concrete roof slab etc shall be painted with epoxy phenolic coating system having total 220 microns DFT.
5.	VI/A	II-A8	6.00.00, Annexure-B	8 of 31	a) The basic wind speed "V_b" at ten	a) The basic wind speed "V_b" at ten metres above the mean ground level : 47 metres/second

AMENDMENT NO. 3 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. No.	Section / Part	SUB SECTION	Clause No.	Page No.	EXISTING	READ AS
6.	VI/A	II-A10	7.02.00	10 OF 30	For excavation 6 metres below FGL, sheet piling shall be provided.	Excavation may be carried out by using either sheet piling/ diaphragm wall/ secant piling/ contiguous piling or their combination.
7.	VI/A	II-A7/A8/A3/A5/A11	7.02.03 (xv)	14 OF 33/ 13 OF 31/ 14 OF 31/ 14 OF 40/ 15 OF 29	High Strain Dynamic Load Test may be carried out for routine load testing of working piles. However, at least two numbers of static routine vertical load tests shall be carried out on pile on which high strain dynamic load test has already been carried out for establishing the correlation between the two tests. In case of discrepancy if any between dynamic and static vertical load tests, then additional static routine vertical load tests shall be conducted as decided by the Engineer and the results of static routine vertical	**Either of Static routine load test** or High Strain Dynamic Load Test may be carried out for routine load testing of working piles. However, at least two numbers of static routine vertical load tests shall be carried out on pile on which high strain dynamic load test has already been carried out for establishing the correlation between the two tests. In case of discrepancy if any between dynamic and static vertical load tests, then additional static routine vertical load tests shall be conducted as decided by the Engineer and the results of static routine vertical load shall prevail.

AMENDMENT NO. 3 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. No.	Section / Part	SUB SECTION	Clause No.	Page No.	EXISTING	READ AS
					load shall prevail. Number of routine vertical pile load tests as per clause 7.02.03 (ix) shall be total of static routine vertical load test and high strain dynamic load tests.	Number of routine vertical pile load tests as per clause 7.02.03 (ix) shall be total of static routine vertical load test and high strain dynamic load tests.
8.	VI/A	II-A10 Project Information Barh STPP Stage-I	7.00.00	10 to 13 of 30	SOIL DATA AND FOUNDATION SYSTEM	**"SOIL DATA AND FOUNDATION SYSTEM"** given in **"Annexure-1"** to this amendment shall replace the contents of **Clause 7.00.00, Page 10 to 13 of 30,** Sub-section-II-A10, Part-A Sec-VI, of Tech. Specification.

AMENDMENT NO. 3 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. No.	Section / Part	SUB SECTION	Clause No.	Page No.	EXISTING	READ AS
9.	VI/A	II-A6 Project Information Solapur	7.00.00	9 to 21 of 31	Foundation system & Geotechnical data	**"Foundation system & Geotechnical data"** given in **"Annexure-2"** to this amendment shall replace the contents of **Clause 7.00.00, Page 9 to 21 of 31,** Sub-section- II-A6, Part-A Sec-VI, of Tech. Specification.
10.	VI/A	II-A4 Project Information Darlipali	Annexure-IV of clause 7.00.00	-	-	**"Annexure-IV BORE LOGS"** at **"Annexure-3"** to this amendment added with clause 7.00.00, II-A4, Part-A Sec-VI, of Tech. Specification.

AMENDMENT NO. 3 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. No.	Section / Part	SUB SECTION	Clause No.	Page No.	EXISTING	READ AS
11.	VI/A	II-A9 Project Information Meja TPP-I	Annexure-IV of clause 7.00.00		Annexure-IV Borelog	**"Bore Log "** given in **"Annexure-4"** to this amendment shall replace the contents of **Page 26 to 28 of 36 , Clause 7.00.00,** Sub-section-II-A9, Part-A Sec-VI, of Tech. Specification.
12..	VI/A	II-A1/A2//A4/ A5/ A6/A8/A11	-	-	-	**Electrical Resistivity Test (ERT) Data at "Annexure-5".**

AMENDMENT NO. 3 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. No.	Section / Part	SUB SECTION	Clause No.	Page No.	EXISTING	READ AS
13.	VI/A	IIA2 Project Information Lara STPP Stage-I	5.00.00	3 to 10 of 48	"CRITERIA FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT"	"**CRITERIA FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT**" given in **"Annexure-6"** to this amendment shall replace the contents of **Clause 5.00.00, Sub-section- II-A2, Part-A Sec-VI, of Tech. Specification**.
14.	VI/A	II-A10 Project Information Barh STPP Stage-I	5.00.00	2 to 7 of 30	"CRITERIA FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT"	"**CRITERIA FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT**" given in **"Annexure-7"** to this amendment shall replace the contents of **Clause 5.00.00, Sub-section- II-A10, Part-A Sec-VI, of Tech. Specification**.

AMENDMENT NO. 3 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. No.	Section / Part	SUB SECTION	Clause No.	Page No.	EXISTING	READ AS
15.	Section VI / Part A	Sub-Section III D	1.06.00	2 of 4	Uniform Finished Ground Level (FGL) in **FGD absorber area** shall be made available by the owner at a level specified in tender drawing.	Uniform Finished Ground Level (FGL) in **FGD areas** shall be made available by the owner at a level specified in tender drawing.
16.	Section VI / Part A	Sub-section IIID	2.00.00	2 of 4	……. ……Bidder shall provide permanent access to all facilities/structures from the nearby existing roads of the Owner. Roads shall be in concrete (M 35) as per IRC standards, with minimum thickness of pavement (PQC) as 250mm. Width of all such roads shall be 7.5 M concrete pavement.	……. ……Bidder shall provide permanent access to all facilities/structures from the nearby existing roads of the Owner. Roads shall be in concrete as per IRC standards, with minimum thickness of pavement (PQC) as 250mm (in M 35 grade) and DLC of 150 thick (in M 10 grade). Double lane road (width 12m having 7.5m wide pavement & 2.25m wide shoulders on both sides) shall be provided.

AMENDMENT NO. 3 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. No.	Section / Part	SUB SECTION	Clause No.	Page No.	EXISTING	READ AS
17.	Section VI / Part B	Sub-section IVD	15.00.00	32 of 69	…….. …….. Sewage pump house shall be provided as per IS:4111.	…….. …….. Sewage pumping stations shall be provided as per IS:4111.
18.	Section VI / Part B	Sub-section IVD	14.00.00	31 of 69	…….. …..These values shall be based on rainfall intensity of **90mm/hr** …….. ……	……..These values shall be based on rainfall intensity of **75mm/hr** …….. ……

AMENDMENT NO. 3 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. No.	Section / Part	SUB SECTION	Clause No.	Page No.	EXISTING	READ AS
19.	Section VI / Part A	Sub Section IIA10 Project information, BARH STPP STAGE-1 (3X660MW)	2.00.00	30 of 30		The topographical survey drawing no: 9562-999-POC-F-002 is attached with this amendment as **Annexure-8**
20.	Section VI / Part A	Sub Section IIA8 Project information, NABINAGA STPP STAGE-1 (3X660MW)	10.00.00	31 of 31		The topographical survey drawing no: 0370-999-POC-F-002 is attached with this amendment as **Annexure-9**

AMENDMENT NO. 3 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. No.	Section / Part	SUB SECTION	Clause No.	Page No.	EXISTING	READ AS
21.	Section VI / Part A	Sub Section IIA2 Project information, LARA STPP STAGE-1 (2X800MW)	-	48 of 48		The topographical survey drawing no: 9548-999-POC-F-002 is attached with this amendment **as Annexure-10**
22.	Section VI / Part B	Sub-Section-IV-D Civil Works	4.02.00	18 to 19 of 69	The scope for potable water supply includes all distribution …….. conforming to IS: 458 and at rail crossing R.C.C. box culvert to be provided. **For sewerage below ground stoneware pipes conforming to IS: 651 with concrete bedding and haunch.**	The scope for potable water supply includes all distribution …….. conforming to IS: 458 and at rail crossing R.C.C. box culvert to be provided.

AMENDMENT NO. 3 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. No.	Section / Part	SUB SECTION	Clause No.	Page No.	EXISTING	READ AS
23.	Section VI / Part B	Sub-Section-IV-D Civil Works	7.00.00, Para-2	24 of 69	In case Bidder opts for steel super-structure with RCC floors/ roof, the bidder shall necessarily use Troughed permanently colour coated metal decking sheets having minimum thickness of **0.8mm** as permanent shuttering. The detailed material property requirement of metal deck sheet is specified elsewhere in the specification. These profiled metal deck sheets shall be fixed to the structural steel beams/ purlins using headed shear anchor studs specified elsewhere in the specification.	In case Bidder opts for steel super-structure with RCC floors/ roof, the bidder shall necessarily use Troughed permanently colour coated metal decking sheets having minimum thickness of **0.6mm** as permanent shuttering. The detailed material property requirement of metal deck sheet is specified elsewhere in the specification. These profiled metal deck sheets shall be fixed to the structural steel beams/ purlins using headed shear anchor studs specified elsewhere in the specification.

AMENDMENT NO. 3 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. No.	Section / Part	SUB SECTION	Clause No.	Page No.	EXISTING	READ AS
24.	Section VI / Part B	Sub-Section-IV-D Civil Works	3.03.00, Para-1	6 of 69	The over ground portion of the transfer house shall be framed structure…… …Brick wall cladding shall be supported on encased wall beams and suitably anchored to adjoining columns and beams.**Contractor shall have option to use tubular steel sections for roof truss only**. Verticalbracings shall be provided only on four sides along the periphery. Grade slab with0.9m height one brick thick wall plastered on both side at periphery shall be provided for all transfer houses.	The over ground portion of the transfer house shall be framed structure……..……Brick wall cladding shall be supported on encased wall beams and suitably anchored to adjoining columns and beams. Vertical bracings shall be provided only on four sides along the periphery. Grade slab with0.9m height one brick thick wall plastered on both side at periphery shall be provided for all transfer houses.

AMENDMENT NO. 3 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. No.	Section / Part	SUB SECTION	Clause No.	Page No.	EXISTING	READ AS
25.	Section VI / Part B	Sub-Section-IV-D Civil Works	3.04.00, Para-1	7 of 69	The crusher house shall be framed structure…… ……Adequate steel doors and windows for natural lighting and ventilation shall be provided. **Contractor shall have option to use tubular steel sections for roof truss only**. Vertical bracings shall be provided only on four sides along the periphery.	The crusher house shall be framed structure…… ……Adequate steel doors and windows for natural lighting and ventilation shall be provided. Vertical bracings shall be provided only on four sides along the periphery.
26.	Section VI / Part B	Sub-Section-IV-D Civil Works	3.09.00, Para-1	8 of 69	All floors of transfer points/crusher houses and other facility buildings shall be accessible through staircase. ……..For steel staircases , Stringers shall be of rolled steel channel (minimumISMC 250) and tread shall be of steel gratings. Out side stairs to transfer points/crusher house shall be open type. Minimum 50 x 50 x 6 mm size angles with lugs shall be provided as edge protection for treads of stairs in underground TP's.	All floors of transfer points/crusher houses and other facility buildings shall be accessible through staircase. ……..For steel staircases, Stringers shall be of rolled steel channel (minimumISMC 250) and tread shall be of steel gratings. Out side stairs to transfer points/crusher house shall be open type. **However sheeting shall be provided at the top**. Minimum 50 x 50 x 6 mm size angles with lugs shall be provided as edge protection for treads of stairs in underground TP's.

AMENDMENT NO. 3 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. No.	Section / Part	SUB SECTION	Clause No.	Page No.	EXISTING	READ AS
27.	Section VI / Part B	Sub-Section-IV-D Civil Works	3.01.00, Para-11	3 of 69	Plinth protection along with drains shall be provided along the Hopper complex. However, 5m wide paving shall also be provided around machinery hatches.	Plinth protection along with drains shall be provided along the Hopper complex. However, minimum 5m wide paving shall also be provided around machinery hatches **and Truck hopper**.
28.	Section VI / Part B	Sub-Section-IV-D Civil Works	24.00.00 ,	42 of 69	**CONCRETE** c) M35- For spring supported RCC deck	**CONCRETE** c) M35- For spring supported RCC deck **and rail load bearing structure (if applicable).**

AMENDMENT NO. 3 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. No.	Section / Part	SUB SECTION	Clause No.	Page No.	EXISTING	READ AS
29.	Section VI / Part B	Sub-Section-IV-D Civil Works	39.03.00 ,	66 of 69	Fly ash based Portland pozzolona cement conforming to IS: 1489 Part - I shall preferably be used. However, the contractor may use other types of cements conforming to IS: 269, IS: 8112, IS: 12269, & IS: 455.	**Cement** Fly ash based portland pozzolana cement conforming to IS:1489 (Part-1) shall be used for all areas other than for the critical structures identified below. Other properties shall be as per IS code. Ordinary Portland Cement (OPC) shall necessarily be used for the following structures. a) Spring supported decks of limestone crusher b) RCC for Chimney shell. The grade of cement shall be Grade 43 for OPC conforming to IS:8112. In place of fly ash based portland pozzolana cement, OPC mixed with Fly Ash can be used. Batching plant shall have facility for mixing fly ash. Fly ash shall conform to IS:3812(Part I & Part II). Percentage of fly ash to be mixed in concrete shall be based

SL. No.	Section / Part	SUB SECTION	Clause No.	Page No.	EXISTING	READ AS
						on trial mix. Mix design shall be done with varying percentage of fly ash mix with cement.
30.	Section VI / Part B	Sub-Section-IV-D Civil Works	39.05.00 ,	66 of 69	-	**Aggregates** a) **Coarse Aggregate** Coarse aggregate for concrete shall be crushed stones chemically inert, hard, strong, durable against weathering of limited porosity and free from deleterious materials. It shall be properly graded. It shall meet the requirements of IS: 383. b) **Fine Aggregate** Fine aggregate shall be hard, durable, clean and free from adherent coatings of organic matter and clay balls or

SL. No.	Section / Part	SUB SECTION	Clause No.	Page No.	EXISTING	READ AS
						pellets. Fine aggregate in concrete shall conform to IS : 383. For plaster, it shall conform to IS : 1542 and for masonry work to IS : 2116. c) Petrographic examination of aggregate shall be carried out by the contractor at National Council for Cement and Building Materials (NCB), Ballabgarh, or any other approved laboratory to ascertain the structure and rock type including presence of strained quartz and other reactive minerals. In case, the coarse aggregate sample is of composite nature, the proportions (by weight) of different rock types in the composite sample and petrographic evaluation of each rock should also be ascertained. While determining the rock type, special emphasis should be given on identification of known reactive rocks like

SL. No.	Section / Part	SUB SECTION	Clause No.	Page No.	EXISTING	READ AS
						chalcedony, opal etc. The procedure laid down in IS 2430 for sampling of aggregates may be followed. The laboratory shall determine potential reactivity of the aggregate, which may lead to reaction of silica in aggregate with the alkalis of cement and / or potential of some aggregates like limestone to cause residual expansion due to repeated temperature cycle. If the same is established, the contractor shall further carry out alkali aggregates reactivity test as per IS 2386 (Pt.VII) and / or repeated temperature cycle test to establish the suitability of the aggregates for the concrete work. The test results, with the final recommendations of the laboratory, as to a suitability of the aggregate, for use in the concrete work for various structures and suggested measures, in case of results

SL. No.	Section / Part	SUB SECTION	Clause No.	Page No.	EXISTING	READ AS
						are not satisfactory, shall be submitted to the Engineer for his review, in a report form. In case in the report, it is established, that the aggregates contain reactive silica, which would react with alkalis of the cement, the contractor shall change the source of supply of the aggregate or use low alkali cement as per recommendation or take measures as recommended in the report as instructed by Engineer. In case aggregates indicate residual expansion, under repeated temperature cycle test (from 10^{o} Celsius to 65^{o} Celsius and for 60 temperature cycles) the material shall not be used for concreting of Lime stone crusher decks, Mills, Fans and other equipment foundations which are likely to be subjected to repeated

AMENDMENT NO. 3 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. No.	Section / Part	SUB SECTION	Clause No.	Page No.	EXISTING	READ AS
						temperature cycle. The contractor shall use aggregates free from residual expansion under repeated temperatures cycle test.
31.	Section VI / Part B	Sub-Section-IV-D Civil Works	8.00.00, Para-3	26 of 69	Bricks to be used in brickwork shall be of minimum Class designation 50.	Only fly ash bricks shall be used in all construction. Bricks shall be table moulded/ machine made of uniform size, shape and sharp edges and shall have minimum compressive strength of 75kg/cm^2. Burnt clay fly ash bricks and fly ash lime bricks shall conform to IS 13757 and IS 12894 respectively. Minimum fly ash content in fly ash based bricks shall be 25%.

AMENDMENT NO. 3 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. No.	Section / Part	SUB SECTION	Clause No.	Page No.	EXISTING	READ AS
32.	SECTION – VI, PART-B	SUB-SECTION-III-C5 PLC BASED CONTROL SYSTEM	9.05.00	19 of 27	Bidder shall clearly bring out in the proposal the redundancy feature along with configuration diagram, single line diagram and datasheets etc. & this shall be finalized subject to employer's approval during detail engineering. Configuration B : UPS system shall consist of 1 x 100% charger and inverter, 1 x 100% Ni Cd Battery Bank for 1 hour, Bypass Line Transformers and Voltage Stabilizer, static switch, manual bypass switch, 2 x 100% ACDB, 1x100% Microprocessor controlled Battery Health Monitoring System (BHMS) and other necessary protective devices and accessories.	Bidder shall clearly bring out in the proposal the configuration diagram, single line diagram and datasheets etc. & this shall be finalized subject to employer's approval during detail engineering. Configuration B : UPS system shall consist of 1 x 100% charger and inverter with input isolation transformer, 1 x 100% Ni Cd Battery Bank for 1 hour, Bypass Line Transformers and Voltage Stabilizer, static switch, manual bypass switch, 2 x 100% ACDB, 1x100% Microprocessor controlled Battery Health Monitoring System (BHMS) and other necessary protective devices and accessories.
	SECTION – VI, PART-E	Tender drawing C&I		18 of 53 (of PDF)	Scheme of UPS system Configuration-B Drg. no. 0000-999-POI-A-019C	UPS Configuration-B drawing 0000-999-POI-A-019C updated.

AMENDMENT NO. 3 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. No.	Section / Part	SUB SECTION	Clause No.	Page No.	EXISTING	READ AS
33.	SECTION – VI, PART-A	SUB-SECTION-IIIC C&I	New clause 1.00.00 e)	1 of 8		1.00.00 e) Scope defined in PART-A read in conjunction with PART-B has to be provided for each station (i.e. 11 sets for 11 stations) under LOT-1A package. The scope detailed hereunder in the following clauses is for one set.
34.	SECTION – VI, PART-E	Tender drawing C&I		13 of 53 (of PDF)	Standard configuration drawing for PLC based offsite control system. Tender drawing no. 0000-151-POI-A-013 (Rev no. A).	Standard configuration drawing for PLC based offsite control system. Tender drawing no. 0000-151-POI-A-013 (Rev no. B).
35.	SECTION – VI, PART-A	SUB-SECTION-IIIC C&I	New clause 2.07.00	4 of 8	-	2.07.00 Contractor shall provide one no. of Hand held HART calibrator per generating unit.

AMENDMENT NO. 3 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. No.	Section / Part	SUB SECTION	Clause No.	Page No.	EXISTING	READ AS
36.	SECTION – VI, PART-A	SUB-SECTION-IIIC C&I	New clause 6.08.00	7 of 8	-	6.08.00 Binary and modulating controls of complete Flue gas desulphurization system, associated material handling systems etc. and other systems being provided under the contract shall be implemented in PLC. The PLC based Control System shall have separate process blocks for unitised system and one process block for common system including material handling system. For example in KUDGI-I (3x800MW), the PLC based control system shall have following process blocks: (i) Unit-1 FGD and associated system (ii) Unit-2 FGD and associated system (iii) Unit-3 FGD and associated system (iv) Common system including material handling systems.
37.	SECTION – VI, PART-B	SUB-SECTION-III-C2, MEASURING INSTRUMENTS	8.00.00	16 OF 34	Coriolis Flow Transmitter: Viscosity range of Fluid 0-500cst for HFO.	Coriolis Flow Transmitter: Viscosity range of Fluid 0-500cst for HFO.

AMENDMENT NO. 3 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. No.	Section / Part	SUB SECTION	Clause No.	Page No.	EXISTING	READ AS
38.	SECTION – VI, PART-A	SUB-SECTION-IIIC C&I	6.01.00	7 of 8	6.01.00 …….. on as required basis (to be decided during detail Engineering) for controlling and monitoring of the FGD and associated system being provided under the contract located in FGD control room. One OWS shall also be provided with capabilities of programming station of PLC and Human Machine Interface system (EWS cum OWS). The PLC configuration drawing……	6.01.00 …….. on as required basis (to be decided during detail Engineering) for controlling and monitoring of the FGD and associated system being provided under the contract located in FGD control room. One OWS shall also be provided with capabilities of programming station of PLC and Human Machine Interface system (EWS cum OWS). However, bidder to consider minimum quantity of OWS and OWS cum EWS as follows: a) OWS (placed in FGD control room)-(N+1) where N is the total number of generating units per project under this package. b) OWS cum EWS (placed in FGD control room)-ONE (1) c) OWS (placed in central control room of each generating unit)-TWO (2). The PLC configuration drawing……

AMENDMENT NO. 3 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. No.	Section / Part	SUB SECTION	Clause No.	Page No.	EXISTING	READ AS
39.	SECTION – VI, PART-A	SUB-SECTION-IIIC C&I	New clause 6.09.00	7 of 8	------	6.09.00 The Bidder shall provide maintenance services of complete control System under a comprehensive Annual Maintenance Contract (AMC) for period of three year after Warranty period.
	SECTION – VI, PART-B	SUB-SECTION-III-C5 PLC BASED CONTROL SYSTEM	16.01.00	26 of 27	16.01.00 The Bidder shall provide maintenance services of complete control System under a comprehensive Annual Maintenance Contract (AMC) for period of one year after Warranty period and thereafter AMC for only hardware support for next two years.	16.01.00 The Bidder shall provide maintenance services of complete control System under a comprehensive Annual Maintenance Contract (AMC) for period of three year after Warranty period.
40.	SECTION – VI, PART-E	Tender drawing C&I		19 and 20 of 53 (of PDF)	Instrumentation/control/power supply cabling diagram Drg No. 0000-101/102-POI-A-021 Sheet 1 of 3 and sheet 2 of 3	Instrumentation/control/power supply cabling diagram Drg No. 0000-101/102-POI-A-021 Sheet 1 of 3 and sheet 2 of 3 updated.

AMENDMENT NO. 3 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. No.	Section / Part	SUB SECTION	Clause No.	Page No.	EXISTING	READ AS
41.	SECTION – VI, PART-A	SUB-SECTION-IIIC C&I	7 of 8	New clause 6.10.00	-	6.10.00 Contractor shall provide control desk placed in FGD control room, meeting specification requirements stipulated in clause 10.04.00, PART-B, Sub Section III-C5 of technical specification. Contractor shall also provide a control desk for each generating unit, of length 2 meter aesthetically matching with the existing control desk of main plant Central Control Room (CCR) for placing FGD OWS in main plant CCR.
42.	SECTION – VI, PART-E	Tender drawing		5 of 53 (of PDF) 6 of 53 (of PDF)	Tender drawing no. 0011-109-POM-A-001(a): Scheme of FGD Absorber system (Single unit) Tender drawing no. 0011-109-POM-A-001: Scheme of FGD Absorber system (For two units)	NOTE 13 and 17 deleted NOTE 13 and 17 deleted

AMENDMENT NO. 5 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. NO.	SPECIFICATION REFERENCE				EXISTING	READ AS
	SEC/ PART	SUB SEC.	PAGE NO.	CLAUSE NO.		
					intermediate levels could vary between 45 and 105 meters. The intermediate lights shall be spaced as equally as possible. Aviation obstruction lighting shall be complete with lights, photo cell, controller, special cables, etc.	lowest level should not be lower than 45 meters above the ground and vertical spacing of the intermediate levels could vary between 45 and 105 meters. The intermediate lights shall be spaced as equally as possible. Aviation obstruction lighting shall be complete with lights, photo cell, controller, special cables, etc.
35.	Section VI / Part B	Sub-Section -IV-D Civil Works	2.00.00	1 of 69	"Sub QR for civil works:"	**" Clause Deleted"**
36.	VI/B	Sub-section IVD Civil Works	1.02.00	01 of 69	The specifications are intended for the general description of the work.....in writing with the Employer in respect of interpretation of any portions of this document.	The specifications are intended for the general description of the work, quality and workmanship. The specifications are not, however, intended to cover minutest details and the work shall be executed according to the relevant latest Indian Standard Codes / I. R. S. / I. R. C. specifications. **Where provisions are not covered in Indian Standards, reference shall be made to ACI, AISC, ASCE, EN, CICIND and other international standards or to the best prevailing local Public Works Department practices or to the instructions of the Engineer.** Some of the relevant I. S. Codes to be followed

AMENDMENT NO. 5 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. NO.	SPECIFICATION REFERENCE				EXISTING	READ AS
	SEC/ PART	SUB SEC.	PAGE NO.	CLAUSE NO.		
						are mentioned in the Technical Specifications. The Contractor is expected to get clarified on any doubts about the specifications, etc. before bidding, in writing with the Employer in respect of interpretation of any portions of this document.
37.	VI/A	II-A1/A3/A4/A5/A6/A7/A9/A11 Project Information	5.00.00		SITE SPECIFIC SEISMIC PARAMETERS FOR DESIGN OF STRUCTURES AND EQUIPMENT	**"SITE SPECIFIC SEISMIC PARAMETERS FOR DESIGN OF STRUCTURES AND EQUIPMENT"** given in **"Civil Annexure-1"** to this amendment shall replace the **"SITE SPECIFIC SEISMIC PARAMETERS FOR DESIGN OF STRUCTURES AND EQUIPMENT"** at **Clause 5.00.00, Sub-section-II- A1/ A3/A4/A5/A6/A7/A9/A11, Part-A, Sec-VI, of Tech. Specification.**
38.	Amendment No.03. to Technical specification (Section-VI) (Amendment No. CS-0011-109(1A)-2-AMDT-03(T)) Sl.No. 13, Page-8 of 102				"SITE SPECIFIC SEISMIC PARAMETERS FOR DESIGN OF STRUCTURES AND EQUIPMENT" of Lara STPP Project	**"SITE SPECIFIC SEISMIC PARAMETERS FOR DESIGN OF STRUCTURES AND EQUIPMENT"** of Lara STPP Project given in **"Civil Annexure-2"** to this amendment shall replace the **"SITE SPECIFIC SEISMIC PARAMETERS FOR DESIGN OF STRUCTURES AND EQUIPMENT"** Amendment No.03. to Technical specification (Section-VI) (Amendment No. CS-0011-109(1A)-2-AMDT-03(T)), Sl.No. 13, Page-8 of 102

AMENDMENT NO. 5 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. NO.	SPECIFICATION REFERENCE				EXISTING	READ AS
	SEC/ PART	SUB SEC.	PAGE NO.	CLAUSE NO.		
39.	Amendment No.03. to Technical specification (Section-VI) (Amendment No. CS-0011-109(1A)-2-AMDT-03(T)) Sl.No. 14, Page-8 of 102				"SITE SPECIFIC SEISMIC PARAMETERS FOR DESIGN OF STRUCTURES AND EQUIPMENT" of Barh STPP Project	**"SITE SPECIFIC SEISMIC PARAMETERS FOR DESIGN OF STRUCTURES AND EQUIPMENT"** of Barh STPP Project given in **"Civil Annexure-3"** to this amendment shall replace the **"SITE SPECIFIC SEISMIC PARAMETERS FOR DESIGN OF STRUCTURES AND EQUIPMENT"** at Amendment No.03. to Technical specification (Section-VI) (Amendment No. CS-0011-109(1A)-2-AMDT-03(T)), Sl.No. 14, Page-8 of 102
40.	Errata No.01 to Technical specifications, Section-VI (Doc. No.:CS-0011-109(1A)-2-ERRATA-01)				"SITE SPECIFIC SEISMIC PARAMETERS FOR DESIGN OF STRUCTURES AND EQUIPMENT" of Nabinagar STPP Project (3x660MW)	**"SITE SPECIFIC SEISMIC PARAMETERS FOR DESIGN OF STRUCTURES AND EQUIPMENT"** of Nabinagar STPP (3x660MW) Project given in **"Civil Annexure-4"** to this amendment shall replace the **"SITE SPECIFIC SEISMIC PARAMETERS FOR DESIGN OF STRUCTURES AND EQUIPMENT"** at Errata No.01 to Technical specification (Doc. No.:CS-0011-109(1A)-2-ERRATA-01).

AMENDMENT NO. 5 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. NO.	SPECIFICATION REFERENCE				EXISTING	READ AS
	SEC/ PART	SUB SEC.	PAGE NO.	CLAUSE NO.		
41.	Section VI / Part B	Sub-Section-IV-D Civil Works	17.01.00	35 of 69	Design of steel structures shall be done by working stress method. Design shall be as per provisions of IS:800:1984.	Design of steel structures shall be done as per provisions of IS:800: 2007 (Limit state design) and other relevant IS standards.
42.	Section VI / Part B	Sub-Section-IV-D Civil Works	17.26.00	38 of 69	-	For industrial structures, analysis for verification of mechanism shall be carried out as per IS:1893 (Part 4):2015 for Earthquake loads.
43.	Section VI / Part B	Sub-Section-IV-D Civil Works	17.27.00	38 of 69	-	Design drawings of steel structures shall include the connection, joint & fastener details for Main columns, Beams & Bracings.
44.	VI/A	IIA2	BORE LOG	Page:23 to 39 of 48	BH No.53,54,55,57,58,60,163,164	**"Bore Logs"** given in **"Civil Annexure-5"** to this amendment shall replace the contents of **Bore Logs, Page 23 to 39 of 48,** Sub-section- II-A2, Part-A Sec-VI, of Tech. Specification.
45.	VI/B	IV-D	3.01.00(a)	4 of 69	--------	**New Clause:** **Limestone Storage Silo** The supporting structure for silo shall be of structural steel. Independent supporting structure shall be provided for each silo.
46.	Amendment No. 03 to technical specification (Section-VI) Sl. No. 02, Page 2 of 102				Single-flue chimney(s) shall be provided. Chimney shall be of reinforced concrete construction. There shall be one flue (liner) for	Single-flue chimney(s) shall be provided, **except for Tanda TPP (2X660MW) and Meja TPP (2X660MW) where twin-flue**

SL. NO.	SPECIFICATION REFERENCE				EXISTING	READ AS
	SEC/ PART	SUB SEC.	PAGE NO.	CLAUSE NO.		
					each unit. The flue gas emission point shall be minimum 150 meters above the plant grade level. **The centre to centre distance between the proposed chimney(s) and the existing chimney(s) in any direction shall not be less than 150 metres.**	**Chimney shall be provided.** Chimney shall be of reinforced concrete construction. There shall be one flue (liner) for each unit. **The flue gas emission point for single flue chimney** shall be minimum 150 meters above the plant grade level **and for twin flue chimney flue gas emission point shall be minimum 220m above the plant grade level.** The centre to centre distance between the proposed chimney(s) and the existing chimney(s) in any direction shall not be less than 150 metres. **For Barh-I (3X660MW) already existing 275m high chimneys shall be utilized with modifications as specified elsewhere in mechanical specification and hence, new chimney is not to be provided under FGD package**. **General Arrangement Drawing of already existing Chimneys at Barh-I are provided in Sub Section-II -A10, Part A, Section-VI for reference.**
47.	VI/B	IV-D	3.14.01 Para 3	11 of 69	The flue duct outside the chimney shall be suitably connected to the flue liner inside the chimney through a transition duct. The transition duct **shall be bottom supported and** shall be profiled into a circular shape to connect to the	The flue duct outside the chimney shall be suitably connected to the flue liner inside the chimney through a transition duct. The transition duct shall be profiled into a circular shape to connect to the flue liner. The flue

SL. NO.	SPECIFICATION REFERENCE				EXISTING	READ AS
	SEC/ PART	SUB SEC.	PAGE NO.	CLAUSE NO.		
					flue liner. The flue duct shall be so designed that no load is transferred on the chimney shell due to the duct. The interface between the flue liner and the transition ducting shall be provided with non-metallic **fluroelastomeric fabric** expansion joint.	duct shall be so designed that no load is transferred on the chimney shell due to the duct. The interface between the flue liner and the transition ducting shall be provided with non-metallic expansion joint.
48.	VI/B	IV-D	3.14.01 Para 4	11 of 69	The expansion joint in the flue liner shall comprise of non-metallic **fluoroelastomeric** material suitable **to withstand a temperature of 300 Deg C**, shall be acid resistant to withstand acidic flue gas condensates arising out of flue gas parameters & operating conditions as specified elsewhere in the specification and shall also prevent dust accumulation. The space between the expansion joint material and the liner shall be packed and sealed by providing a bolster made up of light weight compressible material suitable **to withstand a temperature of 300 Deg C** and acid resistant to withstand acidic flue gas condensates arising out of flue gas parameters & operating conditions as specified elsewhere in the specification. The bolster shall be confined in texturized glass fabric having a final covering of stainless steel wire mesh.	The expansion joint in the flue liner shall comprise of non-metallic material suitable **for wet stack operations,** shall be acid resistant to withstand acidic flue gas condensates arising out of flue gas parameters & operating conditions as specified elsewhere in the specification and shall also prevent dust accumulation. The space between the expansion joint material and the liner shall be packed and sealed by providing a bolster made up of light weight compressible material suitable **for wet stack operations** and acid resistant to withstand acidic flue gas condensates arising out of flue gas parameters & operating conditions as specified elsewhere in the specification. The bolster shall be confined in texturized glass fabric having a final covering of stainless steel wire mesh. Design of expansion joint shall comply EPRI guideline to avoid contact of condensate with expansion joint material and to ensure drainage of condensate.
49.	VI/B	IV-D	3.14.01 Para 5	11 of 69	Chimney roof shall be of RCC slab over a grid of structural steel beams and provided with rainwater drainage system. An internal structural steel staircase supported from chimney shell	Chimney roof shall be of RCC slab over a grid of structural steel beams and provided with rainwater drainage system. An internal structural steel staircase supported from

SL. NO.	SPECIFICATION REFERENCE				EXISTING	READ AS
	SEC/ PART	SUB SEC.	PAGE NO.	CLAUSE NO.		
					with chequered plate floor panels and pipe handrails, shall be provided **for full height of the chimney** and an internal cage ladder for a small height, over last staircase landing to access the chimney roof through a roof access hatch.	chimney shell with chequered plate floor panels and pipe handrails, shall be provided **upto the platform just below roof platform** and an internal cage ladder for a small height, over last staircase landing to access the chimney roof through a roof access hatch.
50.	VI/B	IV-D	3.14.01 Para 6	11 of 69	The other components of the chimney include liner test ports (for continuous pollution monitoring), liner hatches, grade level slab of RCC with metallic hardener floor finish, acid resistant treatment on roof slab, a large electrically operated grill type roll-up door and personnel access metallic door at grade level, roof drain basin, rain water down comer pipe (150 mm diameter galvanized pipe), connection to plant drains, louvers with bird screens for ventilation and all other openings in the wind shield, **mild steel wind strakes (if required),** all finishing works, electrical power distribution boards, lighting panels, power & control cabling and wiring systems, stair and platforms lighting, socket outlet, lightning protection and grounding system, aviation obstruction lighting with photoelectric controller etc, communication system, a rack and pinion elevator and other items, though not specifically mentioned but reasonably implied and necessary to complete the job in all respects.	The other components of the chimney include liner test ports (for continuous pollution monitoring), liner hatches, grade level slab of RCC with metallic hardener floor finish, acid resistant treatment on roof slab, a large electrically operated grill type roll-up door and personnel access metallic door at grade level, roof drain basin, rain water down comer pipe (150 mm diameter galvanized pipe), connection to plant drains, louvers with bird screens for ventilation and all other openings in the wind shield, all finishing works, electrical power distribution boards, lighting panels, power & control cabling and wiring systems, stair and platforms lighting, socket outlet, lightning protection and grounding system, aviation obstruction lighting with photoelectric controller etc, communication system, a rack and pinion elevator and other items, though not specifically mentioned but

AMENDMENT NO. 5 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. NO.	SPECIFICATION REFERENCE				EXISTING	READ AS
	SEC/ PART	SUB SEC.	PAGE NO.	CLAUSE NO.		
						reasonably implied and necessary to complete the job in all respects.
51.	VI/B	IV-D	3.14.02 Para 7	12 of 69	The chimney and its components shall be designed to resist the most onerous forces resulting from all the possible combinations of the various loadings. **Design of all chimney components shall be based on working stress method.**	The chimney and its components shall be designed to resist the most onerous forces resulting from all the possible combinations of the various loadings.
52.	VI/B	IV-D	3.14.03 Para 1	12 of 69	The wind shield shall be designed for vertical loading, cross wind loading, seismic loading, circumferential wind loading, thermal gradients etc. The **load calculation and load combinations** shall be as detailed in IS 4998 **(Part 1) : 1992**. The wind shield shall be analysed for cases with and without flue liner loads.	The wind shield shall be designed for vertical loading, cross wind loading, seismic loading, circumferential wind loading, thermal gradients etc. The **analysis and design of wind shield shall be carried out as per IS 4998**. The wind shield shall be analysed for cases with and without flue liner loads.
53.	VI/B	IV-D	3.14.03 Para 2	12 of 69	Forces/stresses in the wind shield due to eccentricity effects of local **(e.g. corbel)** loadings, insolations effects, rotation of chimney foundations, construction tolerances and moments of second order shall also be considered.	Forces/stresses in the wind shield due to eccentricity effects of local loadings, insolations effects, rotation of chimney foundations, construction tolerances and moments of second order shall also be considered.
54.	VI/B	IV-D	3.14.03 Para 6	12 of 69	The stresses for the shell design shall not exceed the limits given in Cl. 7.0 of IS:4998 (PART-I) 1975 for various combinations of loads, excepting the stress in concrete for the case of dead load + wind load which shall not	DELETED

AMENDMENT NO. 5 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. NO.	SPECIFICATION REFERENCE				EXISTING	READ AS
	SEC/ PART	SUB SEC.	PAGE NO.	CLAUSE NO.		
					exceed 0.30fck where fck is the characteristic compressive strength of concrete.	
55.	VI/B	IV-D	3.14.03 Para 9	13 of 69	There shall not be any reverse (outward) slope in the inside face of chimney shell. Where there is a **sudden** change in slope/ profile of the shell, the circumferential reinforcement shall be increased to twice the requirement as per the design in a circumferential band extending atleast 3m above and below such slope/profile change level.	There shall not be any reverse (outward) slope in the inside face of chimney shell. Where there is a change in slope/ profile of the shell, the circumferential reinforcement shall be increased to twice the requirement as per the design in a circumferential band extending atleast 3m above and below such slope/profile change level.
56.	VI/B	IV-D	3.14.03 Para 14	13 of 69	The final design shall be checked & verified by 'Wind Tunnel Test' and shall be conducted at a reputed institution. Dynamic interference effects due to additional chimney(s)/NDCTS's and other tall structures located in the area or in the future expansion stage of the project shall be determined along with the other topographical features of the local area through model test.	The final design shall be checked & verified by 'Wind Tunnel Test' conducted at a reputed institution. Dynamic interference effects due to additional chimney(s)/NDCTS's and other tall structures located **upto distance of 20 times diameter at 2/3rd height of subject chimney,** in the area or in the future expansion stage of the project**, as envisaged by the owner at the time testing,** shall be determined along with the other topographical features of the local area through model test.
57.	VI/B	IV-D	3.14.04 Para 5	13 of 69	Clean-out door shall be provided below the flue for the removal of ash.	DELETED

AMENDMENT NO. 5 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. NO.	SPECIFICATION REFERENCE				EXISTING	READ AS
	SEC/ PART	SUB SEC.	PAGE NO.	CLAUSE NO.		
58.	VI/B	IV-D	3.14.07 Para 5	14 of 69	The chimney foundation shall be designed for the most critical combination of forces and moments, resulting from all possible combinations of the various loadings from the chimney system during all stages of constructions. The effect of water table shall be considered and the foundation shall be checked for overturning for minimum and maximum vertical loads. There should be no uplift under any portion of the foundation for any loading condition. Since chimney is a wind sensitive structure no allowance shall be made in the load carrying capacity of the bearing strata / piles under any load case/combination with wind. **No allowance shall be made in the stresses for design of foundation for wind loading.** The foundation diameter to depth ratio shall be maintained to around 10 and should preferably not exceed 12. The diameter of the reinforcing bar for the main radial and tangential reinforcement for the foundation shall not be less than 25mm. The spacing of radial steel at the outer edge of the foundation shall not be more than 250mm. Grade of concrete for foundation shall be minimum **M 25**.	The chimney foundation shall be designed **as per limit state method as per IS 4998** for the most critical combination of forces and moments, resulting from all possible combinations of the various loadings from the chimney system during all stages of constructions. The effect of water table shall be considered and the foundation shall be checked for overturning for minimum and maximum vertical loads. There should be no uplift under any portion of the foundation/**piles** for any loading condition. Since chimney is a wind sensitive structure, no allowance shall be made in the load carrying capacity of the bearing strata / piles under any load case/combination with wind. The foundation diameter to depth ratio shall be maintained to around 10 and should preferably not exceed 12. The diameter of the reinforcing bar for the main radial and tangential reinforcement for the foundation shall not be less than 25mm. The spacing of radial steel at the outer edge of the foundation shall not be more than 250mm. Grade of concrete for foundation shall be minimum **M 30**.
59.	VI/B	IV-D	3.14.08 Para 2	14 of 69	The insulation thickness shall be determined based on the maximum/minimum ambient	DELETED

SL. NO.	SPECIFICATION REFERENCE				EXISTING	READ AS
	SEC/ PART	SUB SEC.	PAGE NO.	CLAUSE NO.		
					temperature, surface air velocity worked out based on the draught of ventilation air in the annular space between the flue liner and chimney shell, insulation surface emissivity of 0.3 and the insulation cold face maximum temperature not exceeding 55 degree Celsius. The draught of air in the annular space shall be the natural draught created by the heating of air by the flue liner and the air being vented out through the openings in the chimney shell. The increase in the annulus air temperature due to the rising heated air shall be taken into account while calculating the insulation thickness.	
60.	VI/B	IV-D	3.14.09 (i)	15 of 69	All exposed steel surfaces (including exterior surface of mild steel flue liner in case the design does not envisage provision of thermal insulation on the exterior surface of flue liner) **except surfaces of steel wind strakes** shall be painted as specified in corrosion protection clause of this specification.	All exposed steel surfaces (including exterior surface of mild steel flue liner in case the design does not envisage provision of thermal insulation on the exterior surface of flue liner) shall be painted as specified in corrosion protection clause of this specification.
61.	VI/B	IV-D	3.14.09 (ii)	15 of 69	All exposed surfaces of steel wind strakes shall be painted with epoxy phenolic coating system having total 240 microns DFT. a) All steel surfaces shall be provided with two component epoxy primer coat (having solid by volume minimum 51% ±2%) of minimum 70 micron DFT to be applied over blast cleaned surface conforming to Sa 2½ finish of ISO 8501-1 with surface profile 40-60 Micron. The primer	DELETED

AMENDMENT NO. 5 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. NO.	SPECIFICATION REFERENCE				EXISTING	READ AS
	SEC/ PART	SUB SEC.	PAGE NO.	CLAUSE NO.		
					coat shall be applied in shop immediately after blast cleaning by airless spray technique. b) Primer coat shall be followed with the application of Intermediate coat of epoxy phenolic coating (solid by volume minimum 63%) of minimum 100 micron DFT. This coat shall be applied in shop after an interval of minimum 24 hours (from the application of primer coat) by airless spray technique. c) Intermediate coat shall be followed with the application of finish coat of two-pack aliphatic Isocyanate cured acrylic finish paint (solid by volume minimum 55% ±2%) with Gloss retention (SSPC Paint Spec No 36, ASTM D 4587, D 2244, D 523) of Level 2 (after minimum 1000 hours exposure, Gloss loss less than 30 and colour change less than 2.0 ΔE) and minimum 70 micron DFT. This coat shall be applied in shop after an interval of minimum 10 hours and within six (6) months (from the completion of Intermediate coat), Colour and shade of the coat shall be as approved by the Employer.	
62.	VI/B	IV-D	3.14.09 (iii)	15 of 69	All steel parts embedded in concrete like **Strake embedment assembly including** bolts, nuts, washers, pipe sleeves and insert plate shall be galvanized as per IS:4736. The minimum weight for galvanizing shall be 610 g/sq.m and shall comply with relevant IS Codes.	All steel parts embedded in concrete like bolts, nuts, washers, pipe sleeves and insert plate shall be galvanized as per IS:4736. The minimum weight for galvanizing shall be 610 g/sq.m and shall comply with relevant IS Codes.

AMENDMENT NO. 5 TO TECHNICAL SPECIFICATION (SECTION VI)

SL. NO.	SPECIFICATION REFERENCE				EXISTING	READ AS
	SEC/ PART	SUB SEC.	PAGE NO.	CLAUSE NO.		
						(iv) ……
129.	VI	I-M1	8 of 51	4.01.01 3(iii)	Pressure at Booster Fan suction | 0 mmWc	Pressure at terminal point before Booster Fan suction | 0 mmWc
130.	VI/B	I-M1	27 of 51	7.07.05	The secondary wastewater underflow shall be taken to the adequately sized filtrate tank, while the overflow shall be taken to a wastewater tank.	The secondary wastewater underflow shall be taken to the adequately sized filtrate tank while the overflow shall be taken to a wastewater tank. **In case Bidder opts to provide additionally Lamella separator before the waste water tank and after the secondary hydro cyclone for removing impurities from the system, the solids concentration in waste water up to max 10% can be acceptable .However, the required moisture content in Gypsum & required Gypsum quality shall be complied.**
131.					ZLD envisaged for Barh (3x660 MW) & BRBCL (4x250MW)	**ZLD stands deleted for both these projects (Barh-I (3x660 MW) & BRBCL (4x250MW)). Accordingly, all clauses and Drgs indicated in the specification pertaining to ZLD will not be applicable and clauses and drgs indicated in the**

SL. NO.	SPECIFICATION REFERENCE				EXISTING	READ AS
	SEC/ PART	SUB SEC.	PAGE NO.	CLAUSE NO.		
						specification related Wastewater treatment system shall be applicable to these two projects also.
132.	VI/A	IV	2 of 3	1.08.00	**Waste Water** FGD waste water pipes shall terminate along with isolation valve at 5 Meters near HCSD Mixing Tank , and 300 mm above FFL in HCSD Silo Area. Pressure at terminal point shall be 3.0 kg/cm2(g) , pH shall be 7.0 (approx.) and temperature shall be <50°C.	**Waste Water** FGD waste water pipes shall terminate along with isolation valve at 5 Meters near HCSD Mixing Tank , and 300 mm above FFL in HCSD Silo Area. Pressure at terminal point shall be 3.0 kg/cm2(g) , pH shall be 7.0 (approx.) and temperature shall be <50-60°C. **For (Barh-I (3x660 MW) & BRBCL (4x250MW):-** **FGD waste water pipes shall terminate along with isolation valve ash slurry sump. PH shall be 7.0 (approx.) and temperature shall be <50-60°C at terminal point.**
133.	VI/A	VII	1 of 61	1.01.00 a)	The list of mandatory spares considered essential by the Employer is indicated in the list enclosed to this Sub-Section. The bidder shall indicate the prices for each and every item (except for items not applicable to the bidders design) in the 'Schedule of Mandatory Spares' whether or not he considers it necessary for the Employer to have such spares. If the bidder fails to comply with the above or fails to quote the price of any spare item, the cost of such spares	The list of mandatory spares considered essential by the Employer is indicated in the list enclosed to this Sub-Section. The bidder shall indicate the prices for each and every item (except for items not applicable to the bidders design) in the 'Schedule of Mandatory Spares' whether or not he considers it necessary for the Employer to have such spares. If the bidder fails to comply with the above or fails to quote the

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
13.	PART-A	III-A5	1 OF 6	1.01.00	Based on site visit, bidder shall submit layout for Limestone handling plant & Gypsum handling facilities along with their techno-commercial bid. Bidder shall bring out all necessary modification and relocation of existing facilities, if required, along with proposed Layout submitted with the bid	We understand any modification and relocation is not in the scope of this package. Please confirm	All required modification and demolition work of existing facilities shall be in the bidder's scope. However if any relocation of existing facility is required, the same shall be done by the employer.
14.	PART-A	III-A5	2 OF 6	2.01.01	Based on site visit, bidder shall submit layout for Limestone handling plant & Gypsum handling facilities along with their techno-commercial bid. Bidder shall bring out all necessary modification and relocation of existing facilities, if required, along with proposed Layout submitted with the bid	Request customer to furnish the drawings of the existing facilities to study the modification required in the existing facility.	Bidder shall refer the GLP drawing attached with the tender documents and shall also visit the site to study existing facilities that require modification.
15.	PART-B	IV-D	23 OF 69	5.07.00	Polycarbonate sheet of 3 mm thick….	We propose to use 2 mm thick polycarbonate sheets. Please confirm.	Bidder shall comply with technical specification requirement

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
16.	PART-B	IV-D	30 OF 69	11.00.00	Fencing around lime storage/ gypsum storage area.	We do not understand the requirement of any fencing in these areas. Kindly review the requirement and confirm.	Refer Scope of work. Refer clause 2.00.00, Section-VI, Part-A of technical specification.
17.	PART-B	IV-D	8 OF 69	3.07.00	Gypsum storage shed- Gypsum storage shed shall be of RCC –framed structure with steel structure framed structure-----	Details specified for gypsum storage shed is not clear. Please furnish the detail specification for the gypsum storage shed. We propose to use space frame structure with bolted joints. Please confirm.	Bidder to refer amendment in this regard.
18.	PART-A	III-A5	3 0F6	2.01.07	Crushed limestone reclaim hopper(RH silo)Machinery hatch---	Please furnish the detail specification for the lime stone storage shed. We propose to use space frame structure with bolted joints. Please confirm.	Bidder to refer necessary amendment in this regard.
19.	PART-A	III-A5	3 0F6	2.01.10	Suitable no. of motorized travelling tripper /flow diverter----feeding the crushed limestone to limestone shed	We understand that intermediate supporting trestle can be provided for the supporting of tripper conveyor gallery inside lime stone shed. Please confirm.	Confirmed. However adequate space for movement of dozer/payloader shall be provided.
20.	PART-A	III-A5	60F6	3.06.00	Suitable no. of motorized travelling tripper /flow divert-	We understand that intermediate supporting trestle can be provided	Confirmed. However adequate space for movement of doz-

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
					er----feeding the gypsum to gypsum shed.	for the supporting of tripper conveyor gallery inside gypsum shed. Please confirm.	er/payloader shall be provided.
21.	PART-B	IV-D	8 OF 69	3.07.00	Gypsum storage shed- Gypsum storage shed shall be of RCC –framed structure with steel structure framed structure-----	We understand that for the gypsum stock pile area no PCC/RCC paving is required. Only leveling and grading of gypsum stockpile area is needed.	Bidder to refer amendment in this regard.
22.	PART-A	III-A5	3 0F6	2.01.07	Crushed limestone reclaim hopper(RH silo)Machinery hatch---	We understand that no retaining wall and peripheral drain needed around lime stone stock pile and gypsum stock pile please confirm.	Bidder's understanding is not correct. Retaining wall and peripheral drain around lime stone stock pile and gypsum stock pile along with suitable entry point for dozer entry with ramp need to be provided by the successful bidder.
BARH							
23.	VI/PART-A	II-A10	1 OF 30	1.05.00	Railway siding.	We understand that work of railway siding is not in the scope of bidder. Kindly confirm our understanding is correct.	Bidders understanding is correct.
24.	VI/PART-A	II-A10	10 OF 30	7.01.00	FGL generally corresponds to RL 46.20M----------to achieve the FGL as indicated above.	Please furnish the topographical survey drawing and contour drawings of the site.	Bidder to refer amendment in this regard.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
25.	VI/PART-A	II-A10	10 OF 30	7.01.00	FGL generally corresponds to RL 46.20M----------to achieve the FGL as indicated above.	We understand that FGD area marked in plot plan is already levelled and graded and now no further leveling and grading is needed. Please confirm.	Site levelling shall be done by Owner as per the levels specified in GLP in tender document. Only site clearance and minor grading is in bidder's scope.
26.	VI/PART-A	II-A10	10 OF 30	7.03.00	The foundation system to be adopted for different structures shall be as given below--------	Please furnish the bore log details and drawings showing the locations of various bore logs.	Borelog have already furnished in the tender document. For, location of boreholes, co-ordinates indicated in borelog may be referred.
27.	Plot plan	-	-	9558/9560-999-POC-F-001/Rev. No.8-D0	ROAD AND DRAINS	Since FGD facilities are to be incorporated in the existing layout .Kindly furnish the road and drain layout for the present scope of work.	Kindly refer GLP of Barh project furnished with the tender document.
GADARWARA II							
28.	-	-	-	-	General layout plan	Kindly furnish the FGL to be adopted for the different systems/areas of FGD	FGL is indicated in GLP.
MOUDA II							
29.	-	-	-	-	General layout plan	Kindly furnish the FGL to be adopted for the different systems/areas of FGD	FGL is indicated in GLP.
NABINAGAR II							
30.	-	-	-	-	General layout plan	Kindly furnish the FGL to be adopted for the different systems/areas of FGD	FGL is indicated in GLP.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
SOLAPUR							
31.	-	-	-	-	Geo- technical investigation Report	Kindly furnish geo technical report along with the Recommended SBC and foundation system to be adopted.	The geotechnical investigation report for the vicinity area will be made available for the Bidder's study at the Owner's office. However, for borelog data, bidder may refer Amendment .
32.	-	-	-	-	General layout plan	Kindly furnish the FGL to be adopted for the different systems/areas of FGD	FGL is indicated in GLP.
BRBCL							
33.	VI/PART-A	II-A11	3 OF 29	3.00.00	Railway siding.	We understand that work of railway siding is not in the scope of bidder. Kindly confirm our understanding is correct.	Bidders understanding is correct.
34.	VI/PART-A	II-A10	12 OF 29	7.02.01	General Requirement	Please furnish FGL to be considered in FGD area.	FGL is indicated in GLP.
35.	VI/PART-A	II-A10	11 OF 29	7.03.00	Geo technical data and foundation system for the respective project are enclosed at Annexure-III .The corresponding bore logs are enclosed at at Annexure-IV.	Bore log details furnished in Annexure-IV are of ash handling area. Kindly furnish the bore log details of FGD area also.	Bidder may refer Clause No.7.00.02, as mentioned in Clause No. 7.00.02, the available borelog data is of vicinity to proposed structure and the same has already been furnished in the tender document for bidder's guidance. Detailed Geotechnical Investigation shall be carried out by contractor.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
36.	Plot plan		0270-999-POC-F-001(Rev.No .6)		ROAD AND DRAINS	Since FGD facilities are to be incorporated in the existing layout .Kindly furnish the road and drain layout for the present scope of work.	Refer General Layout Plan. Road and drain drawing shall be provided after award.
DARLIPALLI							
37.	VI/PART-A	II-A4	1 OF 30	1.02.00	The main plant---railway siding---	We understand that work of railway siding is not in the scope of bidder. Kindly confirm our understanding is correct.	Confirmed.
38.	VI/PART-A	Annexure-III	19 OF 30		Natural ground level is varying as per enclosed contour/spot level	Please furnish FGL to be considered in FGD area.	FGL is indicated in GLP.
39.	VI/PART-A	II-A10	10 OF 30	7.00.01	Geo technical data and foundation system for the respective project are enclosed at Annexure-III .The corresponding bore logs are enclosed at at Annexure-IV.	Kindly furnish annexure- IV as the same is not available with tender document.	Bidder to refer amendment in this regard.
40.	Plot plan		9549-999-POC-F-001		ROAD AND DRAINS	Since FGD facilities are to be incorporated in the existing layout .Kindly furnish the road and drain layout for the present scope of work.	Refer General Layout Plan. Road and drain drawing shall be provided after award.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
71.					Gypsum/ Byproduct : Gypsum Storage Yard for Wet FGD	Kindly furnish angle of repose for limestone & gypsum.	Angle of repose shall be considered as 38 deg for limestone and 35 deg for gypsum.
72.	SECTION-VI, PART-B,	SUB-SEC-TION-I-M6, LIME-STONE HAN-DLING PLANT	3.1.0	128 OF 274	A mechanised system shall be…..before limestone crusher.	Bidder is considering over ground truck tippler and dedicated lime-stone handling conveyor of capaci-ty 150 TPH till limestone crusher. Please confirm.	Confirmed. However for unloading through existing WT/Track Hopper, the minimum stream capacity shall be 1200 MTPH.
73.	SECTION-VI, PART-B,	SUB-SEC-TION-I-M6, LIME-STONE HAN-DLING PLANT	3.2.0	128 OF 274	"As received" limestone shall be ……up to limestone bunkers.	Bidder understands that the uncrushed limestone received from wagon tippler will be conveyed through existing coal conveyors and will be re-routed through new limestone conveyors till limestone crushers. After crushing, crushed limestone shall be conveyed to limestone storage shed. Please confirm.	Confirmed.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
74.	SECTION-VI, PART-B,	SUB-SEC-TION-I-M6, LIME-STONE HAN-DLING PLANT	3.3.0 & 4.12.3	129 OF 274 144 of 274	Crushing: "In limestone crusher house, limestone from each con-veyor shall pass through 2 nos crushers 7 screens……from either stream. Primary samplers ……rated conveyor capacity.	Bidder is considering 1X100% crusher in crusher house for each incoming stream. Please confirm. Based on our experience, screens are not required below the crush-ers. Crusher is designed to have final product size (-) 20mm. Hence we are not considering any screen equipment below the crushers. Please check and confirm.	Bidder shall comply the technical specifications.
75.	SECTION-VI, PART-B,	SUB-SEC-TION-I-M6, LIME-STONE HAN-DLING PLANT	3.4.0	129 OF 274	Crushed limestone shall be stored in cov-ered……junction towers and ploughs/fixed trippers.	Bidder understand that the crushed limestone (-20mm) shall be stored in a covered storage yard. However, use of travelling tripper and paddle feeders not under-stood. Please elaborate and review the requirement.	Travelling tripper has been envis-aged to distribute crushed lime-stone along the length of limestone storage shed. Paddle feeders are provided to re-claim the stored crushed limestone and feed it to the outgoing lime-stone conveyors to store limestone FGD usage point.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
76.	SECTION-VI, PART-B,	SUB-SEC-TION-I-M6, LIME-STONE HAN-DLING PLANT				Bidder request customer to specify the maximum lime stone and gyp-sum pile height to be considered to arrive the size of storage area and shed to make all the bidders at par.	Maximum pile height shall be de-cided considering the availability of space during detailed engineering.

CIVIL-MOUDA

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUB-SEC.	PAGE NO.	CLAUSE NO.			
77.	VI/A	III-D	2 of 4	1.06.00	Uniform Finished ground level (FGL) in FGD absorber area shall be made available by the owner at a level specified in tender drawing.	In tender drawings only space for FGD area is marked. No FGL is mentioned for FGD area blocks. Kindly clarify and furnish the same.	FGL is indicated in General Lay-out plan

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUB-SEC.	PAGE NO.	CLAUSE NO.			
78.	VI/B	IV-D	26 of 69	10.00.00	Site levelling of gypsum storage area, lime storage area, gypsum dewatering area, truck hopper and associated areas to be levelled in one block. Each block shall be finished to the formation level as specified in drawing…	In tender drawings only space for FGD area is marked. No FGL is mentioned for FGD area blocks. Kindly clarify and furnish the same.	FGL is indicated in General Lay-out plan
79.	VI/B	IV-D	31 of 69	14.00.00	Storm water drain shall be designed taking into account the finished ground levels of the plant area, drainage pattern, intensity of rainfall, etc. with a return period of 50 years. These values shall be based on rainfall intensity of 90mm/hr.	The referred clauses are contradictory. Kindly clarify the rainfall intensity to be considered for designing the plant storm water drain.	The value of minimum rainfall intensity shall be taken as 75mm/hr. Refer amendment issued separately.
80.	VI/B	IV-D	41 of 69	21.00.00	The plant storm water drainage shall be designed taking into account the finished grade levels of the plant area, drainage pattern, intensity of rainfall, etc., The storm water drainage shall cater to storm water run off resulting from one hour rainfall intensity, with a return period of 50 years. The value of minimum rainfall intensity shall be taken as 75mm/hr.		The value of minimum rainfall intensity shall be taken as 75mm/hr. Refer amendment issued separately.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUB-SEC.	PAGE NO.	CLAUSE NO.			
81.	VI/B	IV-D	24 of 69	7.00.00	In case Bidder opts for steel super-structure with RCC floors/ roof, the bidder shall necessarily use Troughed permanently colour coated metal decking sheets having minimum thickness of 0.8mm as permanent shuttering…	In case Bidder opts for steel super-structure with RCC floors/roof, kindly specify the cladding system to be adopted (Brick Cladding / Metal Sheet Cladding).	Type of cladding system if not specified in the technical Specification shall be decided by the bidder considering the functional requirement, schedule of construction and site constraints (if any).
82.	VI/B	IV-D	25 of 69	7.00.00	Passages shall be provided inside the FGD block connecting to the outer periphery road to have access to the various facilities/buildings… All facility buildings shall be provided with 750 mm wide plinth protection all around... An area of minimum 5 m width all around the tank foundations and other facility buildings shall be paved. This paving shall be beyond the extent of plinth protection…	(1) Within the FGD blocks, kindly specify whether the balance area (i.e. area excluding various facilities/buildings, passage areas, plinth protection to facility buildings, additional paving of 5m width all around the tank foundations and other facility buildings beyond the extent of plinth protection, etc.) is to be paved or left unpaved. (2) In case paving is required for the balance area, kindly specify the type of paving (Normal Duty paving/Heavy Duty paving) to be adopted.	Extent and type of paving in FGD block shall be in accordance with Technical specification. However, any functional requirement of paving for FGD facilities not specifically mentioned in technical specification is also in the scope of bidder.
83.	VI/B	IV-D	25 of 69	7.00.00	The paving shall be provided with slope of 1:500 to dispose the surface water/wash water to the nearest drain.		

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUB-SEC.	PAGE NO.	CLAUSE NO.			
84.	VI/A	II-A5	22 OF 40	Annexure-III, e)	The minimum pile length for each group of piles shall be determined based on the nearest bore log. A minimum embedment of 5.0 m and 6.0 m into strata with SPT 'N' greater than 50 for 600 mm dia pile and 760 mm dia pile respectively before termination and at pile termination minimum SPT 'N' shall be 60, while deciding the minimum length of pile. For pile termination, SPT 'N' values shall be used from the nearby bore log data.	The minimum length of pile shall be as per approved geotechnical investigation report during detailed engineering. Please confirm.	Bidder shall comply the provisions of technical specification.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUB-SEC.	PAGE NO.	CLAUSE NO.			
85.	VI/A	II-A5	14 OF 40	7.02.03 xv	High Strain Dynamic Load Test may be carried out for routine load testing of working piles. However, at least two numbers of static routine vertical load tests shall be carried out on pile on which high strain dynamic load test has already been carried out for establishing the correlation between the two tests. In case of discrepancy if any between dynamic and static vertical load tests, then additional static routine vertical load tests shall be conducted as decided by the Engineer and the results of static routine vertical load shall prevail. Number of routine vertical pile load tests as per clause 7.02.03 (ix) shall be total of static routine vertical load test and high strain dynamic load tests.	High strain dynamic load test is not required as static routine load test are being carried out in the piles. Please confirm.	Bidder to refer amendment in this regard.
86.	General	-	-	-	-	Lab test results of geotechnical investigation may please be furnished.	Bidder to refer amendment in this regard.

CIVIL-SOLAPUR

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUB-SEC.	PAGE NO.	CLAUSE NO.			
87.	VI/A	III-D	2 of 4	1.06.00	Uniform Finished ground level (FGL) in FGD absorber area shall be made available by the owner at a level specified in tender drawing.	In tender drawings only space for FGD area is marked. No FGL is mentioned for FGD area blocks. Kindly clarify and furnish the same.	FGL is indicated in General Layout plan
88.	VI/B	IV-D	26 of 69	10.00.00	Site leveling of gypsum storage area, lime storage area, gypsum dewatering area, truck hopper and associated areas to be levelled in one block. Each block shall be finished to the formation level as specified in drawing…	In tender drawings only space for FGD area is marked. No FGL is mentioned for FGD area blocks. Kindly clarify and furnish the same.	FGL is indicated in General Layout plan

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUB-SEC.	PAGE NO.	CLAUSE NO.			
89.	VI/B	IV-D	31 of 69	14.00.00	Storm water drain shall be designed taking into account the finished ground levels of the plant area, drainage pattern, intensity of rainfall, etc. with a return period of 50 years. These values shall be based on rainfall intensity of 90mm/hr.	The referred clauses are contradictory. Kindly clarify the rainfall intensity to be considered for designing the plant storm water drain.	The value of minimum rainfall intensity shall be taken as 75mm/hr. Refer amendment issued separately.
90.	VI/B	IV-D	41 of 69	21.00.00	The plant storm water drainage shall be designed taking into account the finished grade levels of the plant area, drainage pattern, intensity of rainfall, etc., The storm water drainage shall cater to storm water run off resulting from one hour rainfall intensity, with a return period of 50 years. The value of minimum rainfall intensity shall be taken as 75mm/hr.		The value of minimum rainfall intensity shall be taken as 75mm/hr. Refer amendment issued separately
91.	VI/B	IV-D	24 of 69	7.00.00	In case Bidder opts for steel superstructure with RCC floors/ roof, the bidder shall necessarily use Troughed permanently colour coated metal decking sheets having minimum thickness of 0.8mm as permanent shuttering…	In case Bidder opts for steel superstructure with RCC floors/roof, kindly specify the cladding system to be adopted (Brick Cladding / Metal Sheet Cladding).	Refer Sl. No.81

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUB-SEC.	PAGE NO.	CLAUSE NO.			
92.	VI/B	IV-D	25 of 69	7.00.00	Passages shall be provided inside the FGD block connecting to the outer periphery road to have access to the various facilities/buildings... All facility buildings shall be provided with 750 mm wide plinth protection all around... An area of minimum 5 m width all around the tank foundations and other facility buildings shall be paved. This paving shall be beyond the extent of plinth protection…	(1) Within the FGD blocks, kindly specify whether the balance area (i.e. area excluding various facilities/buildings, passage areas, plinth protection to facility buildings, additional paving of 5m width all around the tank foundations and other facility buildings beyond the extent of plinth protection, etc.) is to be paved or left unpaved. (2) In case paving is required for the balance area, kindly specify the type of paving (Normal Duty paving/Heavy Duty paving) to be adopted.	Refer Sl. No.82
93.	VI/B	IV-D	25 of 69	7.00.00	The paving shall be provided with slope of 1:500 to dispose the surface water/wash water to the nearest drain.		
94.	VI/A	II-A6	9 of 31	7.00.01	Geotechnical data and foundation system for the respective project are enclosed at annexure-III. The corresponding bore logs are enclosed at annexure-IV.	Annexure-IV is not available in the specification. Please provide the same.	Bidder to refer amendment in this regard.

CIVIL-MEJA

SL.	ENQUIRY SPECIFICATION	SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS

NO	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
95.	VI/A	III-D	2 of 4	1.06.00	Uniform Finished ground level (FGL) in FGD absorber area shall be made available by the owner at a level specified in tender drawing.	In tender drawings only space for FGD area is marked. No FGL is mentioned for FGD area blocks. Kindly clarify and furnish the same.	FGL is indicated in General Layout plan
96.	VI/B	IV-D	26 of 69	10.00.00	Site leveling of gypsum storage area, lime storage area, gypsum dewatering area, truck hopper and associated areas to be levelled in one block. Each block shall be finished to the formation level as specified in drawing…	In tender drawings only space for FGD area is marked. No FGL is mentioned for FGD area blocks. Kindly clarify and furnish the same.	FGL is indicated in General Layout plan
97.	VI/B	IV-D	31 of 69	14.00.00	Storm water drain shall be designed taking into account the finished ground levels of the plant area, drainage pattern, intensity of rainfall, etc. with a return period of 50 years. These values shall be based on rainfall intensity of 90mm/hr.	The referred clauses are contradictory. Kindly clarify the rainfall intensity to be considered for designing the plant storm water drain.	The value of minimum rainfall intensity shall be taken as 75mm/hr. Refer amendment issued separately.
98.	VI/B	IV-D	41 of 69	21.00.00	The plant storm water drainage shall be designed taking into account the finished grade levels of the plant area, drainage pattern, intensity of rainfall, etc., The storm water drainage shall cater to storm water run off resulting from one hour rainfall intensity, with a return period of 50 years. The value of minimum rainfall intensity shall be taken as 75mm/hr.		The value of minimum rainfall intensity shall be taken as 75mm/hr. Refer amendment issued separately.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
99.	VI/B	IV-D	24 of 69	7.00.00	In case Bidder opts for steel super-structure with RCC floors/ roof, the bidder shall necessarily use Troughed permanently colour coated metal decking sheets having minimum thickness of 0.8mm as permanent shuttering…	In case Bidder opts for steel super-structure with RCC floors/roof, kindly specify the cladding system to be adopted (Brick Cladding / Metal Sheet Cladding).	Refer Sl. No. 81
100.	VI/B	IV-D	25 of 69	7.00.00	Passages shall be provided inside the FGD block connecting to the outer periphery road to have access to the various facilities/buildings... All facility buildings shall be provided with 750 mm wide plinth protection all around... An area of minimum 5 m width all around the tank foundations and other facility buildings shall be paved. This paving shall be beyond the extent of plinth protection…	(1) Within the FGD blocks, kindly specify whether the balance area (i.e. area excluding various facilities/buildings, passage areas, plinth protection to facility buildings, additional paving of 5m width all around the tank foundations and other facility buildings beyond the extent of plinth protection, etc.) is to be paved or left unpaved. (2) In case paving is required for the balance area, kindly specify the type of paving (Normal Duty paving/Heavy Duty paving) to be adopted.	Refer Sl.No.82
101.	VI/B	IV-D	25 of 69	7.00.00	The paving shall be provided with slope of 1:500 to dispose the surface water/wash water to the nearest drain.		Refer Sl.No.82

CIVIL-BARH

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
102.	VI/A	III-D	2 of 4	1.06.00	Uniform Finished ground level (FGL) in FGD absorber area shall be made available by the owner at a level specified in tender drawing.	In tender drawings only space for FGD area is marked. No FGL is mentioned for FGD area blocks. Kindly clarify and furnish the same.	FGL is indicated in General Layout plan
103.	VI/B	IV-D	26 of 69	10.00.00	Site leveling of gypsum storage area, lime storage area, gypsum dewatering area, truck hopper and associated areas to be levelled in one block. Each block shall be finished to the formation level as specified in drawing…	In tender drawings only space for FGD area is marked. No FGL is mentioned for FGD area blocks. Kindly clarify and furnish the same.	FGL is indicated in General Layout plan

CLARIFICATION No.01 (TECHNICAL)

Flue Gas Desulphurization (FGD) System Package for Lot 1A Projects

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
104.	VI/B	IV-D	31 of 69	14.00.00	Storm water drain shall be designed taking into account the finished ground levels of the plant area, drainage pattern, intensity of rainfall, etc. with a return period of 50 years. These values shall be based on rainfall intensity of 90mm/hr.	The referred clauses are contradictory. Kindly clarify the rainfall intensity to be considered for designing the plant storm water drain.	The value of minimum rainfall intensity shall be taken as 75mm/hr. Refer amendment issued separately.
105.	VI/B	IV-D	41 of 69	21.00.00	The plant storm water drainage shall be designed taking into account the finished grade levels of the plant area, drainage pattern, intensity of rainfall, etc., The storm water drainage shall cater to storm water run off resulting from one hour rainfall intensity, with a return period of 50 years. The value of minimum rainfall intensity shall be taken as 75mm/hr.		The value of minimum rainfall intensity shall be taken as 75mm/hr. Refer amendment issued separately.
106.	VI/B	IV-D	24 of 69	7.00.00	In case Bidder opts for steel superstructure with RCC floors/ roof, the bidder shall necessarily use Troughed permanently colour coated metal decking sheets having minimum thickness of 0.8mm as permanent shuttering…	In case Bidder opts for steel superstructure with RCC floors/roof, kindly specify the cladding system to be adopted (Brick Cladding / Metal Sheet Cladding).	Refer Sl.No.81

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
107.	VI/B	IV-D	25 of 69	7.00.00	Passages shall be provided inside the FGD block connecting to the outer periphery road to have access to the various facilities/buildings... All facility buildings shall be provided with 750 mm wide plinth protection all around... An area of minimum 5 m width all around the tank foundations and other facility buildings shall be paved. This paving shall be beyond the extent of plinth protection...	(1) Within the FGD blocks, kindly specify whether the balance area (i.e. area excluding various facilities/buildings, passage areas, plinth protection to facility buildings, additional paving of 5m width all around the tank foundations and other facility buildings beyond the extent of plinth protection, etc.) is to be paved or left unpaved. (2) In case paving is required for the balance area, kindly specify the type of paving (Normal Duty paving/Heavy Duty paving) to be adopted.	Refer Sl.No.82
108.	VI/B	IV-D	25 of 69	7.00.00	The paving shall be provided with slope of 1:500 to dispose the surface water/wash water to the nearest drain.		
109.	VI/A	II-A10	10 OF 30	7.02.00	For excavation 6 metres below FGL, sheet piling shall be provided.	Any suitable slope protection works can be provided. Please confirm	Excavation may be carried out by using either sheet piling/ diaphragm wall/ secant piling/ contiguous piling or their combination. Bidder to refer amendment in this regard.
110.	General	-	-	-	-	Topographical survey details is not available in the specification. Please furnish the same.	Bidder to refer amendment in this regard.

CIVIL TANDA

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
111.	VI/A	III-D	2 of 4	1.06.00	Uniform Finished ground level (FGL) in FGD absorber area shall be made available by the owner at a level specified in tender drawing.	In tender drawings only space for FGD area is marked. No FGL is mentioned for FGD area blocks. Kindly clarify and furnish the same.	FGL is indicated in General Layout plan
112.	VI/B	IV-D	26 of 69	10.00.00	Site leveling of gypsum storage area, lime storage area, gypsum dewatering area, truck hopper and associated areas to be levelled in one block. Each block shall be finished to the formation level as specified in drawing…	In tender drawings only space for FGD area is marked. No FGL is mentioned for FGD area blocks. Kindly clarify and furnish the same.	FGL is indicated in General Layout plan
113.	VI/B	IV-D	31 of 69	14.00.00	Storm water drain shall be designed taking into account the finished ground levels of the plant area, drainage pattern, intensity of rainfall, etc. with a return period of 50 years. These values shall be based on rainfall intensity of 90mm/hr.	The referred clauses are contradictory. Kindly clarify the rainfall intensity to be considered for designing the plant storm water drain.	The value of minimum rainfall intensity shall be taken as 75mm/hr. Refer amendment issued separately.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
114.	VI/B	IV-D	41 of 69	21.00.00	The plant storm water drainage shall be designed taking into account the finished grade levels of the plant area, drainage pattern, intensity of rainfall, etc., The storm water drainage shall cater to storm water run off resulting from one hour rainfall intensity, with a return period of 50 years. The value of minimum rainfall intensity shall be taken as 75mm/hr.		The value of minimum rainfall intensity shall be taken as 75mm/hr. Refer amendment issued separately.
115.	VI/B	IV-D	24 of 69	7.00.00	In case Bidder opts for steel super-structure with RCC floors/ roof, the bidder shall necessarily use Troughed permanently colour coated metal decking sheets having minimum thickness of 0.8mm as permanent shuttering…	In case Bidder opts for steel super-structure with RCC floors/roof, kindly specify the cladding system to be adopted (Brick Cladding / Metal Sheet Cladding).	Refer Sl.No.81
116.	VI/B	IV-D	25 of 69	7.00.00	Passages shall be provided inside the FGD block connecting to the outer periphery road to have access to the various facilities/buildings... All facility buildings shall be provided with 750 mm wide plinth protection all around... An area of minimum 5 m width all around the tank foundations and other facility buildings shall be paved. This paving shall be beyond the extent of plinth protection…	(1) Within the FGD blocks, kindly specify whether the balance area (i.e. area excluding various facilities/buildings, passage areas, plinth protection to facility buildings, additional paving of 5m width all around the tank foundations and other facility buildings beyond the extent of plinth	Refer Sl.No.82

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
117.	VI/B	IV-D	25 of 69	7.00.00	The paving shall be provided with slope of 1:500 to dispose the surface water/wash water to the nearest drain.	protection, etc.) is to be paved or left unpaved. (2) In case paving is required for the balance area, kindly specify the type of paving (Normal Duty paving/Heavy Duty paving) to be adopted.	
118.	VI/A	II-A7	22 OF 33	Annexure-III, e)	The minimum pile length for each group of piles shall be determined based on the nearest bore log. A minimum embedment of 4.0m into the very dense sand strata with SPT 'N' value greater than 50 as observed in such bore log shall be ensured, while deciding the minimum length of pile. For pile termination, SPT 'N' values shall be used from the nearby bore log data.	The minimum length of pile shall be as per approved geotechnical investigation report during detailed engineering. Please confirm.	Bidder shall comply the provisions of technical specification.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
119.	VI/A	II-A7	14 OF 33	7.02.03 xv	High Strain Dynamic Load Test may be carried out for routine load testing of working piles. However, at least two numbers of static routine vertical load tests shall be carried out on pile on which high strain dynamic load test has already been carried out for establishing the correlation between the two tests. In case of discrepancy if any between dynamic and static vertical load tests, then additional static routine vertical load tests shall be conducted as decided by the Engineer and the results of static routine vertical load shall prevail. Number of routine vertical pile load tests as per clause 7.02.03 (ix) shall be total of static routine vertical load test and high strain dynamic load tests.	High strain dynamic load test is not required as static routine load test are being carried out in the piles. Please confirm.	Bidder may conduct either static routine load test or high strain dynamic load test. Bidder to refer amendment in this regard.
120.	General	-	-	-	-	Lab test results of geotechnical investigation may please be furnished.	Bidder to refer amendment in this regard.

CIVIL NPGCPL NABINAGAR

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUB-SEC.	PAGE NO.	CLAUSE NO.			
121.	VI/A	III-D	2 of 4	1.06.00	Uniform Finished ground level (FGL) in FGD absorber area shall be made available by the owner at a level specified in tender drawing.	In tender drawings only space for FGD area is marked. No FGL is mentioned for FGD area blocks. Kindly clarify and furnish the same.	FGL is indicated in General Layout plan
122.	VI/B	IV-D	26 of 69	10.00.00	Site leveling of gypsum storage area, lime storage area, gypsum dewatering area, truck hopper and associated areas to be levelled in one block. Each block shall be finished to the formation level as specified in drawing…	In tender drawings only space for FGD area is marked. No FGL is mentioned for FGD area blocks. Kindly clarify and furnish the same.	FGL is indicated in General Layout plan
123.	VI/B	IV-D	31 of 69	14.00.00	Storm water drain shall be designed taking into account the finished ground levels of the plant area, drainage pattern, intensity of rainfall, etc. with a return period of 50 years. These values shall be based on rainfall intensity of 90mm/hr.	The referred clauses are contradictory. Kindly clarify the rainfall intensity to be considered for designing the plant storm water drain.	The value of minimum rainfall intensity shall be taken as 75mm/hr. Refer amendment issued separately.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUB-SEC.	PAGE NO.	CLAUSE NO.			
124.	VI/B	IV-D	41 of 69	21.00.00	The plant storm water drainage shall be designed taking into account the finished grade levels of the plant area, drainage pattern, intensity of rainfall, etc., The storm water drainage shall cater to storm water run off resulting from one hour rainfall intensity, with a return period of 50 years. The value of minimum rainfall intensity shall be taken as 75mm/hr.		The value of minimum rainfall intensity shall be taken as 75mm/hr. Refer amendment issued separately.
125.	VI/B	IV-D	24 of 69	7.00.00	In case Bidder opts for steel super-structure with RCC floors/ roof, the bidder shall necessarily use Troughed permanently colour coated metal decking sheets having minimum thickness of 0.8mm as permanent shuttering…	In case Bidder opts for steel super-structure with RCC floors/roof, kindly specify the cladding system to be adopted (Brick Cladding / Metal Sheet Cladding).	Refer Sl.No.81

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUB-SEC.	PAGE NO.	CLAUSE NO.			
126.	VI/B	IV-D	25 of 69	7.00.00	Passages shall be provided inside the FGD block connecting to the outer periphery road to have access to the various facilities/buildings... All facility buildings shall be provided with 750 mm wide plinth protection all around... An area of minimum 5 m width all around the tank foundations and other facility buildings shall be paved. This paving shall be beyond the extent of plinth protection...	(1) Within the FGD blocks, kindly specify whether the balance area (i.e. area excluding various facilities/buildings, passage areas, plinth protection to facility buildings, additional paving of 5m width all around the tank foundations and other facility buildings beyond the extent of plinth protection, etc.) is to be paved or left unpaved. (2) In case paving is required for the balance area, kindly specify the type of paving (Normal Duty paving/Heavy Duty paving) to be adopted.	Refer Sl.No.82
127.	VI/B	IV-D	25 of 69	7.00.00	The paving shall be provided with slope of 1:500 to dispose the surface water/wash water to the nearest drain.		
128.	VI/A	II-A8	9 OF 31	ANNEXURE-B	a) The basic wind speed "Vb" at ten	Kindly specify the basic wind speed.	The basic wind speed "Vb" at 10m height above the mean ground level for "NABINAGAR-I 3X660 MW" project shall be 47 metres/second. Also refer Amendment issued separately in this regard.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUB-SEC.	PAGE NO.	CLAUSE NO.			
129.	VI/A	II-A8	21 OF 31	Annexure-III, e)	The minimum pile length for each group of piles shall be determined based on the nearest bore log. A minimum embedment of 4.0m into the very dense sand strata with SPT 'N' value greater than 40 as observed in such bore log shall be ensured, while deciding the minimum length of pile. For pile termination, SPT 'N' values shall be used from the nearby bore log data.	The minimum length of pile shall be as per approved geotechnical investigation report during detailed engineering. Please confirm.	Bidder shall comply the provisions of technical specification.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUB-SEC.	PAGE NO.	CLAUSE NO.			
130.	VI/A	II-A8	13 OF 31	7.02.03 xv	High Strain Dynamic Load Test may be carried out for routine load testing of working piles. However, at least two numbers of static routine vertical load tests shall be carried out on pile on which high strain dynamic load test has already been carried out for establishing the correlation between the two tests. In case of discrepancy if any between dynamic and static vertical load tests, then additional static routine vertical load tests shall be conducted as decided by the Engineer and the results of static routine vertical load shall prevail. Number of routine vertical pile load tests as per clause 7.02.03 (ix) shall be total of static routine vertical load test and high strain dynamic load tests.	High strain dynamic load test is not required as static routine load test are being carried out in the piles. Please confirm.	Bidder may conduct either static routine load test or high strain dynamic load test. Bidder to refer amendment in this regard.
131.	General	-	-	-	-	Lab test results of geotechnical investigation may please be furnished.	Bidder to refer amendment in this regard.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUB-SEC.	PAGE NO.	CLAUSE NO.			
132.	General	-	-	-	-	Topographical survey details is not available in the specification. Please furnish the same.	Bidder to refer amendment in this regard.

CIVIL BRBCL NABINAGAR

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
133.	VI/A	III-D	2 of 4	1.06.00	Uniform Finished ground level (FGL) in FGD absorber area shall be made available by the owner at a level specified in tender drawing.	In tender drawings only space for FGD area is marked. No FGL is mentioned for FGD area blocks. Kindly clarify and furnish the same.	FGL is indicated in General Layout plan
134.	VI/B	IV-D	26 of 69	10.00.00	Site leveling of gypsum storage area, lime storage area, gypsum dewatering area, truck hopper and associated areas to be levelled in one block. Each block shall be finished to the formation level as specified in drawing…	In tender drawings only space for FGD area is marked. No FGL is mentioned for FGD area blocks. Kindly clarify and furnish the same.	FGL is indicated in General Layout plan
135.	VI/B	IV-D	31 of 69	14.00.00	Storm water drain shall be designed taking into account the finished ground levels of the plant area, drainage pattern, intensity of rainfall, etc. with a return period of 50 years. These values shall be based on rainfall intensity of 90mm/hr.	The referred clauses are contradictory. Kindly clarify the rainfall intensity to be considered for designing the plant storm water drain.	The value of minimum rainfall intensity shall be taken as 75mm/hr. Refer amendment issued separately.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
136.	VI/B	IV-D	41 of 69	21.00.00	The plant storm water drainage shall be designed taking into account the finished grade levels of the plant area, drainage pattern, intensity of rainfall, etc., The storm water drainage shall cater to storm water run off resulting from one hour rainfall intensity, with a return period of 50 years. The value of minimum rainfall intensity shall be taken as 75mm/hr.		
137.	VI/B	IV-D	24 of 69	7.00.00	In case Bidder opts for steel super-structure with RCC floors/ roof, the bidder shall necessarily use Troughed permanently colour coated metal decking sheets having minimum thick-ness of 0.8mm as permanent shutter-ing…	In case Bidder opts for steel su-per-structure with RCC floors/roof, kindly specify the cladding system to be adopted (Brick Cladding / Metal Sheet Cladding).	Refer Sl.No.81

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
138.	VI/B	IV-D	25 of 69	7.00.00	Passages shall be provided inside the FGD block connecting to the outer periphery road to have access to the various facilities/buildings... All facility buildings shall be provided with 750 mm wide plinth protection all around... An area of minimum 5 m width all around the tank foundations and other facility buildings shall be paved. This paving shall be beyond the extent of plinth protection…	(1) Within the FGD blocks, kindly specify whether the balance area (i.e. area excluding various facilities/buildings, passage areas, plinth protection to facility buildings, additional paving of 5m width all around the tank foundations and other facility buildings beyond the extent of plinth protection, etc.) is to be paved or left unpaved. (2) In case paving is required for the balance area, kindly specify the type of paving (Normal Duty paving/Heavy Duty paving) to be adopted.	Refer Sl.No.82
139.	VI/B	IV-D	25 of 69	7.00.00	The paving shall be provided with slope of 1:500 to dispose the surface water/wash water to the nearest drain.		
140.	VI/A	II-A11	22 OF 29	Annexure-III, e)	The minimum pile length for each group of piles shall be determined based on the nearest bore log. Pile shall be socketed into yellowish weathered sand stone. A socketing length of four (4) times the diameter of the pile into rock with rock core recovery ≥ 20% shall be ensured for 600 mm & 760 mm dia piles.	The minimum length of pile shall be as per approved geotechnical investigation report during detailed engineering. Please confirm.	Bidder shall comply the provisions of technical specification.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
141.	VI/A	II-A11	15 OF 29	7.02.03 xv	High Strain Dynamic Load Test may be carried out for routine load testing of working piles. However, at least two numbers of static routine vertical load tests shall be carried out on pile on which high strain dynamic load test has already been carried out for establishing the correlation between the two tests. In case of discrepancy if any between dynamic and static vertical load tests, then additional static routine vertical load tests shall be conducted as decided by the Engineer and the results of static routine vertical load shall prevail. Number of routine vertical pile load tests as per clause 7.02.03 (ix) shall be total of static routine vertical load test and high strain dynamic load tests.	High strain dynamic load test is not required as static routine load test are being carried out in the piles. Please confirm.	Bidder may conduct either static routine load test or high strain dynamic load test. Bidder to refer amendment in this regard.
142.	General	-	-	-	-	Lab test results of geotechnical investigation may please be furnished.	Bidder to refer amendment in this regard.

CIVIL BRBCL (MOUDA, SOLAPUR,MEJA,BARH,TANDA, NPGCPL NABINAGAR & BRBCL NABINAGAR)

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
143.	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
144.	VI / A	V	8 OF 26	5.01.00	A "wet Chimney" shall be installed downstream of Wet Flue Gas Desulfurization (FGD) system by the Contractor…	The location of new Wet Chimney shall be near to Existing Chimney in the space provided clearing foundation interface. The design of Wet Chimney shall be done considering interface factor of existing chimney as determined by wind tunnel study. However, no design check or validation shall be done for existing chimney/structures/buildings. Kindly confirm.	It is confirmed that no design check or validation shall be done by the bidder for existing chimney(s).

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION RE-QUIREMENT	COMMENTS / QUERIES	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
212.	Section-VI, PART-A	Sub-Section-VII	39 OF 61	K	Mandatory Spares of Limestone & Gypsum Handling: ELECTRIC HOISTS	fied in referred clause. In case the same has to be considered, then kindly inform about applicable list of mandatory spares to be followed. 4) Further, no spares are mentioned for chain pulley blocks. We understand that no spares shall be provided for chain pulley blocks. Please confirm.	Confirmed.
					CIVIL		
213.	VI/A	III-D	2 of 4	1.06.00	Uniform Finished ground level (FGL) in FGD absorber area shall be made available by the owner at a level specified in tender drawing.	In tender drawings only space for FGD area is marked. No FGL is mentioned for FGD area blocks. Kindly clarify and furnish the same.	FGL is indicated in General Layout plan

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION RE-QUIREMENT	COMMENTS / QUERIES	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
214.	VI/B	IV-D	26 of 69	10.00.00	Site leveling of gypsum storage area, lime storage area, gypsum dewatering area, truck hopper and associated areas to be levelled in one block. Each block shall be finished to the formation level as specified in drawing…	In tender drawings only space for FGD area is marked. No FGL is mentioned for FGD area blocks. Kindly clarify and furnish the same.	FGL is indicated in General Layout plan
215.	VI/B	IV-D	31 of 69	14.00.00	Storm water drain shall be designed taking into account the finished ground levels of the plant area, drainage pattern, intensity of rainfall, etc. with a return period of 50 years. These values shall be based on rainfall intensity of 90mm/hr.	The referred clauses are contradictory. Kindly clarify the rainfall intensity to be considered for designing the plant storm water drain.	The value of minimum rainfall intensity shall be taken as 75mm/hr. Refer amendment issued separately.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION RE-QUIREMENT	COMMENTS / QUERIES	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
216.	VI/B	IV-D	41 of 69	21.00.00	The plant storm water drainage shall be de-signed taking into ac-count the finished grade levels of the plant area, drainage pattern, intensity of rainfall, etc., The storm water drainage shall cater to storm water run off resulting from one hour rainfall inten-sity, with a return peri-od of 50 years. The val-ue of minimum rainfall intensity shall be taken as 75mm/hr.		The value of minimum rainfall intensity shall be taken as 75mm/hr. Refer amendment issued separately.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION RE-QUIREMENT	COMMENTS / QUERIES	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
217.	VI/B	IV-D	24 of 69	7.00.00	In case Bidder opts for steel super-structure with RCC floors/ roof, the bidder shall neces-sarily use Troughed permanently colour coated metal decking sheets having minimum thickness of 0.8mm as permanent shuttering…	In case Bidder opts for steel super-structure with RCC floors/roof, kindly specify the cladding system to be adopt-ed (Brick Cladding / Metal Sheet Clad-ding).	Refer Sl.No.81

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / QUERIES	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
218.	VI/B	IV-D	25 of 69	7.00.00	Passages shall be provided inside the FGD block connecting to the outer periphery road to have access to the various facilities/buildings... All facility buildings shall be provided with 750 mm wide plinth protection all around... An area of minimum 5 m width all around the tank foundations and other facility buildings shall be paved. This paving shall be beyond the extent of plinth protection…	(1) Within the FGD blocks, kindly specify whether the balance area (i.e. area excluding various facilities/buildings, passage areas, plinth protection to facility buildings, additional paving of 5m width all around the tank foundations and other facility buildings beyond the extent of plinth protection, etc.) is to be paved or left unpaved. (2) In case paving is required for the balance area, kindly specify the type of paving (Normal Duty paving/Heavy Duty paving) to be adopted.	Refer Sl.No.82
219.	VI/B	IV-D	25 of 69	7.00.00	The paving shall be provided with slope of 1:500 to dispose the surface water/wash water to the nearest drain.		

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / QUERIES	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
220.	VI/A	II-A4	10 of 30	7.00.01	Geotechnical data and foundation system for the respective project are enclosed at annexure-III. The corresponding bore logs are enclosed at annexure-IV.	Annexure-IV is not available in the specification. Please provide the same.	Bidder to refer amendment
221.	SEC VI / PART B	I M1	6 OF 51	3.02.07	External surface of the chimney flue liner projecting over the chimney roof shall be wrapped with 2mm thick titanium/ C276 sheet over insulation.	These clauses are contradictory. Bidder understands that if 2mm thick titanium/ C276 sheet wrapping over insulation is provided then no painting is required on external surface of the chimney flue liner projecting over the chimney roof. Please confirm.	No painting is required on external surface of chimney flue liner projecting above chimney roof. Also refer Amendment in this regard.
222.	SEC VI / PART B	IV D	15 OF 69	3.14.09 (iv)	….., external surface of mini-shell above roof etc shall be painted with epoxy phenolic coating system having total 220 microns DFT.		

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / QUERIES	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
223.	SEC VI / PART A	V	8 OF 26	5.01.00	External surface of chimney flue liner projecting over the chimney roof shall be wrapped with 2 mm thick Titanium / C-276 sheet over insulation.		
224.	SEC VI / PART A	V	8 OF 26	5.01.00	The chimney flue liner cladding shall be made of 2 mm thick Titanium (Grade 2 as per ASME SB265) or C-276 alloy over 8 mm thick (minimum) mild steel base metal of flue liner. Cladding shall be done to achieve the required quality as per ASTM B 898-11.	Bidder understands that cladding can be done with explosion bonding or hot rolling or combination of both to achieve the required quality as per ASTM B 898-11. Please confirm.	Bidder shall provide the proposed cladding methods as per the NTPC approved fabrication procedures, tests and Quality plan such that it meets the plant operation requirements.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / QUERIES	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
225.	SEC VI / PART B	I M1	6 OF 51	3.02.07	The chimney flue liner cladding shall be made of 2 mm thick Titanium (Grade 2 as per ASME SB265) or C-276 alloy over 8 mm thick (minimum) mild steel base metal of flue liner. Cladding shall be done to achieve the required quality as per ASTM B 898-11.		
226.	SEC VI / PART B	IV D	39 OF 69	20.00.00	Electrodes	Please provide the detail/type of electrodes to be used in welding of titanium/C276.	Type of electrode will be as per Qualified WPS. This qualified WPS needs to be submitted for NTPC approval.
227.	SEC VI / PART B	IV D	39 OF 69	20.07.00	Edge Preparation for Welding	Please provide edge preparation detail for titanium/C276 material.	Edge Preparation detail will be as per Qualified WPS. This qualified WPS needs to be submitted for NTPC approval.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION RE-QUIREMENT	COMMENTS / QUERIES	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
228.	SEC VI / PART A	V	8 OF 26	5.01.00	The chimney flue liner cladding shall be made of 2 mm thick Titanium (Grade 2 as per ASME SB265) or C-276 alloy over 8 mm thick (mini-mum) mild steel base metal of flue liner. Cladding shall be done to achieve the required quality as per ASTM B 898-11.	Please provide the material code to be followed for alloy C-276.	Specification requirement is clear. Bidder shall comply with the specification requirements.
229.	SEC VI / PART B	I M1	6 OF 51	3.02.07	The chimney flue liner cladding shall be made of 2 mm thick Titanium (Grade 2 as per ASME SB265) or C-276 alloy over 8 mm thick (mini-mum) mild steel base metal of flue liner. Cladding shall be done to achieve the required quality as per ASTM B 898-11.		

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION RE-QUIREMENT	COMMENTS / QUERIES	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
230.	SEC VI / PART A	V	8 OF 26	5.01.00	The chimney flue liner cladding shall be made of 2 mm thick Titanium (Grade 2 as per ASME SB265) or C-276 alloy over 8 mm thick (mini-mum) mild steel base metal of flue liner. Cladding shall be done to achieve the required quality as per ASTM B 898-11.	Kindly furnish the following specifica-tions for chimney liners. 1. Permissible tolerances on thickness of clad sheet and base material. 2. Permissible tolerances on flatness for clad sheet and base material. 3. Specify the quality tests which will be conducted on the clad sheet for as-sessing mechanical and chemical proper-ties and on the chimney cans after fabri-cation. 4. Indicate any special requirements ap-plicable for welding and fabrication of chimney at site. 5. Indicate any restriction in size of base metal and clad plate to be used for fabri-cation of flue cans. 6. Mention tensile and yield strength of the cladded material to be achieved.	Specification requirement is clear. Bidder shall comply with the specification requirements.
231.	SEC VI / PART B	I M1	6 OF 51	3.02.07	The chimney flue liner cladding shall be made of 2 mm thick Titanium (Grade 2 as per ASME SB265) or C-276 alloy over 8 mm thick (mini-mum) mild steel base metal of flue liner. Cladding shall be done to achieve the required quality as per ASTM B 898-11.		

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION RE-QUIREMENT	COMMENTS / QUERIES	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
232.	SEC VI / PART A	I	10 OF 19	4.02.03	For Chimney, Bidder or its agency should have in the past built at least one (1) Reinforced concrete chimney of minimum 100m height.	Bidder understands that, there is no other prequalification requirements related to fabrication and erection of titanium/ c276 cladded steel flue liner in chimney. Please confirm.	Bidder's understanding is Correct.
233.	SEC VI / PART B	IV D	2 OF 69	2.03.00	Bidder or its agency should have in the past built at least one (1) Reinforced concrete chimney of minimum 100m height.		
234.	VI / A	V	8 OF 26	5.01.00	A "wet Chimney" shall be installed downstream of Wet Flue Gas Desulfurization (FGD) system by the Contractor…	The location of new Wet Chimney shall be near to Existing Chimney in the space provided clearing foundation interface. The design of Wet Chimney shall be done considering interface factor of existing chimney as determined by wind tunnel study. However, no design check or validation shall be done for existing chimney/structures/buildings. Kindly confirm.	It is confirmed that no design check or validation shall be done by the bidder for existing chimney(s).

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / QUERIES	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
268.	VI/A	III-D	2 of 4	1.06.00	Uniform Finished ground level (FGL) in FGD absorber area shall be made available by the owner at a level specified in tender drawing.	In tender drawings only space for FGD area is marked. No FGL is mentioned for FGD area blocks. Kindly clarify and furnish the same.	FGL is indicated in General Layout plan
269.	VI/B	IV-D	26 of 69	10.00.00	Site leveling of gypsum storage area, lime storage area, gypsum dewatering area, truck hopper and associated areas to be levelled in one block. Each block shall be finished to the formation level as specified in drawing…	In tender drawings only space for FGD area is marked. No FGL is mentioned for FGD area blocks. Kindly clarify and furnish the same.	FGL is indicated in General Layout plan
270.	VI/B	IV-D	31 of 69	14.00.00	Storm water drain shall be designed taking into account the finished ground levels of the plant area, drainage pattern, intensity of rainfall, etc. with a return period of 50 years. These values shall be based on rainfall intensity of 90mm/hr.	The referred clauses are contradictory. Kindly clarify the rainfall intensity to be considered for designing the plant storm water drain.	The value of minimum rainfall intensity shall be taken as 75mm/hr. Refer amendment issued separately.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / QUERIES	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
271.	VI/B	IV-D	41 of 69	21.00.00	The plant storm water drainage shall be designed taking into account the finished grade levels of the plant area, drainage pattern, intensity of rainfall, etc., The storm water drainage shall cater to storm water run off resulting from one hour rainfall intensity, with a return period of 50 years. The value of minimum rainfall intensity shall be taken as 75mm/hr.		The value of minimum rainfall intensity shall be taken as 75mm/hr. Refer amendment issued separately.
272.	VI/B	IV-D	24 of 69	7.00.00	In case Bidder opts for steel super-structure with RCC floors/ roof, the bidder shall necessarily use Troughed permanently colour coated metal decking sheets having minimum thickness of 0.8mm as permanent shuttering...	In case Bidder opts for steel super-structure with RCC floors/roof, kindly specify the cladding system to be adopted (Brick Cladding / Metal Sheet Cladding).	Refer Sl.No.81

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / QUERIES	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
273.	VI/B	IV-D	25 of 69	7.00.00	Passages shall be provided inside the FGD block connecting to the outer periphery road to have access to the various facilities/buildings... All facility buildings shall be provided with 750 mm wide plinth protection all around... An area of minimum 5 m width all around the tank foundations and other facility buildings shall be paved. This paving shall be beyond the extent of plinth protection…	(1) Within the FGD blocks, kindly specify whether the balance area (i.e. area excluding various facilities/buildings, passage areas, plinth protection to facility buildings, additional paving of 5m width all around the tank foundations and other facility buildings beyond the extent of plinth protection, etc.) is to be paved or left unpaved. (2) In case paving is required for the balance area, kindly specify the type of paving (Normal Duty paving/Heavy Duty paving) to be adopted.	Refer Sl.No.82
274.	VI/B	IV-D	25 of 69	7.00.00	The paving shall be provided with slope of 1:500 to dispose the surface water/wash water to the nearest drain.		

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / QUERIES	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
275.	VI/A	II-A3	22 OF 31	Annexure-IV, e)	The minimum pile length for each group of piles shall be determined based on the nearest bore log. A minimum embedment of 2.0m into pebbles/cobbles/boulder strata (river Bed material) as observed in such bore log shall be ensured, while deciding the minimum length of pile. For pile termination, SPT 'N' values shall be used from the nearby bore log data.	The minimum length of pile shall be as per approved geotechnical investigation report during detailed engineering. Please confirm.	Bidder shall comply the provisions of technical specification.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / QUERIES	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
276.	VI/A	II-A3	14 OF 31	7.02.03 xv	High Strain Dynamic Load Test may be carried out for routine load testing of working piles. However, at least two numbers of static routine vertical load tests shall be carried out on pile on which high strain dynamic load test has already been carried out for establishing the correlation between the two tests. In case of discrepancy if any between dynamic and static vertical load tests, then additional static routine vertical load tests shall be conducted as decided by the Engineer and the results of static routine vertical load shall prevail. Number of routine vertical pile load tests as per clause 7.02.03 (ix) shall be total of static routine vertical load test and high strain dynamic load tests.	High strain dynamic load test is not required as static routine load test are being carried out in the piles. Please confirm.	Bidder may conduct either static routine load test or high strain dynamic load test. Refer amendment .

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / QUERIES	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
277.	General	-	-	-	-	Lab test results of geotechnical investigation may please be furnished.	Bidder to refer amendment.
278.	SEC VI / PART B	I M1	6 OF 51	3.02.07	External surface of the chimney flue liner projecting over the chimney roof shall be wrapped with 2mm thick titanium/ C276 sheet over insulation.	These clauses are contradictory. Bidder understands that if 2mm thick titanium/ C276 sheet wrapping over insulation is provided then no painting is required on external surface of the chimney flue liner projecting over the chimney roof. Please confirm.	No painting is required on external surface of chimney flue liner projecting above chimney roof. Also refer Amendment in this regard.
279.	SEC VI / PART B	IV D	15 OF 69	3.14.09 (iv)	….., external surface of mini-shell above roof etc shall be painted with epoxy phenolic coating system having total 220 microns DFT.		
280.	SEC VI / PART A	V	8 OF 26	5.01.00	External surface of chimney flue liner projecting over the chimney roof shall be wrapped with 2 mm thick Titanium / C-276 sheet over insulation.		

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / QUERIES	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
281.	SEC VI / PART A	V	8 OF 26	5.01.00	The chimney flue liner cladding shall be made of 2 mm thick Titanium (Grade 2 as per ASME SB265) or C-276 alloy over 8 mm thick (minimum) mild steel base metal of flue liner. Cladding shall be done to achieve the required quality as per ASTM B 898-11.	Bidder understands that cladding can be done with explosion bonding or hot rolling or combination of both to achieve the required quality as per ASTM B 898-11. Please confirm.	Bidder shall provide the proposed cladding methods as per the NTPC approved fabrication procedures, tests and Quality plan such that it meets the plant operation requirements.
282.	SEC VI / PART B	I M1	6 OF 51	3.02.07	The chimney flue liner cladding shall be made of 2 mm thick Titanium (Grade 2 as per ASME SB265) or C-276 alloy over 8 mm thick (minimum) mild steel base metal of flue liner. Cladding shall be done to achieve the required quality as per ASTM B 898-11.		Bidder shall provide the proposed cladding methods as per the NTPC approved fabrication procedures, tests and Quality plan such that it meets the plant operation requirements.
283.	SEC VI / PART B	IV D	39 OF 69	20.00.00	Electrodes	Please provide the detail/type of electrodes to be used in welding of titanium/C276.	Type of electrode will be as per Qualified WPS. This qualified WPS needs to be submitted for NTPC approval.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / QUERIES	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
284.	SEC VI / PART B	IV D	39 OF 69	20.07.00	Edge Preparation for Welding	Please provide edge preparation detail for titanium/C276 material.	Edge Preparation detail will be as per Qualified WPS. This qualified WPS needs to be submitted for NTPC approval.
285.	SEC VI / PART A	V	8 OF 26	5.01.00	The chimney flue liner cladding shall be made of 2 mm thick Titanium (Grade 2 as per ASME SB265) or C-276 alloy over 8 mm thick (minimum) mild steel base metal of flue liner. Cladding shall be done to achieve the required quality as per ASTM B 898-11.	Please provide the material code to be followed for alloy C-276.	Specification requirement is clear. Bidder shall comply with the specification requirements.
286.	SEC VI / PART B	I M1	6 OF 51	3.02.07	The chimney flue liner cladding shall be made of 2 mm thick Titanium (Grade 2 as per ASME SB265) or C-276 alloy over 8 mm thick (minimum) mild steel base metal of flue liner. Cladding shall be done to achieve the required quality as per ASTM B 898-11.		

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / QUERIES	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
287.	SEC VI / PART A	V	8 OF 26	5.01.00	The chimney flue liner cladding shall be made of 2 mm thick Titanium (Grade 2 as per ASME SB265) or C-276 alloy over 8 mm thick (minimum) mild steel base metal of flue liner. Cladding shall be done to achieve the required quality as per ASTM B 898-11.	Kindly furnish the following specifications for chimney liners. 1. Permissible tolerances on thickness of clad sheet and base material. 2. Permissible tolerances on flatness for clad sheet and base material. 3. Specify the quality tests which will be conducted on the clad sheet for assessing mechanical and chemical properties and on the chimney cans after fabrication. 4. Indicate any special requirements applicable for welding and fabrication of chimney at site. 5. Indicate any restriction in size of base metal and clad plate to be used for fabrication of flue cans. 6. Mention tensile and yield strength of the cladded material to be achieved.	Specification requirement is clear. Bidder shall comply with the specification requirements.
288.	SEC VI / PART B	I M1	6 OF 51	3.02.07	The chimney flue liner cladding shall be made of 2 mm thick Titanium (Grade 2 as per ASME SB265) or C-276 alloy over 8 mm thick (minimum) mild steel base metal of flue liner. Cladding shall be done to achieve the required quality as per ASTM B 898-11.		Bidder's understanding is Correct.
289.	SEC VI / PART A	I	10 OF 19	4.02.03	For Chimney, Bidder or its agency should have in the past built at least one (1) Reinforced concrete chimney of minimum 100m height.	Bidder understands that, there is no other prequalification requirements related to fabrication and erection of titanium/ c276 cladded steel flue liner in chimney. Please confirm.	Bidder's understanding is Correct.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / QUERIES	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
328.	VI/A	III-D	2 of 4	1.06.00	Uniform Finished ground level (FGL) in FGD absorber area shall be made available by the owner at a level specified in tender drawing.	In tender drawings only space for FGD area is marked. No FGL is mentioned for FGD area blocks. Kindly clarify and furnish the same.	FGL is indicated in General Lay-out plan
329.	VI/B	IV-D	26 of 69	10.00.00	Site leveling of gypsum storage area, lime storage area, gypsum dewatering area, truck hopper and associated areas to be levelled in one block. Each block shall be finished to the formation level as specified in drawing…	In tender drawings only space for FGD area is marked. No FGL is mentioned for FGD area blocks. Kindly clarify and furnish the same.	FGL is indicated in General Lay-out plan
330.	VI/B	IV-D	31 of 69	14.00.00	Storm water drain shall be designed taking into account the finished ground levels of the plant area, drainage pattern, intensity of rainfall, etc. with a return period of 50 years. These values shall be based on rainfall intensity of 90mm/hr.	The referred clauses are contradictory. Kindly clarify the rainfall intensity to be considered for designing the plant storm water drain.	The value of minimum rainfall intensity shall be taken as 75mm/hr. Refer amendment issued separately.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / QUERIES	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
331.	VI/B	IV-D	41 of 69	21.00.00	The plant storm water drainage shall be designed taking into account the finished grade levels of the plant area, drainage pattern, intensity of rainfall, etc., The storm water drainage shall cater to storm water run off resulting from one hour rainfall intensity, with a return period of 50 years. The value of minimum rainfall intensity shall be taken as 75mm/hr.		
332.	VI/B	IV-D	24 of 69	7.00.00	In case Bidder opts for steel super-structure with RCC floors/ roof, the bidder shall necessarily use Troughed permanently colour coated metal decking sheets having minimum thickness of 0.8mm as permanent shuttering…	In case Bidder opts for steel super-structure with RCC floors/roof, kindly specify the cladding system to be adopted (Brick Cladding / Metal Sheet Cladding).	Refer Sl.No.81

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / QUERIES	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
333.	VI/B	IV-D	25 of 69	7.00.00	Passages shall be provided inside the FGD block connecting to the outer periphery road to have access to the various facilities/buildings... All facility buildings shall be provided with 750 mm wide plinth protection all around... An area of minimum 5 m width all around the tank foundations and other facility buildings shall be paved. This paving shall be beyond the extent of plinth protection…	(1) Within the FGD blocks, kindly specify whether the balance area (i.e. area excluding various facilities/buildings, passage areas, plinth protection to facility buildings, additional paving of 5m width all around the tank foundations and other facility buildings beyond the extent of plinth protection, etc.) is to be paved or left unpaved. (2) In case paving is required for the balance area, kindly specify the type of paving (Normal Duty paving/Heavy Duty paving) to be adopted.	Refer Sl.No.82
334.	VI/B	IV-D	25 of 69	7.00.00	The paving shall be provided with slope of 1:500 to dispose the surface water/wash water to the nearest drain.		
335.	VI-A	II-A2	23-39 of 48	Annexure-II	BORE LOG	Geotechnical investigation report is not readable. Please provide the report in readable format.	Bidder to refer amendment.
336.	SEC VI / PART B	I M1	6 OF 51	3.02.07	External surface of the chimney flue liner projecting over the chimney roof shall be wrapped with 2mm thick titanium/ C276 sheet over insulation.	These clauses are contradictory. Bidder understands that if 2mm thick titanium/ C276 sheet wrapping over insulation is provided then no painting is required on	No painting is required on external surface of chimney flue liner projecting above chimney roof. Also refer Amendment in this regard.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / QUERIES	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
337.	SEC VI / PART B	IV D	15 OF 69	3.14.09 (iv)	….., external surface of mini-shell above roof etc shall be painted with epoxy phenolic coating system having total 220 microns DFT.	external surface of the chimney flue liner projecting over the chimney roof. Please confirm.	
338.	SEC VI / PART A	V	8 OF 26	5.01.00	External surface of chimney flue liner projecting over the chimney roof shall be wrapped with 2 mm thick Titanium / C-276 sheet over insulation.		
339.	SEC VI / PART A	V	8 OF 26	5.01.00	The chimney flue liner cladding shall be made of 2 mm thick Titanium (Grade 2 as per ASME SB265) or C-276 alloy over 8 mm thick (minimum) mild steel base metal of flue liner. Cladding shall be done to achieve the required quality as per ASTM B 898-11.	Bidder understands that cladding can be done with explosion bonding or hot rolling or combination of both to achieve the required quality as per ASTM B 898-11. Please confirm.	Bidder shall provide the proposed cladding methods as per the NTPC approved fabrication procedures, tests and Quality plan such that it meets the plant operation requirements.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / QUERIES	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
340.	SEC VI / PART B	I M1	6 OF 51	3.02.07	The chimney flue liner cladding shall be made of 2 mm thick Titanium (Grade 2 as per ASME SB265) or C-276 alloy over 8 mm thick (minimum) mild steel base metal of flue liner. Cladding shall be done to achieve the required quality as per ASTM B 898-11.		
341.	SEC VI / PART B	IV D	39 OF 69	20.00.00	Electrodes	Please provide the detail/type of electrodes to be used in welding of titanium/C276.	Type of electrode will be as per Qualified WPS. This qualified WPS needs to be submitted for NTPC approval.
342.	SEC VI / PART B	IV D	39 OF 69	20.07.00	Edge Preparation for Welding	Please provide edge preparation detail for titanium/C276 material.	Edge Preparation detail will be as per Qualified WPS. This qualified WPS needs to be submitted for NTPC approval.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / QUERIES	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
343.	SEC VI / PART A	V	8 OF 26	5.01.00	The chimney flue liner cladding shall be made of 2 mm thick Titanium (Grade 2 as per ASME SB265) or C-276 alloy over 8 mm thick (minimum) mild steel base metal of flue liner. Cladding shall be done to achieve the required quality as per ASTM B 898-11.	Please provide the material code to be followed for alloy C-276.	Specification requirement is clear. Bidder shall comply with the specification requirements.
344.	SEC VI / PART B	I M1	6 OF 51	3.02.07	The chimney flue liner cladding shall be made of 2 mm thick Titanium (Grade 2 as per ASME SB265) or C-276 alloy over 8 mm thick (minimum) mild steel base metal of flue liner. Cladding shall be done to achieve the required quality as per ASTM B 898-11.		
345.	SEC VI / PART A	V	8 OF 26	5.01.00	The chimney flue liner cladding shall be made of 2 mm thick Titanium (Grade 2 as per ASME SB265) or C-276 alloy over 8 mm thick (minimum) mild steel base metal of flue liner. Cladding shall be done to achieve the required quality as per ASTM B 898-11.	Kindly furnish the following specifications for chimney liners. 1. Permissible tolerances on thickness of clad sheet and base material. 2. Permissible tolerances on flatness for clad sheet and base material. 3. Specify the quality tests which	Specification requirement is clear. Bidder shall comply with the specification requirements.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / QUERIES	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
346.	SEC VI / PART B	I M1	6 OF 51	3.02.07	The chimney flue liner cladding shall be made of 2 mm thick Titanium (Grade 2 as per ASME SB265) or C-276 alloy over 8 mm thick (minimum) mild steel base metal of flue liner. Cladding shall be done to achieve the required quality as per ASTM B 898-11.	will be conducted on the clad sheet for assessing mechanical and chemical properties and on the chimney cans after fabrication. 4. Indicate any special requirements applicable for welding and fabrication of chimney at site. 5. Indicate any restriction in size of base metal and clad plate to be used for fabrication of flue cans. 6. Mention tensile and yield strength of the cladded material to be achieved.	
347.	SEC VI / PART A	I	10 OF 19	4.02.03	For Chimney, Bidder or its agency should have in the past built at least one (1) Reinforced concrete chimney of minimum 100m height.	Bidder understands that, there is no other prequalification requirements related to fabrication and erection of titanium/ c276 cladded steel flue liner in chimney. Please confirm.	Bidder's understanding is Correct.
348.	SEC VI / PART B	IV D	2 OF 69	2.03.00	Bidder or its agency should have in the past built at least one (1) Reinforced concrete chimney of minimum 100m height.		

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / QUERIES	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
349.	VI / A	V	8 OF 26	5.01.00	A "wet Chimney" shall be installed downstream of Wet Flue Gas Desulfurization (FGD) system by the Contractor…	The location of new Wet Chimney shall be near to Existing Chimney in the space provided clearing foundation interface. The design of Wet Chimney shall be done considering interface factor of existing chimney as determined by wind tunnel study. However, no design check or validation shall be done for existing chim-ney/structures/buildings. Kindly confirm.	It is confirmed that no design check or validation shall be done by the bidder for existing chimney(s).

Sl. No.	Vol No	Clause No.	Page No.	Issues	Comments / Clarifications	NTPC reply
350.	Sec-VI Part-D ,ECC	Clause no. 28.04.00	Page no. 12	**Site laboratory for Civil Work**	Bidder through its civil work sub-contractors will set up a tempo-rary field quality Lab to conduct normal civil work tests at site. However, customer to allow bid-der/it's subcontractors to take back those field quality lab equipment after completion of work at site. Please confirm.	We understand that after comple-tion of work at site, contractor may be allowed to take back their lab equipments.

SL.	ENQUIRY SPECIFICATION	SPECIFICATION REQUIRE-	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
384.	VI-PART-B	VI-D CIVIL WORKS	24 of 69	6.08.00	Access to RCC roof of Gypsum dewatering building, FGD Control room building, MCC building, ball Mill building shall be through RCC staircase and roof access to all other buildings all shall be through cage ladder as per requirement	It is proposed to provide steel staircases for access to operating floors of all buildings except FGD Control room/MCC building. RCC staircase will be provided for FGD Control room/MCC building. Cage ladder may be allowed for access to roofs of all buildings with roof sheeting. Kindly accept	Bidder shall comply with technical specification requirement.
385.	VI-PART-B	VI-D CIVIL WORKS	-	-	**Ball Mill Building:**	Type of construction of Ball Mill building is not mentioned in the technical specification. Bidder proposes to use structural steel building with roof sheeting and side cladding (sheeting and cladding with permanently colour coated sheeting). Kindly confirm.	Type of building structure (Steel/RCC) and cladding system shall be decided by the bidder considering the functional requirement, schedule of construction and site constraints (if any). However, roof shall be of RCC as per technical specification requirement.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
386.	VI-PART-B	VI-D CIVIL WORKS	-	-	**Gypsum dewatering building:**	Type of construction of Gypsum Dewatering building is not mentioned in the technical specification. Bidder proposes to use structural steel building with roof sheeting and side cladding (sheeting and cladding with permanently colour coated sheeting). Floor of Vacuum belt filter will be RCC over metal deck sheeting. Kindly confirm.	Bidder shall comply with technical specification requirement.

SL. NO	ENQUIRY SPECIFICATION				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC CLARIFICATIONS
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
387.	VI-PART-B	VI-D CIVIL WORKS	-	-	**Recirculation & Oxidation Blower house:**	Type of construction of the building to house recirculation pumps and oxidation blowers is not mentioned in the technical specification. Bidder proposes to use structural steel building with roof sheeting and side cladding (sheeting and cladding with permanently colour coated sheeting). Kindly confirm.	Type of building structure (Steel/RCC) and cladding system shall be decided by the bidder considering the functional requirement, schedule of construction and site constraints (if any). However, roof shall be of RCC as per technical specification requirement.

Sl. No.	Section/Part/ Chapter	Clause No.	Page No.	Bid Specification	Clarification sought by the bidder	NTPC CLARIFICATIONS
538.	Section-VI (TS) Part-B Sub-section-II E15 Station Light-ning	4.00.00.10 .(I)	8 of 16	Lighting Panels shall be of following types:	Please clarify the purpose of 3kVA transformer located inside of LP-3 type lighting panel itself.	LP-3 shall be used for feeding of RC re-ceptacle as mentioned in technical speci-fication. Kindly refer clause no:- 4.00.00.10.h
539.	Section-VI (TS) Part-B Sub-section-II E15 Station Light-ning	Annexure - A.	15 of 16	Annexure - A.	Please clarify average illumination Lux levels (or ratio (%) of fixture) to be adopted in certain area where Emergency AC, Normal DC, Emergency DC Lightings are in-stalled.	Refer to Annexure-B in Station Lighting chapter. Amendment-1 issued
540.	Section-VI (TS) Part-B Sub-Section IV-D Civil Works	3.14.00	10 of 69	Single flue or multiple flue chimneys to be pro-vided	Bidder suggests that this chimney might not be necessary. Please confirm.	Bidder shall comply to the requirements of technical specification.
541.	Section-VI (TS) Part-B Sub-Section IV-D Civil Works	12.00.00 (Roads)	30 of 69	Concrete pavement for roads shall be min. 250mm thick slab	Please clarify which particular specification about roads needs to be followed.	Query is not clear

Sl. No.	Section/Part/ Chapter	Clause No.	Page No.	Bid Specification	Clarification sought by the bidder	NTPC CLARIFICATIONS
542.	Section-VI (TS) Part-B Sub-Section IV-D Civil Works	12.00.00	31 of 69	Dry lean concrete shall be minimum M10 grade and concrete pavement slab shall be minimum M35 grade concrete.	Please clarify which particular specification about roads needs to be followed.	Query is not clear
543.	Section-VI (TS) Part-B Sub-Section IV-D Civil Works	21.00.00	41 of 69	RCC paving of min. 150mm thick with M25 grade concrete	Please clarify which particular specification about roads needs to be followed.	Query is not clear
544.	Section-VI (TS) Part-B Sub-Section IV-D Civil Works	29.02.00	48 of 69	Interconnecting walkway between various structures, buildings & facilities shall be finished with 22mm chequered concrete tiles	Please confirm - between which structures / buildings are interconnecting walkways required? Further, if the interconnecting walkways (if any) are steel structures, can we use steel chequered plate / gratings in place of chequered concrete tiles?	As the layout of FGD system is in Bidder's scope, ascertaining the requirement of Interconnecting walkway between various structures, buildings & facilities is in the scope of Bidder. For finising schedule,Bidder shall comply with technical specification requirement.
545.	Section-VI (TS) Part-B Sub-Section	31.03.00	56 of 69	All steel surfaces should be provided with two component moisture curing zinc silicate primer	What separate paint is required other than the primer, intermediate & final coat already provided in the shop?	For steel sections and structures which are to be transported on sea, anti-corrosive paint before shipment shall be provided to take care of sea worthiness.

Sl. No.	Section/Part/ Chapter	Clause No.	Page No.	Bid Specification	Clarification sought by the bidder	NTPC CLARIFICATIONS
	IV-D Civil Works			coat, followed by polyamide curved epoxy (with MIO content) intermediate & aliphatic isocyanate curved acrylic final coat, all in shop	Please clarify.	
546.	Section-VI (TS) Part-B Sub-Section IV-D Civil Works	31.07.00	57 of 69	All steel sections & fabricated structures, which are required to be transported by sea, shall be provided with anti-corrosive paint before shipment to take care of sea worthiness	Same with above.	For steel sections and structures which are to be transported on sea, anti-corrosive paint before shipment shall be provided to take care of sea worthiness.
547.	Section-VI (TS) Part-E List of Tender Drawings	ELECTRICAL SINGLE LINE DIAGRAM FOR FGD PACAKGE	53 of 53	GENERAL NOTE 11. Panel being used for feeding of CHP	Bidder understands scope of supply for cabling from 11kV FGD TIE SWGR to 11/3.45kV Exiting CHP/AHP TR as below. Please confirm. - Power Cable: Supplied by FGD Supplier's - Cable raceway: Supplied by employer. (up to employer's trestle : Supplied by FGD Supplier's)	Refer amended tender SLD. -Bidder shall comply with technical specification requirement clause no: - 1.08.00.2.However bidder may visit the project in order to get itself acquainted with existing electrical of plant. GLP of respective plants has already been attached.

Sl. No.	Specification Reference				Employer (NTPC) Specification	Bidder Requested Clarification	NTPC CLARIFICATIONS
	Part	Sub-section	Clause no.	Page			
678.	SECTION – VI, PART-D	Erection Condition of contract	44.22.00	33 of 53	Hydra shall not be used for material transport	Bidder understandsing is that Farna shall be used in place of Hydra.	Specification requirement is clear. Bidder shall comply with the specification requirements.
679.	SECTION – VI, PART-A	Scope of supply and Services	2.00.00 (10)	3 of 4	Providing all necessary fire fighting devices/ Equipment/Fire tender etc. required during the project execution……	Bidder shall provide all fire fighting devices / Equipment during the entire Project Execution period for its scope of work. However Bidder requested Employer to provide the Fire Tender of the existing Plant during emergency if required	Bidders understanding/request is not correct.
680.	SECTION – VI, PART-B	SUB-SECTION-VI-D Civil Works	4.01.00	18 of 69	Drainage System	Bidder clarifies that Employers existing drain invert level shall be necessary to plan the RCC drain(in the scope of Bidder) on which water from the pit in FGD area shall be diverted. So Bidder request Employer furnish the above information.	Refer General Layout Plan. Road and drain drawing shall be provided after award.
681.	SECTION – VI, PART-A	SUB-SECTION-II-A2-Project Information-Lara-I 2X800 MW	Annexure-II	23 to 39 of 48	Borelog Data Sheet	The Location and Co-ordinates of various borelogs marked in the data sheet does not match with the location indicated in GLP.	Bidder may refer Clause No.7.00.02, as mentioned in Clause No. 7.00.02, the available borelog data is of vicinity to proposed structure and the

Sl. No.	Specification Reference				Employer (NTPC) Specification	Bidder Requested Clarification	NTPC CLARIFICATIONS
	Part	Sub-section	Clause no.	Page			
						So Bidder request Employer to furnish the corrected documents.	same has already been furnished in the tender document. Detailed Geotechnical Investigation shall be carried out by contractor.
682.	SECTION – VI, PART-A	SUB-SECTION-II-A4-Project Information-Darlipalli-I 2X800 MW	-	-	Borelog Data	No borelog data is available in the tender. Bidder request Employer to furnish the nearest vicinity borelogs if not available for FGD area.	Bidder to refer necessary amendment in this regard.
683.	SECTION – VI, PART-A	SUB-SECTION-II-A6-Project Information-Solapur-II 2X800 MW	-	-	Borelog Data	No borelog data is available in the tender. Bidder request Employer to furnish the nearest vicinity borelogs if not available for FGD area.	Bidder to refer necessary amendment in this regard.
684.	SECTION – VI, PART-A	SUB-SECTION-II-A6-Project Information-Solapur-II 2X800 MW	Annexure-III Soil Data and Foundation System	20 of 31	Net Allowable Bearing Pressure	Bidder understands that in case of soil for depths greater than 1.5m, net allowable bearing pressure value available as per detailed geotechnical investigation during that stage can be utilised for foundation design. Employer is requested to confirm on Bidders understandsing.	Bidder to refer necessary amendment in this regard.

Sl. No.	Specification Reference				Employer (NTPC) Specification	Bidder Requested Clarification	NTPC CLARIFICATIONS
	Part	Sub-section	Clause no.	Page			
685.	SECTION – VI, PART-A	SUB-SECTION-III-A6 ZLD	1.01.00	1 of 3	Pre treatment system shall consist of FGD waste water storage tank (2x50%) to store FGD waste water, GGH washing water, etc.	Bidder proposes 1x100% tank sized for 30 m3/h inflow (Barh-I) and 20 m3/h inflow (Nabinagar) instead of 2x50% tanks. Please confirm.	Stipulation of technical specification is clear. Bidder to comply with technical specification requirements.
686.	SECTION – VI, PART-A	SUB-SECTION-III-A6 ZLD	1.02.00	1 of 3	Contractor shall provide one independent train (1x100%) or two independent trains (2x50%) of Evaporative concentration system.	We propose 1x100% Evaporative Concentration System.	Stipulation of technical specification is clear. Contractor shall provide one independent train (1x100%) or two independent trains (2x50%) of Evaporative concentration system.
687.	SECTION – VI, PART-A	SUB-SECTION-IV Terminal Points & Exclusions	1.08.00	2 of 3	FGD waste water pipes shall terminate along with isolation valve at 5 meters near HCSD mixing tank	Please confirm the terminal points along for outlet of the ZLD system- Water and Solids respectively	Stipulation of technical specification is clear. Bidder to comply with technical specification requirements.
688.	SECTION – VI, PART-A	SUB-SECTION-IV Functional Guarantees & LD	4.02.00	18 of 24	Waste Water: The contractor guarantees that the maximum purge flow rate to waste water treatment system for the complete plant shall be 10 m3/h averaged over a 24 hour period for each unit.	Please clarify the exact flow rate to be considered for designing the ZLD considering 3x660 MW Barh plant and 4x250 MW BRBCL Nabinagar plant.	Bidder to refer necessary amendment in this regard.
689.	SECTION – VI, PART-B	SUB-SECTION-I-M7 ZLD	2.00.00	3 of 32	Conditions of Service - 'All Design Pressure of all device, piping, and auxiliary facilities...Device and tank maximum allowance: operating pressure x 1.5' and also ' pip-	This may not apply for larger "fit for service" equipment like Evaporators and Crystallizers. We will provide our recommendations on design pressures for piping and	Technical specification requirement is clear. However, for evaporator & Crystallizer, proven design and experience meeting provenness criteria specified in tender is acceptable .

Sr. No	Section / Part / Chapter / Volume	Clause No.	Page No.	Bid specification	Bidder's Query	NTPC's Clarification
860.	Section VI / Part A / Subsection III A5	3.01 .00	6 of 6	Gypsum shall be conveyed from the vacuum belt filter to the storage shed through a series of double stream conveyors and transfer points/junction towers.		
861.	Section VI / Part A / Sub Section III A1	3.00.00	2 of 9	The contractors scope shall include a common limestone grinding system for all the units and shall comprise of……..	Bidder understands that limestone handling system is in Bidder's scope. Kindly confirm.	Bidder's understanding is correct. Bidder to refer necessary amendment in this regard.
862.	Section VI / Part A / Subsection III A5	2.01.00	2 of 6	Limestone Handling Plant (LHP)		
863.	Section VI / Part A / Sub Section III D CIVIL WORKS	1.06.00	2 of 4	Uniform Finished Ground Level (FGL) in FGD absorber area shall be made available by the owner at a level specified in tender drawing.	Bidder understands that filling / cutting of earth is in his scope in areas other than the main absorber. Kindly confirm.	Refer amendment issued separately.
864.	Section VI / Part A / Sub Section IV Terminal points and Exclusions	1.10.00	2 of 3	Outlet of gypsum storage silo/ shed	As per section VI, Part-A, Sub Section III - A5, Page 2 of 6, "Gypsum to be conveyed to gypsum storage Shed". Bidder shall consider only a storage shed for gypsum. Kindly confirm.	Confirmed.

Sr. No	Section / Part / Chapter / Volume	Clause No.	Page No.	Bid specification	Bidder's Query	NTPC's Clarification
865.	Section VI / Part B / Sub Section IV-D Civil Works	3.07.00	8 of 69	Gypsum storage shed The gypsum storage shed shall be RCC framed structure with structural steel work shed with permanent colour coated profile steel sheet roof and side cladding...	Bidder requests for an option for the gypsum storage shed to be made of structural steel superstructure with Structural columns and sheeting. Kindly confirm.	Bidder shall follow technical specifications in this regard. Bidder shall also refer s.no.1 of amendment no 1 in this regard.
866.	Project information			Wind and seismic codes	Kindly confirm the following: 1) Bidder would like to consider IS 875 (Part-3):2015 for wind loading 2) Bidder would like to consider IS 1893 (Part 2):2016, "General provisions and buildings" for buildings and IS 1893 (Part-4) : 2015 "Industrial structures including stack - like structures" for stacks along with site specific spectra provided.	Bidder shall comply to site specific "criteria for wind and earthquake resistant design of structures" specified in "Project information" section of technical specification.
867.	Section VI / Part A / Sub Section II-A6 Project information, Solapur (2X660MW)	7.08.00	19 of 31	Employer has carried out geotechnical investigation in vicinity to the proposed area. Logs of representative boreholes for bidder's information in the vicinity of proposed area are enclosed with	Kindly furnish the annexure mentioned in the clause referred in the specification.	Bidder to refer amendment

Sr. No	Section / Part / Chapter / Volume	Clause No.	Page No.	Bid specification	Bidder's Query	NTPC's Clarification
				this annexure.		
868.	Section VI / Part A / Sub Section II-A10 Project information, BARH STPP STAGE-1 (3X660MW)	2.00.00	30 of 30	List of drawings placed below in this subsection…	The topographical survey drawing no: 9562-999-POC-F-002 is unavailable. Kindly provide the same.	Refer amendment issued Separately.
869.	Section VI / Part A / Sub Section II-A4 Project information, Darlipalli (2X660MW)	7.00.00	10 of 30	Geotechnical data and foundation system for the respective project are enclosed at annexure III. The corresponding borelogs are enclosed at annexure IV.	Kindly furnish the annexure IV mentioned in the clause referred in the specification.	Bidder to refer amendment

Sr. No	Section / Part / Chapter / Volume	Clause No.	Page No.	Bid specification	Bidder's Query	NTPC's Clarification
870.	TANDA-II-A7-2 Annexure-IV tanda-II			Bore log data	The co-ordinates of Bore-log provided in the bore logs do not go in conjunction with coordinates in the provided plot plan. Kindly furnish the revised bore-log coordinates in-line with provided plot plan and topo survey.	Bidder may refer Clause No.7.00.02, as mentioned in Clause No. 7.00.02, the available borelog data is of vicinity to proposed structure and the same has already been furnished in the tender document. Detailed Geotechnical Investigation shall be carried out by contractor.
871.	Section VI / Part A / Sub Section II A2	5.00.00	4 of 48	Damping in Structures (c) Reinforced Concerete Stacks : 3%	Bidder requests for horizontal seismic acceleration spectral coefficients for damping factor equals to 3% (as a percentage of critical damping).	The same is provided at "criteria for earthquake resistant design of structures" specified in "Project information" section of technical specification except for Lara Project. It will be furnished in the amendment to technical specification for Lara Project.

Sr. No	Section / Part / Chapter / Volume	Clause No.	Page No.	Bid specification	Bidder's Query	NTPC's Clarification
872.	Section VI, Part B,Subsection IV-D - Civil works	39.03.00	66 of 69	Fly ash based Portland poz-zolona cement conforming to IS:1489, Part I shall preferably be used.	a) OPC cement mixed with fly ash can also be used for FGD structures ex-cept for Chimney. Owner to please confirm. b)Clause 39.03.00 is not applicable for Chimney shell. For Chimney shell, bidder have to use OPC cement only. Please confirm bidder's understand-ing.	a. Bidder shall comply with Technical specifica-tion requirement. b. For chimney shell, only OPC cement shall be used.
873.	General				Only two borelogs are furnished in the tender document for Barh pro-ject. Bidder request Owner to furnish additional bore holes as the FGD structures are located in a scattered manner within the existing units.	Bidder may refer Clause No.7.00.02, as mentioned in Clause No. 7.00.02, the available borelog data is of vicinity to proposed struc-ture and the same has al-ready been furnished in the tender document. De-tailed Geotechnical Inves-tigation shall be carried out by contractor.

Sr. No	Section / Part / Chapter / Volume	Clause No.	Page No.	Bid specification	Bidder's Query	NTPC's Clarification
874.	Section VI, Part A, Subsection IIID, Page 1 of 4	1.04.00	1 of 4	If at any stage of work, any dismantling or modification or relocation of any existing facility is required to be done to complete the work in bidder's scope……the same shall be done by bidder with no extra cost or time implication to the Employer	Dismantling, rerouting & restoration of existing structures which may foul with proposed FGD facilities need to be identified by Owner before hand. Hence Owner is requested to furnish the below mentioned details which are of utmost importance:a)Project wise list of existing structures/ facilities which can be rerouted to accommodate proposed FGD facilities.b) Facility wise schedule of shutdown window which will be available to FGD EPC contractor for interface activities as well as dismantling and rerouting.c)Owner shall be responsible for taking timely Shutdown of existing operational facilities, if required, in order to facilitate FGD construction work. Please confirm.	Relocation of existing facilities will however depend on the bidder's proposal. Any hindrance and evident underground facilities shall be suitably relocated by the bidder. If during the execution of the works it is found that the facilities in the Contractor's scope are fouling with any existing abandoned foundations and underground trenches including pipe and cable trenches for which the contractor is not provided any drawings by NTPC neither the Contractor was appraised beforehand, the

Sr. No	Section / Part / Chapter / Volume	Clause No.	Page No.	Bid specification	Bidder's Query	NTPC's Clarification
						same shall be dismantled & relocated by station. However, Bidder shall note that any re-routing and modification work that will be suggested by the Bidder in such an eventuality shall be subject to the Employer's approval and, if required, Bidder shall modify his design to suite the actual site conditions.

Sr. No	Section / Part / Chapter / Volume	Clause No.	Page No.	Bid specification	Bidder's Query	NTPC's Clarification
875.	Section VI, Part A, Subsection IIID, Page 1 of 4 Section VI, Part B, SubSection IV-D	2.00.00 12.00.00	2 of 4 30 of 69	Bidder shall provide permanent access to all facilities/structures from the nearby existing roads of the Owner. Roads shall be in concrete (M 35) as per IRC….Width of all such roads shall be 7.5 M concrete pavement. The road construction including its shoulders, base, sub base and concrete pavement shall be as per IRC standard.	Bidder requests NTPC to provide width requirement for shoulders? Also whether shoulders are required on both sides of road?	Refer amendment issued separately.
876.	Section VI, Part A,IIA-10	7.03.00, d)	12 of 30	Pile diameter - 600 mm	NTPC Barh - Being an EPC bid, Owner to allow bidder to select pile diameter, length and capacities as per detailed soil investigation and test pile result.	Bidder shall comply the provisions of technical specification.

Sr. No	Section / Part / Chapter / Volume	Clause No.	Page No.	Bid specification	Bidder's Query	NTPC's Clarification
877.	Section VI, Part A,IIA-10	7.03.00, b)	10 of 30	The maximum allowable bearing pressure shall be as per the approved geotechnical report and shall be limited to values as furnished in Table-2	NTPC- Barh Bearing pressure values furnished in table-2 are limited to a depth upto 2.5 m below NGL. Bidder understands that for a greater depth greater than 2.5 m, higher bearing pressure, if applicable as per approved soil investigation report shall be permitted. Please confirm bidder's understanding.	Bidder may refer amendment.
878.	General				Owner to furnish AutoCAD Copy of contour survey drawings for all projects.	Owner provides only PDF files

Sr. No	Section / Part / Chapter / Volume	Clause No.	Page No.	Bid specification	Bidder's Query	NTPC's Clarification
879.	Section VI, Part B, Subsection IV-D - Civil worksSection VI, Part A, Subsec-tion II - A11Section VI, Part A, Subsection II - 8A	39.03.003 9.04.007.0 8.00 g)Annexur e-III (New Nabina-gar-I)	66 of 6966 of 6922 of 2921 of 31	Fly ash based Portland poz-zolona cement conforming to IS:1489, Part I shall preferably be used....or Fe500D, and con-forming to other requirements of IS:1786Chemicals in ground water as observed during in-vestigation are:.....Cement type - As specified elsewhere in the specification.g)Special re-quirements:Chemicals in ground water as observed dur-ing investigation are:.....In view of the above, the following shall be adopted for all foundations and substructures,	BRBCL and Nabinagar - No separate specification for cement type and re-inforcement steel are mentioned in the relevant subsection. Hence bidder shall follow clause no. 39.03.00 for Cement and clause no.39.04.00 (Subsection IV-D, Section VI, Part B) for Reinforcement steel for projects, wherever special requirements are not mentioned. Please confirm bid-der's understanding.	Bidders's understanding is correct.

Sr. No	Section / Part / Chapter / Volume	Clause No.	Page No.	Bid specification	Bidder's Query	NTPC's Clarification
880.	Section VI, Part B, Sub Section - I-M1 Section VI, Part B, Subsection-IV-D - Civil works	3.00.00 3.14.04	5 of 51 13 of 69	The entire flue gas system, flue gas ducts, absorber etc. shall be designed to meet the following conditions: Criteria of flue gas exit velocity for sizing the flue liner material shall be specified elsewhere in the specification.	Owner to specify the below mentioned details for design of 150 m high Chimney: a) Maximum Flue gas exit velocity b) Pressure at Chimney Inlet to be considered by bidder for design. The above mentioned details have not been furnished in tender specification.	**a)** Specification requirement is clear under the referred cl.no. . Bidder shall comply with the specification requirements. **b)** To be optimized by the bidder based on its system design and selection.
881.	Errata 1 to Section VI, Part A, Subsection II - A8	Annexure B	9 of 31	a) The basic wind speed "Vb" at ten	NTPC 3x660MWNabinagar - The basic wind speed Vb at ten meters above the mean ground level may please be specified.	The basic wind speed "Vb" at 10m height above the mean ground level for "NABINAGAR-I 3X660 MW" project shall be 47 metres/second. Also refer Amendment issued separately in this regard.

Sr. No	Section / Part / Chapter / Volume	Clause No.	Page No.	Bid specification	Bidder's Query	NTPC's Clarification
882.	Section VI, Part A, Subsection IIA6-4		Equip-ment layout plan at El 0.00 m	NTPC Solapur - All elevations indicated in the drawing are wrt TG building ground floor elevation as (+/-)0.00 which corresponds to RL(+) 416.5	NTPC Solapur - Bidder understands that FGL for the plant is RL 461 m whereas TG ground floor level i.e. FFL is RL 461.50. Please confirm.	Bidder's understanding is correct.
883.	Section VI, Part A, Subsection IIA6-4	7.00.01	9 of 31	The corresponding bore logs are enclosed at annexure-IV.	NTPC Solapur - Owner to furnish soil investigation report for the vicinity area as the same are not available with tender document.	Bidder to refer amend-ment.
884.	Section VI, Part B, Sub Section - IV-D	12.00.00	31 of 69	Concrete pavement of the road shall be done with fully mechanized paver fitted with electronic sensors for con-struction technique.	As quantum of road work is very less and considering lack of space within the existing units, bidder understands that deployment of mechanical pav-ers are not mandatory. Owner to kindly confirm bidder's understand-ing.	Method(s) as per IRC may be followed.
885.	Section VI, Part B, Sub Section IV D, Civil works	10.00.00	26 of 69	Site LevellingSite levelling of gypsum area, lime storage ar-ea, gypsum dewatering area, truck hopper and associated areas to be levelled in one block.	Bidder is free to decide FGL based on existing NGL in order to optimize cut-ting and filling quantities. Owner to please confirm.	Site levelling shall be done by Owner as per the levels specified in GLP in tender document. Only site clearance and minor grading is in bidder's

Sr. No	Section / Part / Chapter / Volume	Clause No.	Page No.	Bid specification	Bidder's Query	NTPC's Clarification
						scope.
886.	Section VI, Part A, Subsection II-A4	Annexure III	19 of 30	Employer has carried out geotechnical investigation in vicinity to the proposed area. Logs of representative boreholes for bidder's information in the vicinity of proposed area are enclosed with this Annexure	Geotechnical investigation for Dalipalli Stage-I, 2x800 MW project is not attached along with the tender document. Owner is requested to furnish the same.	Refer amendment issued separately
887.	Section VI, Part B, Sub Section - IV-D	19.00.00	39 of 69	All steel structures shall be fabricated in factory, transported and erected at site.	Bidder understands that fabrication of silo/hoppers /tanks /absorber shell,etc. can either be fabricated at factory or fabricated at site. In case of site or shop fabrication, field connection will be welded. Please confirm bidder's understanding.	Considering the large dimensions of the said equipment, Bidder's understanding is correct.

Sr. No	Section / Part / Chapter / Volume	Clause No.	Page No.	Bid specification	Bidder's Query	NTPC's Clarification
888.	Section VI, Sub-section - IIA-3	Lara topo-graphic survey		Topographical survey, Drg No. 9548-999-POC-F-002, Rev 0	NTPC Lara Super Thermal Power Pro-ject - Finished ground level for the plant are @ RL 203 M and RL 202 M whereas the natural ground levels (reduced levels) as per the topo-graphical survey drawing are in the range of 224-230 M. Owner to please verify whether bidder have received the correct topographical survey drawing for the referred project.	Refer amendment issued separately.

Sr. No.	Section No.	Clause No.	Bid Specification Stipulation	Bidder's Query / Stipulation	NTPC Clarifications
1161.	Part-A-Sub Section-II-A6	Clause no.7.08- Page no.19	Foundation System and Geotechincal Data- Type of Foundation system to be adopted- Open Foundation system.	The foundation design shall be based on final recommendations of geotechnical investigation report approved by Client during execution. Provision shall be made for appropriate compensation If any major variation in the soil data/ sub-soil conditions if identified.	Bidder may refer Cl. No. 7.00.03. If bidder feels, data provided is not adequate, he may carry out geotechnical investigation for bidding purpose. Further, Bidder shall comply the provisions of Technical Specification.
1162.	Sub-Section-IVD -CIVIL WORKS	Clause no.12.00	RCC Roads & RCC Drains	Bidder understands that only approach roads along with drains on both sides shall be provided from the new structures of the proposed FGD. The main plant roads and drains shall be in the scope of the client. Please confirm.	Refer Scope of work. Refer clause 2.00.00 Section-VI, Part-A of technical specification.
1163.	Sub-Section-IVD -CIVIL WORKS	Clause no.13.00	Gate Along Boundary Wall	Bidder understands that any works for construction of gate along boundary wall is excluded from the bidders scope of work.	Refer Scope of work. Refer clause 2.00.00 Section-VI, Part-A of technical specification.

Sr. No.	Section No.	Clause No.	Bid Specification Stipulation	Bidder's Query / Stipulation	NTPC Clarifications
1164.	Sub-Section-IVD -CIVIL WORKS	Clause no.4.01	Contractors scope shall include construction of necessary culverts below railway lines/ roads as per the railway/IRC standards and shall take approvals of railway culverts from the concerned railway authorities.	Bidder has considered RCC hume pipe culverts only below the approach roads in the scope of works for this package. Bidder has excluded the construction of culverts below railway lines and taking their approvals from necessary railway authorities. Bidder request client to kindly confirm.	Bidder shall comply with technical specification requirement.
1165.	Sub-Section-IVD -CIVIL WORKS	Clause no.14.00	The Storm Water drainage for any area under consideration shall be taken in to account the finished grade levels of the area.	Bidder has considered only the drains along the approach roads and garland drains around the proposed structures. These drains shall be connected to the nearest main plant drains with proper slopes. Please confirm.	Bidder's understanding is correct.
1166.	Sub-Section-IVD -CIVIL WORKS	Clause no.25.02	Excavations in hard rock shall be carried by Blasting if required. The contractor shall obtain license from the competant authorities for undertaking blasting works.	Bidder request client to take necessary statutory permissions required for Blasting from the concern authorities. Bidder has excluded these from their scope of work.	Bidder shall comply with technical specification requirement.
1167.	Sub Section I-M1	Clause 5.06.06	Mist eliminator	Whether bidder can propose roof type ME with PP material	Bidder can propose roof type Mist Eliminators with the material specified in the Technical Specification.

Sr. No	Section / Part / Chapter / Volume	Clause No.	Page No.	Bid specification	Bidder's Query	NTPC's Clarification
913.	Section VI, Part B, Sub Section IV D, Civil works	17.21.00 b)	37 of 69	Waterproofing treatment shall be provided for liquid retaining/carrying structures and basement type structures (requiring dry working condition).	Bidder understands that clause no. 17.21.00 of subsection IV-D Civil works, is not applicable for truck hopper and limestone hopper. Please confirm.	Bidder's understanding is correct.
914.	Section VI, Part B, Sub Section IV D, Civil works	3.01.00	3 of 69	Truck hopper - Chemical injection grouting for inner faces. Polymer modified cementitious coating on earth side face as per the following:		
915.	SECTION- VI, PART-ASUB SECTION-III-A1FGD	1.03.00	1 of 9	The FGD system shall have an independent absorber for each unit, common limestone milling systems and common gypsum dewatering system for each Lot 1 A Project.	The space available for installation of FGDs at most sites is very limited. In such cases, it shall be beneficial to optimise the available space when offered technology is capable to do so with equal effectiveness. Bidder offers Jet Bubbling Technology, which has excellent flexible operability even at turndown ratios of 15%. We request NTPC to accept option of offering combined absorber for multiple units. Our collaborator has proven references of such common absorbers installed for multiple units operating successfully globally.	Specification requirement is clear. Bidder shall comply with the specification requirements.

Sr. No.	Section No.	Clause No.	Bid Specification Stipulation	Bidder's Query / Stipulation	NTPC Clarifications
1170.	Sub-Section-IVD -CIVIL WORKS	Clause no.12.00	RCC Roads & RCC Drains	Bidder understands that only approach roads along with drains on both sides shall be provided from the new structures of the proposed FGD. The main plant roads and drains shall be in the scope of the client. Please confirm.	Refer Scope of work. Refer clause 2.00.00 Section-VI, Part-A of technical specification
1171.	Sub-Section-IVD -CIVIL WORKS	Clause no.13.00	Gate Along Boundary Wall	Bidder understands that any works for construction of gate along boundary wall is excluded from the bidders scope of work.	Refer Scope of work. Refer clause 2.00.00 Section-VI, Part-A of technical specification.
1172.	Sub-Section-IVD -CIVIL WORKS	Clause no.4.01	Contractors scope shall include construction of necessary culverts below railway lines/ roads as per the railway/IRC standards and shall take approvals of railway culverts from the concerned railway authorities.	Bidder has considered RCC hume pipe culverts only below the approach roads in the scope of works for this package. Bidder has excluded the construction of culverts below railway lines and taking their approvals from necessary railway authorities. Bidder request client to kindly confirm.	Bidder shall comply with technical specification requirement.
1173.	Sub-Section-IVD -CIVIL WORKS	Clause no.14.00	The Storm Water drainage for any area under consideration shall be taken in to account the finished grade levels of the area.	Bidder has considered only the drains along the approach roads and garland drains around the proposed structures. These drains shall be connected to the nearest main plant drains with proper slopes. Please confirm.	Bidder's understanding is correct.

CLARIFICATION No.01 (TECHNICAL)
Flue Gas Desulphurization (FGD) System Package for Lot 1A Projects

Sr. No.	Section No.	Clause No.	Bid Specification Stipulation	Bidder's Query / Stipulation	NTPC Clarifications
1174.	Sub-Section-IVD -CIVIL WORKS	Clause no.25.02	Excavations in hard rock shall be carried by Blasting if required. The contractor shall obtain license from the competant authorities for undertaking blasting works.	Bidder request client to take necessary statutory permissions required for Blasting from the concern authorities. Bidder has excluded these from their scope of work.	Bidder shall comply the provisions of Technical Specification.
1175.	Sub Section I-M1	Clause 5.06.06	Mist eliminator	Whether bidder can propose roof type ME with PP material	Bidder shall comply with the requirements of Technical Specifications.
1176.	Sub Section I-M1	Clause 5.03.02	Oxidation Blower	The stoichiometric ratio of 2.5 was mostly used in the past for grid type of oxidation, now a day with new spargers, lower SR typically below 2 are in use, can we consider lower SR. Also whether we can offer 3 blowers (2W+1S) common for two units	Bidder shall comply with the requirements of Technical Specifications.
1177.	Extension			As explained during pre-bid meeting, requirement of site visits and overall complex nature of project, we request the bid submission date extension up to **17.10.2017**	Not a technical query.

S. No.	Section	Clause No	Page No.	Statement of Deviation/Part/ Chapter	Variations / Exceptions	NTPC Clarifications
B.	TECHNICAL DEVIATION					

Sl. No.	Specification Reference				Employer (NTPC) Specification	Bidder Requested Clarification	NTPC Clarifications
	Part	Sub-section	Clause no.	Page			
1252.	SECTION – VI, PART-A	SUB-SECTION-II-A1 (Project Information-Kudgi Super Thermal Power Project-3x800 MW)	GLP (Drawing No. 9571-999-POC-F-001, Rev-5D0)		Storage/Laydown area/Area for dumping of excavated material	During site visit, it has been observed that no area has been earmarked for laydown/storage/ excavated material dumping other than the areas identified for FGD. Bidder request Owner to please earmark areas at site for laydown/storage/ excavated material dumping.	Bidder to refer the revised GLP in issued amendments.
1253.	SECTION – VI, PART-A	SUB-SECTION-II-A1 (Project Information-Kudgi Super Thermal Power Project-3x800 MW)	GLP (Drawing No. 9571-999-POC-F-001, Rev-5D0)		Underground substructures, sewer pipes, water pipes, cables etc around the FGD	Bidder request Owner to please provide the drawings for underground pipes, cables, amenities , utilities etc around the FGD area .	Same will be discussed with the successful bidder during the detail engg. stage.
1254.	SECTION – VI, PART-A	Subsection-III-D Civil	1.06.00	2 of 4	Uniform Finished ground level (FGL) in FGD absorber area shall be made available by the owner at a level specified in tender drawing	Bidder understand that Uniformed Finished ground level will be arranged by Employer (at NTP) for the area's allocated for FGD (Space for FGD mentioned in the layout drawing) Employer is requested to	Site levelling shall be done by Owner as per the levels specified in GLP in tender document. Only site clearance and minor grading is in bidder's scope.

Sl. No.	Specification Reference				Employer (NTPC) Specification	Bidder Requested Clarification	NTPC Clarifications	
	Part	Sub-section	Clause no.	Page				
						confirm on Bidders understanding.		
1255.	GENERAL POINT				Employers Hostels/guest house	Employer is requested to allow their existing hostels/gust house on chargable basis.	This may not be possible , however during the execution stage the same canbe discussed with our site.	
1256.	SECTION – VI, PART-B	Subsection-IV-D Civil Works	39.00.00	65 of 69	Sand aggregate for Construction		Query is not clear.	
1257.	GENERAL POINT				Topographical Survey drawing	Bidder request topographical survey drawing in Autocad format of all proposed FGD site..	Bidder to refer necessary amendment in this regard.	
1258.	GENERAL POINT				Area Drainage Study report	Bidder request Owner to furnish Area Drainage Study report for planning the drainage in the area earmarked for FGD facilities of all proposed site.	Bidder to refer the revised GLP in issued amendments.	

S.No	Clause No	Page No.	Description of Bid Document	Bidders Queries/Suggestions	NTPC Clarifications
1548.	Part- B-II Elect 2 clause no 2.01.05 & 3.02.05 Technical requirement	2 & 5	The Cable vault / Cable spreader room space below the HT/LT switchgear room, control room, Unit control equipment----------. Cable Trenches shall be provided only in Swicthgear/MCC rooms	It is proposed to provide cable trenches as per cl no 3.02.05 in Switchgear room. No Cable vault / Cable spreader is considered for Switchgear room.M/s NTPC to confirm acceptance.	Bidder to provide the same as per their standard pratice complying with technical specification
1549.	Part- B-II Elect 1 clause no 7.00.09 Technical requirement	4	SIC termination kit shall be suitable for fault level of 25KA for 0.17 sec	It is requested to reconfirm the fault level for Termination Kit.	Confirmed.
1550.	Part- A Elect 1 Subsection-IIIB Electrical System/Equipment clause no 1.08.00 Technical requirement	2 of 6	Contractor scope shall include laying of cable from employer board ---- on the employers nearest trestle in the FGD Area subject to availability of space & suitability. In case of non availability of space in employer trestle , contractor shall make necessary arrangement for cable tray erection & cable laying	Due to space constraint ,It is not feasible to construct a new trestle from Main Plant Area for FGD System cabling. Hence existing Trestle shall have to be utilized for cabling to FGD Switchgear from Main plant. M/s NTPC is requested to undertake the exercise to create the space in existing trestle for FGD cabling .	Bidder shall comply with technical specification CL no:- 1.08.00.2. In case of non availability of space in employers trestle, bidder shall make necessary arrangements for cable tray erectiona and laying. However bidder may visit the project in order o get itself acquainted with existing electrical of plant.
CIVIL					
1551.	SUB SECTION-II-A10-PROJECT INFORMATION-BARH-I 3X660 MW	30	List of Drawings, Sl No-2(Topographical Survey Drawing) & Sl. No-3(Equipment Layout Plan) are missing.	NTPC to submit the soft copies(Autocad drawing) of missing drawings.	Owner provide's PDF file only.

S.No	Clause No	Page No.	Description of Bid Document	Bidders Queries/Suggestions	NTPC Clarifications
1552.	SUB-SECTION-II-A8 PROJECT IN-FORMATION-NABINAGAR-I 3X660 MW	-	Topographical survey drawing is missing	NTPC to submit the soft cop-ies(Autocad drawing) of topographical survey drawings.	Owner provide's PDF file only.
1553.	SUB-SECTION-II-A8PROJECT IN-FORMATION-NABINAGAR-I 3X660 MW_Clause No:6.00.00	9	SITE SPECIFIC DESIGN PARAMETERS: The various design parameters, as defined in IS: 875 (Part-3), to be adopted forthe pro-ject site shall be as follows: a) The basic wind speed “Vb” at ten	NTPC to furnish basic wind speed "Vb" at 10m height above the mean ground level.	The basic wind speed "Vb" at 10m height above the mean ground level for "NABINAGAR-I 3X660 MW" project shall be 47 metres/second. Also refer Amendment issued separately in this regard.
1554.	SUB-SECTION-II-A8 PROJECT IN-FORMATION-NABINAGAR-I 3X660 MW_Clause No:7.08.00_SR-g_Item No-2	21	2) In view of the above, the following shall be adopted for all foundations and sub-structures,	Item description is incomplete.	Query is not clear.

S.No	Clause No	Page No.	Description of Bid Document	Bidders Queries/Suggestions	NTPC Clarifications
1555.	SUB-SECTION-II-A3,A4,A6,A7 & A11 PROJECT IN-FORMATION-	-	Bore log details for following projects are missing, 1. Solapur STPP, Stage-II (2x660MW), 2. Gadarwara STPP, Stage-I (2x800MW), 3.Nabinagar TPP (4X250 MW), 4. DAR-LIPALLI STPP, Stage-I (2X800 MW), 5. Tanda STPP, Stage-II (2x660MW)	NTPC to furnish the borelog details of missing project.	For Borelog details, bidder may refer Project information chapter furnished in Technical Specification for Gadarwara STPP, Nabinagar TPP and Tanda STPP. Further, Bidder may also refer amend-ment no.1 for Darlipalli STPP, Meja and Soalpur STPP.
1556.	SECTON -VI TECHNICAL SPECIFICATION, Clause: 4.02.00	18	The scope for foul water from toilets shall include layout and laying of sewers up to the Employer's main sewer line for sew-erage system together with all fittings and fixtures and inclusive of ancillary works such as connections, manholes and in-spection chambers within the building and from the building to the Employer's sewer line.	NTPC to furnish the exisitng Sewer layout drawing.	Drawing shall be provided after award of work.

S.No	Clause No	Page No.	Description of Bid Document	Bidders Queries/Suggestions	NTPC Clarifications
1557.	SECTON -VI TECHNICAL SPECIFICATION, Clause: 4.02.00, Clause: 21.00.00, Clause: 15.00.00	29,41,32	Clause: 4.02.00-For sewerage below ground stoneware pipes conforming to 18: 651 with concrete bedding and haunch. Clause: 21.00.00-Sewer lines (Cast Iron), interconnected by sewer manholes (RCC) at regular intervals (not exceeding 30 meter centre to centre) shall be provided to dispose off sewage from FGD area to the nearest available manhole of the owner. Clause: 15.00.00-Cement concrete pipes of class NP-3 as per 18:458 shall be used below ground level for sewage disposal in all areas.	NTPC to confirm the type of pipe to be used for sewage disposal.	Refer amendment issued separately.
1558.	SECTON -VITECHNICAL SPECIFICATION, Clause: 12.00.00	30	Specification pertaing to road shoul-der(shoulder width, subgrade materials used and their thickness) is missing.	NTPC to furnish the shoulder specifi-cation.	Refer amendment issued separately.
1559.	SECTON -VI TECHNICAL SPECIFICATION, Clause: 15.00.00	32	Sewage pump house shall be provided as per IS:4111.	NTPC to furnish the sewage pump house specification.	Refer amendment issued separately.

S.No	Section/Part/ Chapter	Clause No.	Page No.	Statement of subject	Clarification	NTPC Clarifications
						of Sub Section-III-C of Part A of specification.
1572.						
1573.	**CIVIL**					
1574.	PART B				Please clarify the tender GLP drawlings cover all exiting buildings and sturctures in the planning space.	Bidder to refer the amended GLP.
1575.	PART B				Are there some exiting buildings and sturctures in the planning space for FGD needed to be removed? If there were, was the removement work under the Contractor's scope, or under the Owner's scope?	
1576.	PART B				When the planning space for FGD is not enogh, if the contractor could chose another fit and spare space for FGD.	Bidder to refer the revised GLP in issued amendments.
1577.	PART B				Please provide groundwater annual water level elevation and quality of groudwater, and its corrosion possibility to concrete and steel undergraound.	Bidder to refer the revised GLP in issued amendments.
1578.	MEJA-II-A9-2 Meja GLP				Please provide the planning space for FGD.	Query is not clear.
1579.	DARLIPALLI-II-A4-1 PROJECT INFOR-				Please provide BORE LOG in or adjacent to the planning space for FGD.	Bidder to refer necessary amendment.

S.No	Sec-tion/Part/ Chapter	Clause No.	Page No.	Statement of subject	Clarification	NTPC Clarifications
	MATION					
1580.	SOLAPUR-II-A6-1 PROJECT INFOR-MATION				Please provide BORE LOG in or adjacent to the planning space for FGD.	Bidder to refer necessary amendment.
1581.	PART B				Please clarify the structures types of all kinds of sturcture for FGD	Type of Building structure (RCC/ Steel), if not specified in the technical Specification shall be decided by the bidder considering the functional requirement, schedule of construction and site con-straints (if any).

Sl.No	Section /Part / Chapter	Clause No.	Page No.	As per RFQ	Pre Bid Queries	NTPC Clarifications
	FGD SYSTEMS					
1625.	Section-VI Part-B SUB-SECTION-IV-D CIVIL WORKS	6.08.00	24 of 69	Access to RCC roof of Gypsum dewatering building, FGD Control room building, MCC building, Ball mill building shall be through RCC staircase, and roof access to all other buildings all shall be through cage ladder as per requirement.	Bidder understands that Gypsum Dewatering Building,FGD Control room,MCC building,Ball mill building ,Slurry Recirculation pump house,Oxidation blower are RCC framed building with Brick walls. In addition No wall / Cladding shall be provided for areas where Blower,Slurry Recirculation Pumps,Dewatering equipment, Limestone Ball mill were located since these areas need maintenance acess for the above equipments. However Electrical Control room,MCC room will be enclosed type with Brick walls. NTPC to confirm.	Bidder shall comply with technical specification requirement.
1626.	Section-VI Part-B Sub Sec-I-M1 (FGD)	7.07.07	28 of 51	All piping, valves & instrumentation upto the employer's terminal point shall be in the contractor's scope. Contractor shall provide the complete lime dosing system (in projects where	NTPC to furnish the size of Lime powder and inform whether the lime will be supplied in the form of bags or transported through truck.	Specification requirement is clear. Bidder shall comply with the specification requirements.